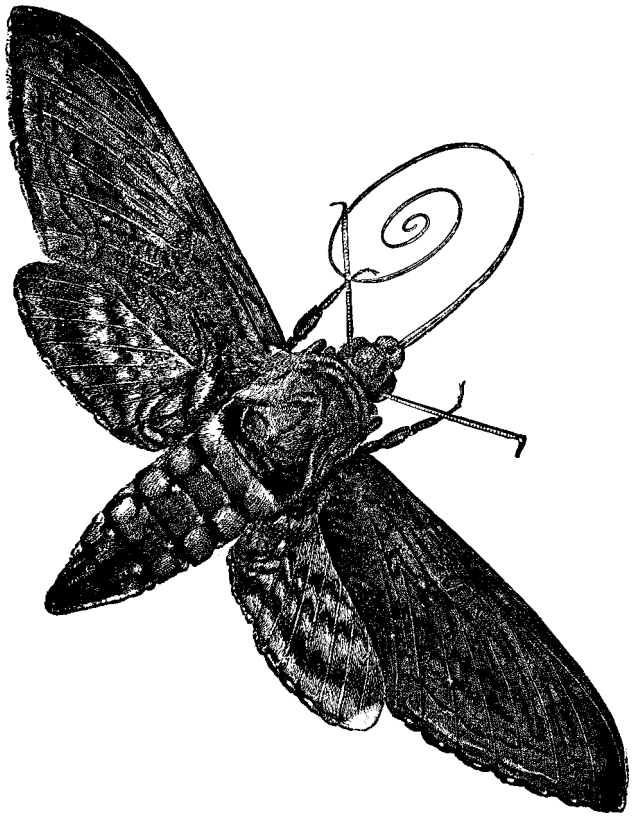
Introduction to
ANIMALS: INVERTEBRATES



BACKGROUND INFORMATION—INVERTEBRATES

Organizing and identifying the vast array of animals in the world is an enormous task. Scientists have tackled this challenge by dividing animals into two separate groups—the **vertebrates** and the **invertebrates**. Vertebrates are animals that have backbones. Most vertebrates are immediately recognizable as animals. Sharks, birds, snakes, frogs, horses, and humans are all vertebrate animals. Invertebrates are animals that lack a backbone. Although most people only recognize a few kinds of invertebrate animals, invertebrates far outnumber vertebrates. In fact, 97% of all animals are invertebrates. Insects, spiders, worms, squid, snails, sponges, and coral are all members of the invertebrate group. But, invertebrates and vertebrates share certain characteristics that make them animals.

Characteristics of Animals

• Unlike plants, animals are unable to make their own food. To get the energy they need to live, they must capture and eat other organisms.

• Animals are multi-cellular, and because of the complexity of their many cells, most cannot absorb their food directly. Instead, animals digest their food in a **gut** or stomach, which breaks it down into simpler proteins, carbohydrates, and fats. (However, some parasites such as tapeworms, absorb nutrients directly from their host.)

• Animal cells are **specialized** for different "jobs" or functions. For example, the cells in the gut work differently than the cells in the lungs or heart of an animal. Some cells are specialized to carry oxygen to the different parts of the body. Other cells digest food. Still others help to sense light or pass information from the brain to other areas of the body.

• Animal cells are arranged in a pattern according to their function. Cells that share the same function make up **tissue**. For example, cells that capture oxygen for land animals make up lung tissue. Cells that filter poisons from the blood in humans make up liver tissue. **Organs** are composed of tissues that function together. Lung tissue makes up the lung, heart tissue makes up the heart, and liver tissue makes up the liver. Organs that function together make up **organ systems**. For example, the intestines and stomach are part of the digestive system. The heart pumps blood through veins and arteries, and they are all part of the circulatory system. Some simple animals, like

sponges and coral, don't have distinct organs, but they are made up of specialized cells.

• Parts of animals are arranged in specific ways. The pattern or arrangement of animals' body parts is called **symmetry**. Animals are sometimes classified according to their symmetry. Some animals, like starfish, have body parts arranged in a circle around a central point. This arrangement is called **radial symmetry**. Other animals, like humans, have **bilateral symmetry**. These animals can be "divided" down the middle into two identical halves. Symmetry is usually only a surface characteristic, however. An animal's internal organs are not always symmetrical.

• The kind of food an animal eats determines its **feeding habit**. Feeding habits in the animal kingdom are extremely diverse, but include the following general categories: 1) **herbivores**, 2) **carnivores**, 3) **omnivores**. Herbivores eat only plants. Carnivores eat only other animals. (When an animal hunts and eats another animal it is referred to as a **predator**. The animal being hunted and eaten is called **prey**.) Omnivores eat both plants and animals. **Parasites** are organisms that grow, feed, and live on or in other organisms. The animal being parasitized is called the **host**. A parasite contributes nothing to the survival of its host and usually does some damage to the host. Occasionally, it's enough damage to kill the host.

Invertebrates

The word invertebrate literally means "without a backbone." Like all living things, invertebrates sense and respond to their environment, move, and reproduce. Because they are animals, invertebrates also gather food, breathe oxygen, and protect themselves. Invertebrates may have skeletons, but they don't have bones like other animals.

Sensing and Responding to the Environment

A change in an animal's **environment** that causes a reaction in the animal is called a **stimulus.** Animals sense stimuli in a variety of ways. For example, planaria, a flatworm, has an "eye spot" that detects light, but cannot form images like our eyes. Still, this ability allows them to detect the dark, rocky crevices where they like to live.

Some invertebrates have more advanced sensory abilities involving **antennae** of one kind or another. Antennae can generally detect both touch and chemicals. The "messages" the antennae receive are relayed to the animal's brain so the animal can react to the stimulus. Jellyfish (which are not actually fish) have yet another way of

sensing their environment. When a jellyfish's stinging cells are touched by another animal, the cells discharge a tiny venom-filled harpoon that both ensnares and paralyzes its prey.

Respiration

All animals "breathe." When oxygen is taken in by an animal, it is carried to each cell, where it plays a part in helping to convert food into energy. The process is called **respiration**. Invertebrates that live underwater usually rely on **gills** to take in oxygen. The animal's blood then carries the oxygen to the rest of the cells in the animal's body. Invertebrates like sow bugs (isopods), clams, sea worms, and lobsters also have gills for respiration. Animals such as jellyfish and flatworms absorb oxygen directly from the environment.

Body Temperature

Most invertebrates are **ectothermic**—they are unable to maintain an internal body temperature that is independent from their surroundings. Their body temperature varies according to the temperature of their surroundings. This is why ants and houseflies tend to be less active on cold days. Moths and honeybees must warm up in order to fly and will shiver to warm up their flight muscles.

Protection

There are many different ways invertebrates protect themselves from danger. Many, like clams and snails, have shells to hide in. Others have sharp spines that discourage predators. The squid uses distraction. When a squid feels threatened, it squirts a dark inky substance towards the danger and swims the other way. Insects use distraction to protect themselves, too. For example, some butterflies have patterns on their wings that look like big, dangerous eyes. Another way invertebrates protect themselves is by matching their surroundings through **camouflage**. For example, when a praying mantis is completely still on a leaf, its green body blends in with the vegetation and is difficult to see.

Invertebrates are extremely diverse, but as with all animals, they must find food, are multicellular, and have specialized cells that are arranged in patterns according to their functions. The activities in this section will allow students to discover some of the diversity and complexity among this amazing group of animals.

INFORMACIÓN BÁSICA—LOS INVERTEBRADOS

La organización e identificación de la vasta colección de animales en el mundo es una tarea de enormes proporciones. Los científicos han abordado este desafío y comenzaron por dividir a los animales en dos grupos: los **vertebrados** y los **invertebrados**. Los vertebrados son animales que tienen columna vertebral. Es fácil darse cuenta inmediatamente de que la mayoría de los vertebrados son animales. Los tiburones, los pájaros, las serpientes, las ranas, los caballos y los seres humanos, todos ellos constituyen parte de los vertebrados. Los invertebrados son animales que no tienen columna vertebral. Aunque la mayoría de las personas sólo puede reconocer unos pocos tipos de invertebrados, existen muchos más invertebrados que vertebrados. En realidad, el 97% de todos los animales son invertebrados. Los insectos, las arañas, los gusanos, los calamares, las babosas, las esponjas y los corales, todos ellos son miembros del grupo de los invertebrados. Pero, los vertebrados y los invertebrados tienen ciertas características en común que hacen que ambos sean considerados animales.

Características de los animales

• A diferencia de las plantas, los animales no son capaces de producir su propio alimento. Para obtener la energía que necesitan para vivir deben capturar y comer otros organismos.

• Los animales son multicelulares y debido a la complejidad de las mismas células, no pueden absorber los alimentos directamente. En lugar de absorción directa, los animales digieren sus alimentos en la **barriga** o estómago, donde se desintegran en proteínas simples, carbohidratos y grasas. (Sin embargo, algunos parásitos tales como las tenias absorben nutrientes directamente de su huésped).

• Las células de los animales se especializan para realizar diferentes "trabajos" o funciones. Por ejemplo, las células de la barriga trabajan de forma diferente que las células de los pulmones o del corazón del animal. Algunas células se especializan en llevar oxígeno a las diferentes partes del cuerpo. Otras células digieren los alimentos. Y otras ayudan a percibir la luz y a enviar información del cerebro a otras áreas del cuerpo.

• Las células animales están configuradas de acuerdo a sus funciones. Las células que comparten la misma función forman el **tejido**. Por ejemplo, las células que absorben el oxígeno en los animales de tierra forman el tejido pulmonar. Las células que filtran las sustancias tóxicas que hay en la sangre de los seres humanos forman el tejido del hígado. Los **órganos** están compuestos de tejidos que funcionan en conjunto. El pulmón está formado por tejido pulmonar, el corazón está formado por tejido cardíaco, el tejido hepático forma el hígado. Los órganos que funcionan en conjunto forman un **sistema de órganos**. Por ejemplo, los intestinos y el estómago son parte del sistema digestivo. El corazón bombea sangre a través de las venas y las arterias, las cuales forman parte del sistema circulatorio. Algunos animales simples, como las esponjas y el coral, no tienen órganos diferenciados pero están compuestos por células especializadas.

• Las distintas partes del animal están organizadas de una manera específica. La configuración u organización de las partes del cuerpo se llama **simetría**. A veces, se clasifica a los animales de acuerdo con su simetría. Algunos animales, como la estrella de mar, tienen las partes de su cuerpo organizadas en un círculo alrededor de un punto central. Este tipo de configuración se llama **simetría radial**. Otros animales, como los seres humanos tienen **simetría bilateral**. Este tipo de animales puede "dividirse" por la mitad en dos partes idénticas. Sin embargo, la simetría es, en general, una característica superficial ya que los órganos internos de un animal no siempre son simétricos.

• El tipo de alimentos que come el animal determina sus **hábitos alimenticios**. En el reino animal, los hábitos alimenticios son extremadamente diversos, pero en general pueden dividirse en las siguientes categorías generales: 1) **herbívoros,** 2) **carnívoros**, 3) **omnívoros**. Los herbívoros sólo comen plantas. Los carnívoros comen otros animales. (Un animal que caza y come a otro animal, se llama **predador**. El animal que es atrapado se llama **presa**.) Los omnívoros comen tanto plantas como animales. Los **parásito**s son organismos que crecen, se alimentan y viven sobre o dentro de otros organismos. El animal que ha sido infectado con parásitos se llama **huésped**. Los parásitos no contribuyen a la supervivencia de su huésped y en general le causan algún tipo de daño. A veces, el daño es tan severo que mata al huésped.

Invertebrados

La palabra invertebrado significa, literalmente, "sin columna vertebral". Al igual que otros organismos vivientes, los invertebrados perciben y responden al medio ambiente, se mueven y se reproducen. Como el resto de los animales, los invertebrados también deben obtener sus alimentos, respiran oxígeno y deben protegerse a sí mismos. Algunos invertebrados tienen esqueletos, pero no tienen huesos como el resto de los animales.

Percepción y respuesta al medio ambiente

Un cambio proveniente del **medio ambiente** del animal y que causa una reacción en el mismo, se llama **estímulo**. Los animales sienten los estímulos en una variedad de formas. Por ejemplo, la planaria, un gusano plano (platelminto) tiene una "mancha ocular" que detecta la luz, pero no puede formar imágenes como lo hacen nuestros ojos. Pero aún así, esta habilidad le permite detectar las grietas oscuras y rocosas en las cuales les gusta vivir.

Algunos invertebrados tienen habilidades sensoriales más avanzadas contenidas en algún tipo de **antenas**. Generalmente, las antenas pueden detectar sustancias químicas y tienen habilidades táctiles. Los "mensajes" que reciben las antenas se transmiten al cerebro del animal para que éste pueda reaccionar a los estímulos. Las medusas tienen otra manera de percibir el medio ambiente. Cuando otro animal toca las células urticantes de la medusa, estas células descargan un arpón diminuto lleno de veneno que atrapa y paraliza a la presa.

La respiración

Los animales "respiran". Cuando un animal inhala el oxígeno, éste es transportado a cada una de las células y colabora con ellas para convertir el alimento en energía. Este proceso se llama **respiración**. Los invertebrados que viven bajo agua, en general, cuentan con sus **branquias** para inhalar oxígeno. Luego, la sangre del animal transporta el oxígeno al resto de las células del cuerpo. Los invertebrados, tales como las cochinitas de la humedad (isópodos), las almejas, los gusanos de mar y las langostas también tienen branquias para respirar. Los animales tales como la medusa y el gusano plano absorben el oxígeno directamente del medio ambiente.

La temperatura del cuerpo

La mayoría de los invertebrados son **ectotérmicos** (animales de sangre fría), no pueden mantener una temperatura interna del cuerpo independiente del medio exterior. Es decir, la temperatura del cuerpo varía con la temperatura del medio ambiente. Por esta razón las moscas comunes tienden a ser menos activas durante los días fríos. Las polillas y las abejas melíferas deben entrar en calor para poder volar y tiritan para calentar los músculos que las ayudan a volar.

La protección

Los invertebrados se protegen a sí mismos del peligro de muchas maneras distintas. Muchos de ellos, tales como las almejas y las babosas, tienen caparazones donde esconderse. Otros tienen espinas puntiagudas que desalientan a los predadores. El calamar usa la distracción como defensa. Cuando un calamar se siente amenazado, arroja una sustancia oscura como una tinta hacia el lugar de donde proviene el peligro y nada hacia el lado contrario. También los insectos usan la técnica de la distracción para protegerse. Por ejemplo, algunas mariposas tienen dibujos en sus alas que parecen ojos enormes y peligrosos. Otra manera en que los invertebrados se protegen a sí mismos es tratando de confundirse con el medio ambiente a través del **camuflaje**. Por ejemplo, cuando una mantis religiosa (mamboretá) se queda completamente quieta sobre una hoja, el cuerpo que es verde, se confunde con la vegetación y es muy difícil verla.

Los invertebrados son extremadamente diversos, pero al igual que sucede con todos los animales, cada uno de ellos debe encontrar su propio alimento, son multicelulares y tienen células especializadas configuradas para realizar funciones específicas. Las actividades prácticas de esta sección permitirán al estudiante descubrir algunas de las diversidades y complejidades de este increíble grupo de animales.

SYMMETRY

Simetría

Grades		
K–4	Whole Class	45–60 min.

Purpose

Students will find examples of bilateral and radial symmetry in their environment.

Materials

Paper (2 pieces per student)
Scissors
Student Activity Sheet

Concepts

- The pattern or arrangement of body parts on an animal is called symmetry.
- When body parts are arranged in a circle around a central point, it is called radial symmetry.
- When an animal can be "divided" down the middle into two equal halves, it is called bilateral symmetry.
- The internal organs of an animal are not necessarily symmetrical.

Conceptos

- Simetría es la configuración o disposición de las partes del cuerpo de un animal.
- Simetría radial se refiere a la disposición de las partes del cuerpo que forman un círculo alrededor de un punto central.
- Simetría bilateral se encuentra en los casos en que el animal puede "dividirse" por la mitad en dos partes iguales.
- Los órganos internos de un animal no siempre son simétricos.

Safety

If you will be doing the scavenger hunt outside, tell students which boundaries they are not allowed to cross. Also review rules for respecting animals and plants outside.

Vocabulary

Symmetry
Radial symmetry
Bilateral symmetry

Vocabulario

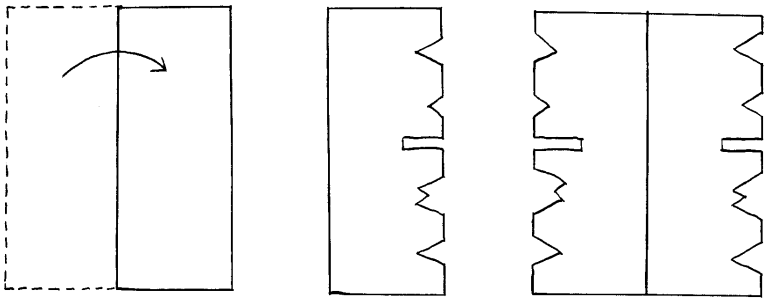
Simetría
Simetría radial
Simetría bilateral

Procedure

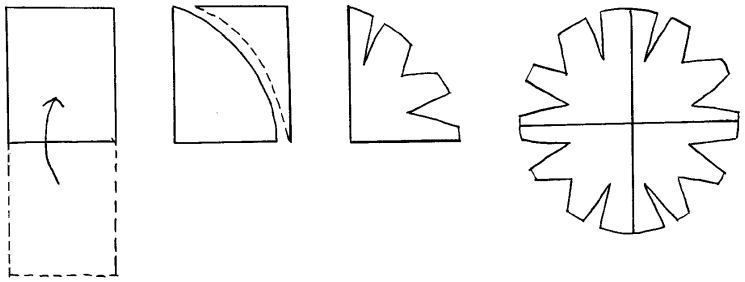
1. Preparation

Introduce the activity by defining **symmetry**. Hand out two pieces of paper and a pair of scissors to each student. Tell them they will be making a sample cut-out of two types of symmetry that are common in animals: **bilateral** and **radial symmetry**.

For the bilateral symmetry cut-out, have students fold one piece of paper in half. While keeping the paper folded, tell students to cut a design into the side opposite the fold. When the paper is unfolded, each half will be a mirror image of the other. This is an example of bilateral symmetry.



For the radial symmetry cut-out, have students fold the second piece of paper in half then fold it in half again. Next, tell students to make a rounded cut along the unfolded edge of the paper as if they were making a paper snow flake (see diagram). Then have students cut a design into the rounded edge. When the paper is unfolded, the design will be arranged around a central point in the middle of the paper—an example of radial symmetry.



2. Scavenger hunt

With cut-outs in hand, take students outside (or stay inside if the weather is bad) for a symmetry scavenger hunt. Give each student a pencil and a Student Activity Sheet. Tell them they will be looking for at least 10 items that have either bilateral or radial symmetry. Every time they find an item, they will be writing the item name in the appropriate column on the Student Activity Sheet. Younger students can draw a picture of the item in the column. Give students 10 to 20 minutes to search for symmetrical items.

3. Discuss scavenger hunt

Ask students to share the examples of bilateral and radial symmetry they found outside. Name some familiar animals and see if students can guess if they have bilateral or radial symmetry.

Questions to Ask During the Activity

1. What type of symmetry do people have? (Bilateral symmetry.)

2. Is our symmetry perfect? (Not quite. We all have slight differences on each side that keep us from being perfect. For example, some people have one ear that is slightly different than the other or one foot that is bigger than the other.)

3. Do plants have radial or bilateral symmetry? (Most plants have neither type of symmetry.)

Preguntas sobre el tema de la actividad

1. ¿Qué tipo de simetría tienen las personas? (Simetría bilateral)

2. ¿Es nuestra simetría perfecta? (No del todo. Tenemos pequeñas diferencias entre cada lado y por eso la simetría no es perfecta. Por ejemplo, algunas personas tienen una oreja un poco distinta que la otra o un pie más grande que el otro.)

3. ¿La simetría de las plantas es radial o bilateral? (Ninguna de las dos. La mayoría de las plantas no tienen ningún tipo de simetría.)

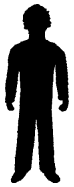
Extensions

Have students create a paper butterfly—a good example of bilateral symmetry. Tell students to fold a piece of paper in half lengthwise, then use a pattern to trace and cut the outline of a butterfly while the paper is folded. To decorate, paint one half of the butterfly. While it is still wet, fold the butterfly in half again. Before the paint dries, open the butterfly wings to see a great example of bilateral symmetry.

STUDENT ACTIVITY SHEET

Symmetry

Write (or draw) the items you find that have bilateral symmetry or radial symmetry:

 ***Bilateral symmetry***	 ***Radial symmetry***

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE

Simetría

Escribe (o dibuja) los objetos que hayas encontrado que tengan simetría radial o bilateral:

 ***Simetría bilateral***	 ***Simetría radial***

SOIL INVERTEBRATES
Invertebrados de tierra

Grades		
3–8	4–5	Day 1: 30 min. Day 2: 45–60 min.

Purpose

Students will capture and observe soil invertebrates.

Materials

For each group:
- Soil
- Jar
- Funnel
- Wet paper towel
- Small, shallow container for observing invertebrates
- Desk lamp or other direct light source
- Magnifying glass or microscope (optional)

For each individual:
- Student Activity Sheet

Concepts

- Many invertebrates live in the soil, where they are hidden from sight.
- The invertebrate group encompasses a variety of organisms that may or may not look like each other.
- Soil invertebrates like cooler, darker areas, away from direct light.

Conceptos

- Muchos invertebrados viven en la tierra, donde no se los ve a primera vista.
- El grupo de invertebrados abarca una variedad de organismos que pueden parecerse entre ellos o no.
- A los invertebrados de tierra les gustan los lugares frescos, oscuros y lejos de la luz directa.

Vocabulary

Invertebrate
Insects
Arachnids
(spiders, mites, tick, and scorpions)
Isopods
(related to shrimp, crabs, and lobsters)
Annelids
(segmented worms like earthworms)
Mollusks
(related to snails and squid)
Exoskeleton

Vocabulario

Invertebrado
Insectos
Arácnidos
(arañas, garrapatas, ácaros y escorpiones)
Isópodos
(relacionados con los camarones, cangrejos y langostas)
Anélidos
(gusanos segmentados como las lombrices de tierra)
Moluscos
(relacionados con las babosas y los calamares)
Exoesqueleto

In Advance

Collect soil or have students collect soil to bring in. (The best places to collect soil would be in a garden, in a woody area, or along a stream or river). Copy Student Activity Sheets and gather other materials.

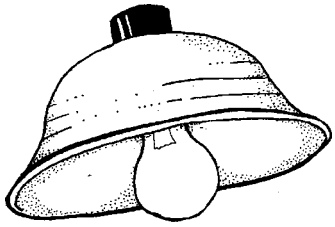
Procedure

1. Introduce activity

Begin by defining the **invertebrate** group. (See the background information for this section.) Tell students that many small invertebrates go unseen because they make their living in the soil. They will be setting up a "trap" to get invertebrates out of the soil where they can be observed.

2. Set-up

Divide the class into groups of 4 to 5 students. Give each group a jar, funnel, soil sample, wet paper towel, and desk lamp. Tell students to line the bottom of the jar with the wet paper towel, then put the funnel inside the jar's opening. Next, have students put the soil inside the funnel. (A small amount of soil might fall through.) Move the jars to an area where they can be left overnight. Set up the lamps so they shine directly on top of the funnels, leaving several inches of space between the hot bulb and the funnel top.



3. Observe

The next day, have each group turn off the lamps and remove the funnel from the jar. Collect the soil so the invertebrates can be returned to it later. Give each group a shallow container for their invertebrates and a magnifying glass or microscope if available. Also give each student a Student Activity Sheet.

Tell students to carefully transfer their invertebrates from the wet paper towel to the container and observe them with the magnifying glass or microscope. Have them draw their invertebrates and answer the questions on the Student Activity Sheet.

4. Discuss observations

When students have finished observing their invertebrates, discuss their observations as a class. Be sure to use the "Why It Happens" section of this activity to try to classify some of the invertebrates and discuss their differences. Have students show the class any unusual invertebrates they found. After the discussion, return the invertebrates to the soil. (Later, find a suitable place to release the invertebrates outside.)

Questions to Ask During the Activity

1. What was the most common type of invertebrate you found?

2. How many legs do **insects** have? (Six.)

3. How many legs do spiders (**arachnids**) have? (Eight.)

4. How many legs do **isopods** have? (Fourteen.)

5. What type of symmetry do earthworms have? (Bilateral symmetry.)

6. Are earthworms insects? (No, they are called **annelids** and they belong to a different phylum than insects.)

7. What is the hard covering on some beetles and isopods called? (**Exoskeleton**.)

Preguntas sobre el tema de la actividad

1. ¿Cuál es el tipo de invertebrado más común que encontraste?

2. ¿Cuántas patas tienen los **insectos**? (Seis)

3. ¿Cuántas patas tienen las arañas (**arácnidos**)? (Ocho)

4. ¿Cuántas patas tienen los **isópodos**? (Catorce)

5. ¿Qué tipo de simetría tienen las lombrices de tierra? (Simetría bilateral)

6. ¿Son insectos las lombrices de tierra? (No, se llaman **anélidos** y pertenecen a un filo que no es el de los insectos.)

7. ¿Cómo se llama la caparazón dura que recubre a algunos escarabajos e isópodos? (**Exoesqueletos**)

Why It Happens/More on the Topic

Invertebrates that live below the soil generally like cool, moist, dark areas. By putting the light on top of the funnel, the invertebrates move downward to avoid the heat and light. The wet paper towel keeps them from drying out.

Insects have three pairs of legs and three body segments. Adult insects generally have one or two pairs of wings. (They are the only invertebrates with wings). Often their bodies are surrounded by a hard structure called an exoskeleton.

Arachnids (includes spiders, mites, ticks, and scorpions) have four pairs of legs and breathe through lung-like sacs or breathing tubes. Some have bodies with segments, others don't.

Isopods (a common isopod is the pillbug) are a kind of crustacean related to shrimp, crabs, and lobsters. They have seven pairs of legs and are not insects.

Annelids are segmented worms. Earthworms are annelids. They move through the soil, eating organic matter. They move by grasping the soil with tiny bristles on each of their segments.

Mollusks include clams, mussels, oysters, snails, slugs, squids, and octopuses. They usually have soft bodies often enclosed by a shell made of hard calcium carbonate (the material in chalk). In the water, they filter organic particles that pass over their gills and mouth.

Algo más sobre el tema...

Por lo general, a los invertebrados que viven debajo de la tierra les gustan los lugares frescos, húmedos y oscuros. Al poner la luz en la parte de arriba del embudo, los invertebrados se mueven hacia abajo para evitar la luz y el calor. La toalla de papel humedecida los ayuda a evitar que se sequen.

Los insectos tienen tres pares de patas y el cuerpo dividido en tres segmentos. Los insectos adultos, generalmente, tienen uno o dos pares de alas. (Son los únicos invertebrados que tienen alas.) A menudo los cuerpos están recubiertos por una estructura dura llamada exoesqueleto.

Los arácnidos (que incluyen arañas, garrapatas, ácaros y escorpiones) tienen cuatro pares de patas y respiran a través de unos pulmones que parecen sacos o tubos respiratorios. Algunos tienen cuerpos segmentados y otros no.

Los isópodos (un isópodo común es la cochinilla de la humedad) son un tipo de crustáceos relacionados con el camarón, el cangrejo y la langosta. Tienen siete pares de patas y no son insectos.

Los anélidos son gusanos segmentados. Las lombrices de tierra son anélidos. Se desplazan a través del suelo y comen sustancias orgánicas. Para desplazarse, se "agarran" a la tierra con las pequeñas cerdas que tienen en cada segmento.

Los **moluscos** incluyen almejas, mejillones, ostras, caracoles, babosas, calamares y pulpos. En general, tienen cuerpos blandos dentro de un caparazón duro de carbonato de calcio (el mismo material de las tizas). Cuando están en el agua, filtran las partículas orgánicas que pasan a través de las branquias y de la boca.

Modifications

For younger students (including K-2), the activity can be done as a demonstration. Transfer collected invertebrates to other containers for students to observe at stations throughout the classroom. Have students draw the invertebrates they see, then discuss them as a class.

Extensions

If students didn't get a broad variety of invertebrates in their soil samples, consider adding some invertebrates for them to observe. Isopods, earthworms, and mealworms or darkling beetles can be purchased from commercial biological supply companies. Clams can be purchased at the grocery store.

Another extension idea would be to gather soil from several different areas (sandy soil vs. clay soil, surface soil vs. deep soil, etc.) to see how the composition of invertebrates compares.

References

Bosak, Susan V. Science Is...A Source Book of Fascinating Facts, Projects, and Activities. Markham, Ontario, Canada: Scholastic Canada, 1991.

Mitchell, Lawrence G., John A. Mutchmor, and Warren D. Dolphin. Zoology. Menlow Park, CA: The Benjamin/Cummings Publishing Company, Inc., 1988.

STUDENT ACTIVITY SHEET

Soil Invertebrates

Draw pictures of the invertebrates you see in your soil sample:

1. Can you identify any of the invertebrates you see? What are they?

2. Why do you think the invertebrates ended up at the bottom of the jar?

3. What would happen to an earthworm if you did not put the wet paper towel in the bottom of the jar?

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE
Invertebrados de tierra

Dibuja los invertebrados que has visto en tu muestra de tierra:

1. ¿Puedes identificar alguno de los invertebrados que has visto? ¿Qué son?

2. ¿Por qué crees que los invertebrados se fueron al fondo del frasco?

3. ¿Qué le pasaría a una lombriz de tierra si no pones la toalla de papel humedecida en el fondo del frasco?

EARTHWORMS

Lombrices de tierra

Grades		
3–8	4–5	90 minutes*

Purpose

Students will observe earthworms to learn about their characteristics and test an earthworm's preferences using the scientific method.

Materials

Earthworms (preferably night crawlers, available at local bait shops)
Paper towels
Hand lenses or magnifying glass (optional)
Spray bottle with water
Cookie sheet
Heating pad (an electric one works better than a microwavable one)
Ice tray with ice cubes
2–3 cups of different soil types (preferably a sandy soil and a dark, loamy soil)
Student Activity Sheets

Concepts

- Earthworms are classified with other segmented worms into a group called annelids.
- Earthworms need to stay moist because they breathe through their skin.
- Earthworms prefer dark, loamy soil with a lot of organic material for them to eat.

Conceptos

- Las lombrices de tierra, junto con otros gusanos segmentados, se clasifican dentro del grupo de los anélidos.
- Las lombrices de tierra necesitan mantenerse húmedas porque respiran a través de la piel.
- Las lombrices de tierra prefieren la tierra cuando es oscura, margosa y tiene mucho material orgánico para comer.

** Can be done in three parts*

Vocabulary

Invertebrate
Detritivore
Organic matter
Ectothermic

Vocabulario

Invertebrado
Detritos
Materia orgánica
Ectotermo

In Advance

Buy earthworms. Copy Student Activity Sheets. Put the heating pad and the ice tray under each end of the cookie sheet 1/2 hour before beginning the first experiment of earthworm preferences. (The cookie sheet can be set up while students are making their first observations.)

Procedure

1. Set-up for earthworm observations

Divide the class into groups of 4 to 5 students. Tell students they will be given an earthworm to look at. You should remind students that earthworms are live animals that should be handled with care. Also, they will need to make sure their earthworm stays moist by occasionally spraying it with the spray bottle. Give each student a copy of the Student Activity Sheet "Earthworm Observations."

Give each group a wet paper towel, an earthworm, and a magnifying glass or hand lens (optional). The earthworms should be kept on the paper towels while they are being observed.

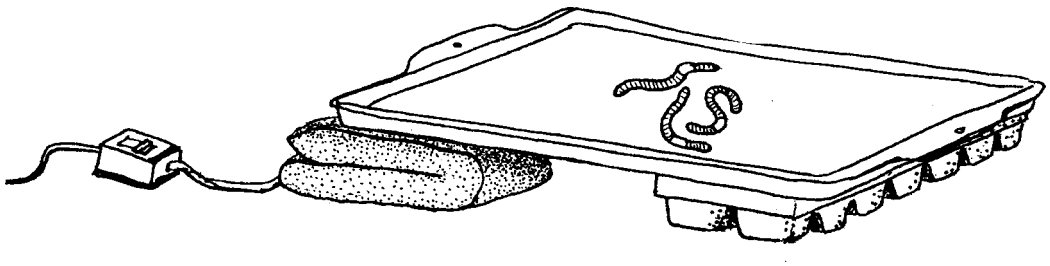
2. Observations and discussion

Tell students to answer the questions on the Student Activity Sheet as they make their observations. When they are finished, discuss their observations and answers as a class. Collect the earthworms and put away other materials.

Experiment 1 - Do earthworms prefer heat or cold?

1. Set-up

One half hour before the experiment, put the heating pad under half of the cookie sheet and the ice tray under the other half. Set the heating pad to medium or high.



Leave a space in the center to initially place the earthworms that is not under either the heating pad or the ice tray.

2. Hypothesize

Give each student a copy of the Student Activity Sheet "What Do Earthworms Like?" Tell students that you have set up an experiment to see if earthworms prefer cold temperatures or warm temperatures. Show students the cookie sheet set-up. Ask students to discuss what temperature they think the earthworms will prefer and have them write their hypothesis on the Student Activity Sheet.

3. Procedure

Place several earthworms in the center of the cookie sheet. Allow the earthworms to settle down and begin making their choices. Ask students why it might be better to have several earthworms rather than one earthworm for this experiment. Be sure to keep the earthworms moist with the spray bottle.

4. Results

When the earthworms have made their preference clear, tell students to write their observations and the outcome of the experiment on their Student Activity Sheet.

5. Conclusion

Have students compare the results with their hypothesis. Was their hypothesis supported by the results of the experiment? If not, what can they conclude about the experiment results and earthworms' temperature preferences?

Experiment 2 - What type of soil do earthworms prefer?

1. Discuss experiment set-up

Using the first experiment as an example, ask students how they might set up an experiment to see what type of soil earthworms prefer. Students will probably decide that earthworms can be given the choice between different soil types to see which

they move towards (e.g., wet soil, dry soil, sandy soil, highly organic soil, potting soil, etc.).

2. Set-up

Using the cookie sheet again, put a mound of the sandy soil on one side and a mound of dark, loamy soil on the other side.

3. Hypothesize

Ask students to discuss what soil type they think the earthworms will prefer. Have them write their hypothesis on the Student Activity Sheet.

4. Procedure

Gently place several earthworms in the center of the cookie sheet. Again, allow the earthworms to settle down and select which soil type they prefer.

5. Results

When the earthworms have made their preference clear, have students write their observations and the outcome of the experiment on their Student Activity Sheet.

6. Conclusion

Have students compare the results with their hypothesis. Was their hypothesis supported by the results of the experiment? If not, what can they conclude about the experiment results and earthworms' soil preferences?

7. Discuss

Using the "Why It Happens" section of this activity, discuss earthworm structures and behaviors.

Questions to Ask During the Activity

1. What kind of **invertebrates** are earthworms? (They belong to a group called annelids, which includes segmented worms.)

2. What is the function of the tiny bristles (setae) on the underside of the earthworm? (They help the earthworm "grab" the soil particles so it can pull itself along.)

3. Why are earthworms good to have in a garden? (They loosen and aerate the soil as they burrow through it, making it easier for plant roots to grow. They also help decompose **organic matter**.)

4. What is the control in the first experiment? (The middle of the cookie sheet because it is neither very cold nor very warm.)

5. What are the experimental variables in the second experiment? (The two different types of soil.)

Preguntas sobre el tema de la actividad

1. ¿Qué tipo de **invertebrados** son las lombrices de tierra? (Pertenecen a un grupo llamado anélidos, el cual incluye a los gusanos segmentados.)

2. ¿Qué función tienen las pequeñas cerdas (septos) en la parte de abajo de la lombriz? (Ayudan a la lombriz a que "agarre" las partículas de tierra para poder arrastrarse.)

3. ¿Por qué es bueno tener lombrices de tierra en el jardín? (Aflojan y airean la tierra al enterrarse, de esta manera facilitan el crecimiento de las raíces. También ayudan a descomponer la **materia orgánica**.)

4. ¿Cuál es la variable de control en el primer experimento? (La bandeja del medio porque no está ni muy caliente ni muy fría.)

5. ¿Cuáles son las variables del experimento en el segundo experimento? (Los dos tipos de tierra.)

Why It Happens/More on the Topic

Earthworms belong to the phylum called annelids, which includes segmented worms. On an earthworm, the segments look like many horizontal lines along the body. Earthworms are not only harmless, they are beneficial to people. Earthworms help aerate the soil by mixing up the layers of soil and making it easier for plant roots to grow. Earthworms are **detritivores** that prefer dark, rich, loamy soil with a lot of organic material for them to eat.

Earthworms have a head end (anterior) and a tail end (posterior). Adult earthworms have a smooth, swollen band around their body, called a clitellum. The purpose of the clitellum is for egg and sperm exchange during reproduction. Each individual earthworm can produce both eggs and sperm. However, they cannot self-fertilize. Instead, they join with another earthworm at the clitellum to exchange sperm cells.

Earthworms have no eyes, but they are sensitive to light. They are also very sensitive

to touch, especially vibrations. They have a mouth, but no teeth. Instead, they grind their food in a gizzard-like muscle in their digestive tract.

Earthworms have no lungs. Instead, oxygen diffuses from the air, through their skin, and into their blood vessels. Their skin needs to stay moist for them to breathe. IF AN EARTHWORM DRIES OUT, IT DIES!

Earthworms move by muscular action. They have two sets of muscles: one set is circular around the earthworm; the other set runs lengthwise along the earthworm's body. An earthworm can become long and thin by contracting the muscles that encircle its body. When the earthworm contracts its long muscles, it draws the tail end toward the head end, and the earthworm becomes shorter and fatter. The rough, hair-like bristles on the underside of the earthworm, called setae, also help the earthworm move. The setae helps the earthworm "grip" soil particles and other rough surfaces.

Earthworms have a very limited ability to regenerate certain damaged or lost parts of their body. But, they cannot regenerate whole parts of their body. If you cut an earthworm in half, it will not become two earthworms.

Algo más sobre el tema...

Las lombrices de tierra pertenecen al filo de los anélidos, el cual incluye a los gusanos segmentados. Los segmentos en una lombriz de tierra parecen líneas horizontales a lo largo del cuerpo. Las lombrices de tierra no sólo son totalmente inofensivas, sino que además son muy beneficiosas para la gente. Las lombrices de tierra airean el suelo al mezclar las distintas capas de tierra, lo cual facilita el crecimiento de las raíces de las plantas. Las lombrices de tierra son **detritos**, es decir, prefieren suelos oscuros, ricos y margosos con mucha materia en descomposición para comer.

Las lombrices de tierra tienen una cabeza en el extremo anterior y una cola en el extremo posterior. Las lombrices adultas tienen una banda abultada y lisa alrededor del cuerpo, llamada clitelo. En el clitelo se intercambian óvulos y espermatozoides durante la reproducción. Cada una de las lombrices puede producir tanto óvulos como espermatozoides. Sin embargo, no se pueden fertilizar a sí mismas. Para hacerlo se juntan con otra lombriz a la altura del clitelo e intercambian espermatozoides.

Algo más sobre el tema (continuación)

Las lombrices de tierra no tienen ojos, pero son sensibles a la luz. También son muy sensibles al tacto, especialmente a las vibraciones. Tienen boca, pero no tienen dientes. Trituran los alimentos con un músculo parecido a una molleja, dentro de la estructura digestiva.

Las lombrices de tierra no tienen pulmones. El oxígeno del aire es absorbido por la piel a través de un proceso de difusión y luego va a los vasos sanguíneos. La piel necesita permanecer húmeda para que puedan respirar. ¡SI UNA LOMBRIZ DE TIERRA SE SECA, MUERE!

Las lombrices de tierra se desplazan mediante la acción muscular. Tienen dos grupos de músculos: uno es circular, ubicado alrededor del cuerpo de la lombriz y el otro es longitudinal, ubicado a lo largo. Una lombriz puede hacerse larga y delgada contrayendo los músculos circulares. Cuando la lombriz contrae sus músculos longitudinales, atrae el extremo de la cola hacia la cabeza y la lombriz se hace corta y gruesa. Las cerdas ásperas que parecen pelos ubicadas en la parte inferior de la lombriz se llaman septos y la ayudan a deslizarse. Los septos ayudan a la lombriz a "agarrarse" de las partículas de tierra y de otras superficies rugosas.

Las lombrices de tierra tienen una habilidad muy limitada para regenerar las partes del cuerpo que se han dañado o que se han desprendido. Pero, no pueden regenerar partes enteras. Si cortas la lombriz al medio, no se transformará en dos lombrices.

Modifications

For younger grades, use the Student Activity Sheet "Earthworm Observations" as a guide to lead a class discussion while students observe their earthworms. The experiments can be done without using the Student Activity Sheet.

Extensions

Students can experiment with other earthworm preferences. For instance, some of the loamy soil can be mixed with vinegar (acidic), some can be mixed with baking soda (alkaline), and some left unmodified. Place the soil mixtures in mounds along the cookie sheet. This will test the earthworm's preference for acidic, alkaline, or unmodified loamy soil.

Additional activities with earthworms

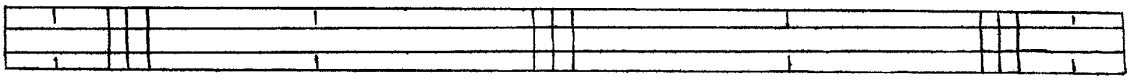
For activities that help children understand movement, anatomy, and behaviors of worms, we suggest that you purchase Canadian crawlers from a bait shop. They are large and easier to observe. However, they must be refrigerated to be kept alive, and they will not survive in a classroom worm bin that is kept at room temperature. Do not force anyone to handle worms if they seem hesitant or afraid, and do not allow children to tease others with the worms. It is cruel to the worm as well as their classmates! Most children will overcome their fears if allowed to watch others handle the worms with confidence and interest.

"Inside a Worm"

Place the worm in a clear plastic shoe box. Be sure to spray it with water to keep it moist. Darken the room and shine a flashlight up through the box. Students will be able to see the worm's internal organs—particularly the intestines. The light will make the worm uncomfortable, so do not do this for very long periods of time.

"Worm Motion"

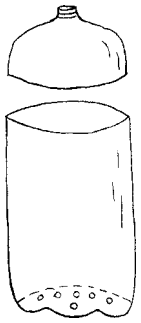
Watch a worm move. Can you tell which end is the head? A worm has muscles that run around the circumference of its body, and longitudinal muscles that run the length of its body. When it contracts the circular muscles, the body becomes longer and slimmer. When it contracts the longitudinal muscles, its body becomes shorter and bigger around. In addition, each worm has **setae**, or hair-like appendages on the underside of its body. These setae can be used as "brakes" to keep part of its body from moving. To model the movement of a worm, use a wide rubber band that is cut to lay flat. Mark one end as the head and the other as the tail. Draw a few lines the length of the band, and then draw some lines across the band at 1/2 inch intervals. Make some small marks along the sides of the band to represent the setae. Lay the "worm" on the table, hold the tail end in place and stretch the head end forward. The worm will become long and slim. This is what a worm looks like when it has contracted its circular muscles, holding its tail end in place with its setae. Slowly release the pressure on the tail end while holding down the head end. Your "worm" will move its tail end forward, and its body will become shorter and wider. This represents the worm contracting its longitudinal muscles, while holding its front end still with the setae.



Markings on wide rubber band

"A Classroom Worm Bin"

Red wigglers are ideal for a classroom worm bin. They thrive with very little attention, reproduce rapidly, and do well in a worm bin at room temperature. A covered plastic storage box from your local discount store (20–30 gal) will easily hold hundreds of worms. Drill some 1/4 inch holes in the bottom and sides for aeration, and line with newspaper. Fill with damp soil, strips of newspaper, and leaves. Put a sheet of newspaper over the soil and spray this paper with water. Your worm bin could be started with as few as six worms. (Remember, all worms are both male and female, and are able to produce young!) Students will enjoy "worm tending" (feeding table scraps and spraying the worms with water). It is not a good idea to put scraps that are animal products in the bin. The worms will eat egg, cheese, or meat, but the bin will smell bad and maggots will appear. It is also not advisable to use citric fruit very often, or the soil will become too acidic. Watch the bin carefully to judge how often and how much to feed and spray the worms. Your worm bin should smell of rich soil when the lid is open. You will not be able to smell it with the lid closed. If it begins to smell sour or rotten, take out the extra spoiled food and leave the lid off overnight to let the soil dry out. Don't worry if you don't see worms for a while—there are probably some surviving cocoons that will hatch.



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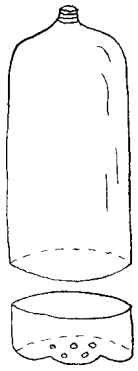

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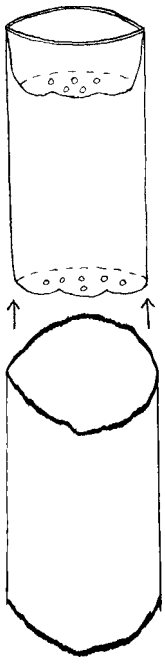

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"Individual Worm Farms"

Students enjoy having their own worm farms made from 2-liter soda bottles. The container requires two bottles. Cut the top section off one bottle, and use the bottom section of the other bottle as the lid for the container (placed upside down) and it will also serve as a "watering cup" for the container (see illustration). Drill 1/8" holes in the bottom of the container for drainage, and in the watering cup to provide a light sprinkle to the soil when a small amount of water is poured into the cup. Line the bottom of the container with shredded newspaper, then fill three-quarters full with a mixture of soil, shredded paper, and leaves. Three

wigglers will give the student a good start on his/her worm farm. Top the soil with more shredded paper, fit the cup/lid into the top, and water lightly. Make a dark paper sleeve to cover the container. It should be loosely taped so it will easily slide off and on. Students will enjoy decorating the paper to represent a worm habitat or to illustrate the varieties of food the worms might enjoy. Because the worms are in a dark environment, some of their burrows will be made against the clear plastic sides of the bottle, and can be observed when the sleeve is removed. Once a week, allow students to dump out their worm farms into flat boxes and check on their worms. Encourage them to keep a record of the increasing population. With a small container such as this, it is best to feed and water sparingly once or twice a week. If a worm farm smells bad, it is being fed and watered too much. Take out the extra food and leave the lid off overnight. As with the classroom worm bin, do not add animal products as food items.

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Website: http://www.wormwoman.com/acatalog/index.html.

In addition to the above teacher references, there are a number of excellent books for children. Check your local library for resources with clear photographs or drawings to help your students understand the anatomy and behaviors of earthworms.

STUDENT ACTIVITY SHEET

Earthworm Observations

Answer the questions below as you look at your earthworm.

1. What color is the earthworm? _____

2. Describe how the earthworm feels. _____

_____

3. How does the top side of the earthworm feel different from the bottom side?

_____

_____

4. Look at the underside of the earthworm with the hand lens or a magnifying glass. What do you see?

_____

_____

5. Place a check next to the body parts you see on the earthworm:

____ eyes ____ mouth ____ ears ____nose

6. Can you tell which is the front end and which is the tail end of the earthworm? Describe the difference.

_____

_____

7. Describe how your earthworm moves. _____

_____

8. What else to you notice about your earthworm?

_____

_____

9. Draw a picture of your earthworm below:

STUDENT ACTIVITY SHEET

What Do Earthworms Like?

Experiment 1: Warm, cold or in between?

Hypothesis (What do you think the earthworms will choose?)	***Results*** (What did the earthworms choose?)	***Observations*** (What did you notice as the earthworms made their choice?)

Experiment 2: Soil preferences

Hypothesis (What do you think the earthworms will choose?)	***Results*** (What did the earthworms choose?)	***Observations*** (What did you notice as the earthworms made their choice?)

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE

Observaciones sobre la lombriz de tierra

Contesta las siguientes preguntas mientras observas tu lombriz de tierra.

1. ¿De qué color es tu lombriz de tierra? _____

2. Describe que sientes al tocar a la lombriz. _____

_____

3. ¿Cuál es la diferencia al tacto entre el lado de arriba y el lado de abajo de la lombriz?

_____

_____

4. Observa el lado de abajo de la lombriz con un lente de aumento o con una lupa. ¿Qué ves? _____

_____

5. Marca en el espacio apropiado las partes de la lombriz que has podido observar:

____ ojos ____ boca ____ orejas ____ nariz

6. ¿Puedes darte cuenta de cuál es el extremo anterior y cuál es el posterior en tu lombriz? Describe las diferencias.

_____

_____

7. Describe cómo se desplaza la lombriz. _____

_____

8. ¿Qué otra cosa has notado en tu lombriz? _____

_____

9. Dibuja tu lombriz en el espacio siguiente:

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE

¿Qué le gusta a la lombriz de tierra?

Experimento No 1: ¿Frío, caliente o templado?

Hipótesis (¿Qué crees que la lombriz elegirá?)	***Resultados*** (¿Qué eligió la lombriz?)	***Observaciones*** (¿Qué notaste cuando la lombriz eligió?)

Experimento No 2: Preferencia de suelos

Hipótesis (¿Qué crees que la lombriz elegirá?)	***Resultados*** (¿Qué eligió la lombriz?)	***Observaciones*** (¿Qué notaste cuando la lombriz eligió?)

EARTHWORM WORK

Labor de las lombrices de tierra

Grades		
3–8	Whole Class	30 min. setup 15 min./week for 2 weeks 20 min. at the end of the third week (observations)

Purpose

Students will conduct an experiment to see how earthworms affect soil.

Materials

Three 1 gallon buckets (or larger)
Soil—enough to almost fill the buckets
Small shovel
Paper plates—2 per student
Earthworms (can be purchased at a local bait shop)
Composting material (food scraps, dry leaves, etc. cut into one inch chunks)
Magnifying glasses or hand lenses (optional)
Water
Student Activity Sheet

Concepts

- As earthworms eat their way through hard soil, they create spaces for air and water to pass through.
- Earthworms improve soil for growing plants by decomposing dead plants and animals.

Conceptos

- A medida que los gusanos comen y se mueven a través del suelo duro, crean túneles por donde pueden pasar el aire y el agua.
- Las lombrices descomponen las plantas y los animales muertos y así mejoran la calidad de la tierra para que crezcan las plantas.

Vocabulary

Experimental control
Variables
Decompose
Nutrients

Vocabulario

Control del experimento
Variables
Descomposición
Nutrientes

In Advance

Gather enough soil to almost fill all three buckets. Look for compacted soil, perhaps from the side of a road or a heavily used trail. Collect composting material such as bits of food (except meat) or leaves (except from pine trees). Copy the Student Activity Sheets.

Procedure

1. Look at soil

Give each student a paper plate with a sample of the soil on it. Also give each student a copy of the Student Activity Sheet. Tell students where you collected the soil and what, if anything, was growing in it. Ask students what type of things they might expect to find in soil that is good for growing plants.

Have students take a close look at their soil, using hand lenses or magnifying glasses if available. What color is the soil? Do they see small bits of plants in the soil? Are there any invertebrates? If so, how many? How would they describe the texture of the soil? Have students write their observations on the Student Activity Sheet.

2. Set-up

Tell students you will be setting up an experiment to see how earthworms affect soil. Have students return their soil samples to the buckets.

Add some water to one bucket and set it aside. Tell students that this bucket will be the **experimental control**. All you will be doing to this bucket is adding some water once a week.

In the second bucket, add half of the composting material and the same amount of water as the first bucket. Mix the contents of the bucket with the small shovel, then set the bucket aside.

In the third bucket, add the other half of the composting material, the same amount of water as the other buckets, and the earthworms. (The more earthworms you add, the faster the soil will change). Gently mix the contents of the bucket and set the bucket aside. Buckets can be kept inside or outside. Ask students what the **variables** are in this experiment.

3. Predict

On the Student Activity Sheet ask students to write their predictions about the changes they expect to see in the three buckets over the next several weeks. Will the soil look the same? Which soil will change the most?

4. "Feed" the soil

Once a week for the next two weeks, add some water to each bucket. Also add more composting material to the second and third buckets. Students can bring in composting material from home.

5. Look at soil again

After three weeks, give each student a paper plate with a sample of the soil from the first bucket. Have students look at the soil again and write down any changes they observe on their Student Activity Sheet. Next, give each student a soil sample from the second bucket (have them keep the sample from the first bucket for comparison). What differences do they notice between the two soil samples? Finally, give students a sample from the third bucket. Have them write their observations on the Student Activity Sheet.

6. Discuss

Ask students what they noticed about the three soil samples. What happened to the soil in the third bucket? Which soil looks the best for growing plants now? What do earthworms do in the soil? Use the information in the "Why It Happens" section of this activity to guide your discussion.

The earthworms can be released outside in a moist area when you are finished with the activity.

Questions to Ask During the Activity

1. What happens to soil next to roads or on trails people walk on? (It gets compacted.)

2. How do earthworms help soil that has been compacted? (As they work their way through the soil, they create spaces for air and water to pass through.)

3. What do earthworms do with the composting material? (They help to **decompose** it by eating and digesting it. The **nutrients** that are released enrich the soil and make it better for growing plants.)

Preguntas sobre el tema de la actividad

1. ¿Qué sucede con la tierra que se encuentra cerca de los caminos o en senderos donde camina la gente? (Se compacta)

2. ¿De qué manera pueden ayudar las lombrices a la tierra que se ha compactado? (Horadan la tierra a medida que se desplazan y crean túneles por donde pueden pasar aire y agua.)

3. ¿Qué hacen las lombrices con la materia en descomposición? (Al consumir y digerir la materia, ayudan a **descomponerla**. Luego los **nutrientes** que se liberan enriquecen el suelo y lo hacen más propicio para que crezcan plantas.)

Why It Happens/More on the Topic

Earthworms belong to the phylum called annelids, which includes segmented worms. On an earthworm, the segments look like many horizontal lines along the body. Earthworms are not only harmless, they are beneficial to people. Earthworms help aerate the soil by mixing up the layers of soil and making it easier for plant roots to grow. Earthworms are **detritivores** that prefer dark, rich, loamy soil with a lot of organic material for them to eat.

Algo más sobre el tema...

La lombriz de tierra pertenece al filo de los anélidos, que incluye a los gusanos segmentados. Los segmentos de la lombriz de tierra parecen líneas horizontales a lo largo del cuerpo. Las lombrices de tierra no sólo son inofensivas sino que además son beneficiosas para la tierra. Las lombrices ayudan a airear el suelo al mezclar las capas de tierra y facilitan el crecimiento de las raíces de las plantas. Las lombrices de tierra son detritos y prefieren la tierra oscura, húmeda y margosa con materia orgánica para consumir.

Modifications

The activity can be done with younger students using the Student Activity Sheet as a guide for class discussion rather than using it individually.

Extensions

Plant fast-growing seeds in each of the three soil types created during the activity. Have students predict which soil will be the best for growing seeds, then watch what happens.

References

Bosak, Susan V. Science Is...A Source Book of Fascinating Facts, Projects, and Activities. Markham, Ontario, Canada: Scholastic Canada, 1991.

Western Regional Environmental Education Council. Project Wild. Boulder, CO, 1986.

STUDENT ACTIVITY SHEET
Earthworm Work

1. Describe the soil sample on the first day of the experiment:

_____

_____

_____

_____

2. Predict how the soil will change in each of the three buckets:

Bucket	Prediction
Bucket 1 • soil • water	
Bucket 2 • soil • water • composting material	
Bucket 3 • soil • water • composting material • earthworms	

STUDENT ACTIVITY SHEET
Earthworm Work (continued)

3. Describe the soil in each bucket after three weeks:

Bucket	Description
Bucket 1 • soil • water	
Bucket 2 • soil • water • composting material	
Bucket 3 • soil • water • composting material • earthworms	

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE

Labor de las lombrices de tierra

1. Describe la muestra de tierra durante el primer día del experimento.

_____

_____

_____

_____

2. Haz predicciones sobre el cambio que sufrirá la tierra que se encuentra en cada una de las cubetas.

Cubeta	**Predicción**
Cubeta No 1 • tierra • agua	
Cubeta No 2 • tierra • agua • materia orgánica	
Cubeta No 3 • tierra • agua • materia orgánica • lombrices de tierra	

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE

Labor de las lombrices de tierra (continuación)

3. Describe la tierra que se encuentra en cada una de las cubetas tres semanas más tarde.

Cubeta	**Descripción**
Cubeta No 1 • tierra • agua	
Cubeta No 2 • tierra • agua • materia orgánica	
Cubeta No 3 • tierra • agua • materia orgánica • lombrices de tierra	

ISOPOD FEEDING HABITS

Hábitos alimenticios de los isópodos

Grades		
2–8	4–5	60 minutes

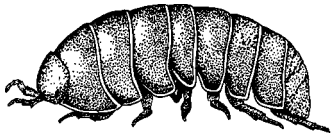
Purpose

Students will use an experiment to see what isopods (pillbugs) like to eat.

Materials

For each group:

10 isopods (Isopods can be purchased from a biological supply company or found outside in moist areas underneath leaves, branches, rocks, or boards.)
Shoe box with lid
1 tablespoon lunch meat
1 small piece of potato
1 small piece of apple
1 tablespoon of grass clippings
Student Activity Sheet
Hand lenses (optional)



Concepts

- Isopods are crustaceans classified in the order Isopoda.
- Isopods are omnivores.

Conceptos

- Los isópodos son crustáceos clasificados en la orden de los Isopoda.
- Los isópodos son omnívoros.

Safety

Have students wash their hands after the activity.

Vocabulary

Feeding habit
Omnivore
Herbivore
Carnivore
Variable

Vocabulario

Hábitos alimenticios
Omnívoros
Herbívoros
Carnívoros
Variable

In Advance

Collect isopods from outside or order them from a biological supply company. Gather other materials and copy the Student Activity Sheet.

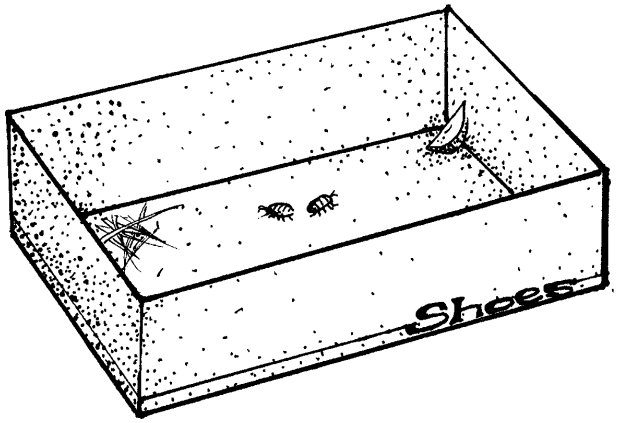
Procedure

1. Introduce the isopods

Show the class one of the isopods and ask them what they call this bug. They are commonly referred to as pill bugs, rolly-poly bugs, and sow bugs. Ask students if they think the isopod is a type of insect. Remind them, if necessary, that insects have three pairs of legs. Tell students that isopods are classified in the order Isopoda. They are a kind of crustacean and are related to shrimp, crabs, and lobsters. Tell the class that they will be setting up an experiment to see what type of food isopods prefer to eat.

2. Set-up

Divide the class into groups of 4 to 5 students. Give each group a shoe box, the meat, the piece of potato, the piece of apple, the grass clippings, and a Student Activity Sheet. Tell the groups to place each of the four foods into a different corner of the box. Next, hand out the isopods and have students place them in the center of the shoe box. To keep the isopods from escaping, have students put the lid on the box.



3. Observations

Explain to students that they will be making observations of the isopods every five minutes for the next 45 minutes. Each time, they should record their observations on the Student Activity Sheet. Remind students to replace the box lid after each observation.

Tell the class you will be announcing the time of each observation. Between observations, you may want students to be occupied with another activity that can be easily interrupted. One option is to have students take a closer look at an isopod's features with a hand lens. They can also experiment to see what the isopod does when it is gently disturbed.

4. Interpreting the data

When the observations are complete, collect the isopods, and have students throw the food in the trash can. The isopods can be released into a moist area outside later.

Ask students if they were able to figure out what the isopod's favorite food was. Did the isopods eat more than one type of food? Was there a food that none of the isopods chose? Based on their observations, what type of **feeding habit** do isopods have? Are isopods **herbivores** (plant-eaters), **carnivores** (meat-eaters), or **omnivores** (eat both plants and animals)?

Questions to Ask During the Activity

1. What is the **variable** in this experiment? (The food types.)

2. Did all the isopods prefer the same food type? (Probably not. Individual isopods have different food preferences.)

3. If the isopods were given a different type of meat, a banana, bread, and leaves, what do you think they would choose to eat? (Isopods are not choosy, they may eat a little bit of everything.)

Preguntas sobre el tema de la actividad

1. ¿Cuál es la **variable** en el experimento? (Los distintos tipos de alimentos.)

2. ¿Prefirieron la misma comida todos los isópodos? (Probablemente no. Cada uno de los isópodos tiene diferentes preferencias alimenticias.)

3. Si les dieras a los isópodos distintos tipos de carne, banana, pan y hojas, ¿qué crees que elegirían? (Los isópodos no son exigentes, es posible que coman un poco de todo.)

Why It Happens/More on the Topic

Isopods are a type of crustacean classified in the same order as shrimp, crabs, and lobsters—the order Isopoda. There are many different isopod species around the world. Unlike shrimp, crabs, and lobsters, isopods live on the land instead of in the water. They are also one of the few land animals that breathe with gills. When isopods feel threatened, they roll up in a tight ball to protect themselves.

Because isopods have difficulty retaining water, they prefer to live in moist, humid environments. They are often found underneath logs, leaves, or rocks where the soil is moist. Generally, isopods are more active at night.

Isopods can be kept in a classroom terrarium if they have a potato slice, a moist paper towel, and a hiding place.

Algo más sobre el tema...

Los isópodos son un tipo de crustáceos clasificados en la misma orden que los camarones, los cangrejos y las langostas, la orden de los Isopoda. Hay muchas especies distintas de isópodos en el mundo. A diferencia de los camarones, cangrejos y langostas, los isópodos viven en la tierra en vez de en el agua. Además, son unos de los pocos animales de tierra que respiran por las branquias. Cuando los isópodos se sienten amenazados, se hacen una bolita para protegerse.

Los isópodos tienen dificultad para retener agua, prefieren vivir en lugares húmedos o mojados. A menudo se encuentran debajo de troncos, de hojas o de rocas donde el suelo es húmedo. En general, los isópodos son más activos durante la noche.

Los isópodos pueden vivir en el terrario de la clase siempre que tengan una rodaja de papa, una toalla de papel húmeda y un lugar donde esconderse.

Modifications

Each group can use a different set of food items to test isopod preferences. Try fruit, bread, rice, cheese, different leaves, etc.

Extensions

Have all the groups pool their data, then create bar graphs showing the number of isopods at each type of food over time. Older students can use the same data to calculate the percentage of the isopods that preferred each food type.

References

Burnett, Robin. The Pillbug Project: A Guide to Investigation. Washington, DC: National Science Teachers Association, 1992.

STUDENT ACTIVITY SHEET
Isopod Feeding Habits

Write the number of isopods closest to each food type below:

Time	Meat	Potato	Apple	Grass Clippings
5 minutes				
10 minutes				
15 minutes				
20 minutes				
25 minutes				
30 minutes				
35 minutes				
40 minutes				
45 minutes				

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE
Hábitos alimenticios de los isópodos

Escribe el número de isópodos que se encuentran más cerca de cada tipo de alimento.

Tiempo transcurrido	**Carne**	**Papa**	**Manzana**	**Hebras de grama**
5 minutos				
10 minutos				
15 minutos				
20 minutos				
25 minutos				
30 minutos				
35 minutos				
40 minutos				
45 minutos				

CAMOUFLAGE

Camuflaje

Grades		
K–2	Whole Class	45 minutes

Purpose

Students will play a game to show how animals that are camouflaged are less likely to be "eaten."

Materials

30 green twist ties or 15 green pipe cleaners cut in half
30 pieces of string or yarn (a few inches long, any color but green)
30 beige rubber bands
Books with pictures of camouflaged animals (especially invertebrates)

Concepts

- Camouflage is an adaptation that allows animals to blend into their surroundings.
- An animal that eats other animals is a predator.
- Animals that are camouflaged are less likely to be found and eaten by predators.
- Many invertebrates are camouflaged.

Conceptos

- El camuflaje es una adaptación que permite que los animales se confundan con el medio ambiente.
- Un animal que come a otro se llama predador.
- Los animales que pueden camuflarse tienen menos posibilidades de que un predador los encuentre y los coma.
- Muchos invertebrados pueden camuflarse.

Vocabulary

Camouflage
Predator
Prey
Invertebrate

Vocabulario

Camuflaje
Predador
Presa
Invertebrado

In Advance

Select a small, grassy site outdoors or a barren desert-type area with little vegetation. Cut yarn and gather materials.

Procedure

1. Set up game

Take students outside to the area you selected and have them line up along one edge. Define the words **predator** and **prey** and tell students that they will pretend to be predators looking for prey in the selected area (e.g, grassy area or sandy area).

Take out the twist ties, yarn, and rubber bands and tell students these items are the "prey" they will be hunting for. Explain that they will be hunting one at a time and they will be picking up one prey item during their turn. Spread the items throughout the selected area while students wait. (It's OK if students watch you spread the items.)

2. Play the game

Call on students one at a time to run into the selected area and "catch" a prey item. They should not spend too much time looking, but should pick an item quickly. The other students can cheer the predator on as he/she searches for prey. Each child should keep his/her prey item for the time being.

If you have time, each student can have a second turn. Pick up the remaining prey items when you are finished.

3. Return to the classroom and count the prey

Bring the students back into the classroom with their prey items. Ask students to raise their hands if they "caught" a twist tie. Write the total number on the chalkboard. Repeat with the yarn and rubber bands. Collect the twist ties, yarn, and rubber bands when they are all counted.

4. Discuss

Ask students which prey item was the most difficult to find in the selected area. Was it the same item that was picked up the least during the game? Students should begin to realize that in a grassy area the green twist ties match the green grass and in a sandy or barren area the beige rubber bands match the surrounding area, which make them difficult to spot. Tell students when an animal matches its surroundings, it is called **camouflage**. Animals use camouflage to hide from danger, especially predators.

Animals that are able to avoid predators live longer. Some predators are also camouflaged. It helps them to avoid detection while they sneak up on their prey.

5. Show pictures

Using picture books, show students pictures of animals that use camouflage to protect themselves. Tell students that many invertebrates are camouflaged, such as the walking stick insect, moths, and butterflies. If possible, show them pictures of invertebrates that match their surroundings. Can they think of any other examples of camouflage?

Questions to Ask During the Activity

1. In what ways can an animal be camouflaged? (Color, pattern, and body shape.)

2. If camouflage helps an animal hide from predators, why are some animals brightly colored animals? (Some animals are brightly colored as a warning to predators that they are toxic to eat. Sometimes an animal's colors help to attract a mate. In some cases, an animal already has another feature that protects it from predators, like a hard shell or spines.)

Preguntas sobre el tema de la actividad

1. ¿De qué manera puede camuflarse un animal? (Color, diseño y forma del cuerpo)

2. ¿Si el camuflaje ayuda a los animales a esconderse de sus predadores, ¿por qué hay algunos animales que tienen colores fuertes y brillantes? (Algunos animales tienen colores brillantes como una manera de advertir a los predadores de que son tóxicos y no deben comerlos. A veces los colores brillantes sirven para atraer a un consorte. En algunos casos, un animal ya tiene algo para protegerse de los predadores, por ejemplo un caparazón o espinas.)

Why It Happens/More on the Topic

Camouflage is an adaptation that helps an animal avoid detection. Animals can be camouflaged by matching the color of their surroundings (a green frog in green grass), or by matching the pattern of their surroundings (a speckled moth on speckled tree bark), or by matching the shape of something in their surroundings (a walking stick is shaped like the stems of a plant).

Algo más sobre el tema...

El camuflaje es una adaptación que ayuda a que los animales no sean detectados. Los animales pueden camuflarse cambiando de color para amalgamarse con el medio ambiente (una rana verde en pasto verde) o mimetizando el diseño del medio (una polilla moteada sobre la corteza de un árbol con manchas) o tratando de confundirse con la forma de algo que se encuentra en los alrededores (el insecto palo tiene la forma del tallo de una planta).

Modifications

The game can be modified for play on other surfaces. On asphalt, use dark grey yarn.

Extensions

Have each student bring in a picture of a wild animal from a magazine or book, then draw a picture of a place where that animal would be camouflaged.

References

Bosak, Susan V. Science Is...A Source Book of Fascinating Facts, Projects, and Activities. Markham, Ontario, Canada: Scholastic Canada, 1991.

THE SPONGE: AN UNUSUAL INVERTEBRATE

La esponja: un invertebrado inusual

Grades		
4–8	3–4	45 minutes

Purpose

Students will look at the internal structure of natural and synthetic sponges, then measure the water-holding capacity of each.

Materials

For each group:

Pieces of natural and synthetic sponges (available in grocery stores, pharmacies, home improvement stores, and biological supply companies)
Balance or kitchen scale
Beaker or water container
Water
Hand lens
Microscope (optional)
Pictures of live sponges

For each individual:

Student Activity Sheet

Concepts

- Natural sponges are invertebrate animals that live in the water.
- Natural sponges feed by filtering food out of the water that passes through their bodies.
- Synthetic sponges are designed to mimic the water-holding capacity of natural sponges.

Conceptos

- La esponja natural es un animal invertebrado que vive en el agua.
- La esponja se alimenta filtrando los alimentos del agua que pasan a través de sus cuerpos.
- La esponja sintética está diseñada para mimetizar la capacidad de absorción de agua que tiene la esponja natural.

Vocabulary

Invertebrate
Nutrients
Endoskeleton
Sponges

Vocabulario

Invertebrado
Nutriente
Endoesqueleto
Esponja

In Advance

Cut up pieces of both kinds of sponges. Copy the Student Activity Sheet.

Procedure

1. Introduce activity

Begin by asking students if they know whether a natural sponge is an animal, plant, or a non-living organism. If they guess it's an animal, can they guess how it is classified and why? Sponges are **invertebrates**, but it's not clear they are even living organisms until they are seen up close.

2. Observe the sponges

Divide the class into groups of 3 or 4 students. Give each group a piece of the natural sponge, a piece of the synthetic sponge, and a hand lens (or microscope if available). Also give each individual a copy of the Student Activity Sheet.

Instruct the students to look at the natural sponge and the synthetic sponge with the hand lenses or microscopes. They should draw their observations on the Student Activity Sheet. Also tell them to write a description of the differences they notice between the two types of sponges. Ask if they can predict which kind of sponge will hold more water.

3. Measure and calculate the water-holding capacity of the sponges

Give each group a balance or kitchen scale and a beaker with water. Tell students they will be weighing their sponges with and without water to see how much water each type of sponge can hold. Because the two sponges are not exactly the same size, they will need to do some calculations after the sponges are weighed.

Have students use the balance or kitchen scale to weigh each dry sponge. Be sure they write the weight (mass) of the dry sponges on the Student Activity Sheet. Next, students should soak each sponge in the beaker of water, weigh them, and write the weight (mass) on the Student Activity Sheet.

Using the information on the Student Activity Sheet, have students calculate the water-holding capacity of each type of sponge.

4. Compare and discuss

When all the groups have finished their calculations, discuss the results as a class. Were all the water-holding capacities the same? Why or why not? Why is water-holding capacity important for a natural sponge?

Questions to Ask During the Activity

1. What is the function of the sponge's "skeleton"? (The skeleton, in addition to the surrounding water, helps to support the sponge.)

2. How do sponges get **nutrients**? (Nutrients are filtered from the water as they pass by special cells within the sponge's body.)

3. How do cell wastes leave the sponge? (They are released into the water that is filtered through the sponge.)

4. Why is water-holding capacity important for a natural sponge? (The more water a sponge can filter, the more nutrients the sponge will pick up.)

5. Is the natural sponge you are using today still alive? (No, what you are looking at is the skeleton of a once-living sponge.)

6. Why do most people use synthetic sponges instead of natural sponges? (Since a natural sponge is part of an animal, there is a limited supply of natural sponges. Also, synthetic sponges are usually less expensive.)

Preguntas sobre el tema de la actividad

1. ¿Cuál es la función del "esqueleto" de la esponja? (El esqueleto junto con el agua que la rodea ayuda a sostener el cuerpo de la esponja.)

2. ¿Cómo recibe la esponja los nutrientes? (Los nutrientes del agua se filtran al pasar por unas células especiales que se encuentran dentro del cuerpo de la esponja.)

3. ¿Cómo se desprende la esponja de los excrementos? (Se liberan en el agua que se filtra a través de la esponja.)

Preguntas (continuación)

4. ¿Por qué es importante para la esponja natural tener mucha capacidad para absorber agua? (Cuanta más agua puede filtrar la esponja, más nutrientes podrá juntar.)

5. ¿Está viva todavía la esponja natural que estás usando hoy? (No, lo que ves es el esqueleto de una esponja natural que alguna vez estuvo viva.)

6. ¿Por qué la mayoría de la gente usa esponjas sintéticas en vez de naturales? (Como la esponja natural es parte de un animal, la oferta es limitada. Además, generalmente las esponjas sintéticas son mucho más baratas.)

Why It Happens/More on the Topic

Natural sponges are invertebrate animals that live in the water. Most sponges stay in one place, attached to a solid surface. They feed by straining food out of the water as it passes through their bodies. The water-holding capacity of a sponge is a measure of how much water the sponge could filter while it was alive.

Natural sponges have an internal skeleton, called an **endoskeleton**, that helps to support their body. The skeleton of many sponges is made of a fibrous protein called **spongin**. Some sponges have endoskeletons made of calcium carbonate or silicon. After the sponge dies, the skeleton remains. It is the skeleton we use.

Algo más sobre el tema...

La esponja natural es un animal invertebrado que vive en el agua. La mayoría de las esponjas se quedan en un lugar adheridas a una superficie sólida. Se alimentan filtrando los alimentos del agua que pasa a través de sus cuerpos. La capacidad de la esponja para absorber agua es una forma de medir cuanta agua podía filtrar esa esponja mientras estaba viva.

La esponja natural tiene un esqueleto interno, llamado **endoesqueleto**, que la ayuda a sostener su cuerpo. El esqueleto de muchas de las esponjas está formado por una proteína fibrosa llamada **espongina**. Otras esponjas tienen esqueletos formados por carbonato de calcio o por dióxido de cilicio. Después de que la esponja muere, queda el esqueleto. El esqueleto es la parte que nosotros usamos.

Modifications

Show younger students an example of how to calculate the water-holding capacity before they calculate their own.

Extensions

Have students research sponges. Where in the world are sponges found? How do the sponge's cells help it to filter water and get the nutrients the sponge needs? Why are sponges classified as an animal rather than a plant or fungi?

References

The New Mexico Museum of Natural History and Science. Proyecto Futuro Life Science Curriculum. First edition. Albuquerque, NM: 1996.

STUDENT ACTIVITY SHEET

Sponges

1. Look at the natural sponge and synthetic sponge under magnification, then draw what you see below:

Natural Sponge	Synthetic Sponge

2. Describe the differences between the two types of sponges.

3. Predict which sponge will hold more water.

4. Weigh both sponges when they are dry and when they are wet. (Weigh them dry first). Write the weights (mass) in the spaces below, then calculate the water-holding capacity of each sponge.

	Wet weight (mass)	Dry weight (mass)	Water-holding capacity = wet mass divided by dry mass
Natural sponge			
Synthetic sponge			

5. Which sponge holds more water? Why?

ACTIVIDADES PRÁCTICAS PARA EL ESTUDIANTE

La esponja

1. Observa la esponja natural y la sintética bajo un lente de aumento y luego dibuja lo que ves en el espacio a continuación.

Esponja natural	**Esponja sintética**

2. Describe las diferencias entre los dos tipos de esponjas.

3. Predice cuál de las esponjas absorberá más agua.

4. Pesa ambas esponjas cuando están secas y luego cuando están mojadas. (Pésalas primero cuando están secas.) Escribe el peso de ambas (masa) en los espacios a continuación, luego calcula la capacidad para retener agua de cada esponja.

	Peso estando mojada (masa)	Peso estando seca (masa)	Capacidad de retención = masa mojada dividido por la masa seca
Esponja natural			
Esponja sintética			

5. ¿Cuál de las dos esponjas retiene más agua? ¿Por qué?