

Creeping and Crawling Observing Mealworms & Earthworms

Utah Science - Heredity



Materials

- ◆ science journal for each student
- ◆ 25-50 live mealworms. Mealworms are very inexpensive and can be purchased at any pet store. Please read “Caring for Mealworms,” below.
- ◆ 25-50 live earthworms or night crawlers. Earthworms are very inexpensive and can be purchased at any fishing supply store.
- ◆ 1 tray for each group
- ◆ 1 metric ruler for each group
- ◆ black and white construction paper to cover half of each tray
- ◆ 1 flashlight for each group
- ◆ 2 chenille stems for each group
- ◆ several items to serve as barriers, such as pencils, clothespins, blocks of wood, crumbled pieces of paper, or soil for each group
- ◆ paper towels
- ◆ waxed paper
- ◆ 1 pipette or eyedropper for each group
- ◆ 1 small container of water for each group
- ◆ bran flakes or oatmeal, carrot tops or celery leaves
- ◆ an assortment of mealworm adults, larvae and pupae (if you do not grow mealworm larvae to adulthood); see “Additional Resources” for ordering information.

Background

Sometimes offspring do not look like the parent organism at first; but as the offspring go through their life cycles they begin to look more like their parent(s). A life cycle is the stages a living organism goes through during its lifetime. Many insects go through dramatic changes from eggs to adults. The process is called metamorphosis.

Every organism responds to its environment, which is the surroundings in which the organism lives. Some behaviors (the way in which an organism acts) are “built-in” because they are inherited from the parent organism. These behaviors are called inherited or instinctual. Other behaviors are not inherited, but can be learned.

During the investigation, keep the mealworms in the container in which you purchased them. Feed the mealworms bran cereal and/or oatmeal. For moisture, place a small piece of apple or potato in the container (frequently check the apple or potato to make sure it is not too dry or getting moldy).

Since some investigations need “hungry” mealworms, have a separate container that has no food source available. Mealworms need to be kept in a warm, but not hot, area. Do not place their container in direct sunlight. Mealworms move slowly when the temperature is below 58°F. They will mature at a faster rate if they are kept in a warm area at 75-85°F. See “Building a Mealworm Habitat,” for more details.

To be effective, this set of activities needs to be conducted over a time period of several days. The following is a suggested time schedule:

Time: 60 - 90 minutes

Grade Level: 5

Science, Standard 5

Students will understand that traits are passed from the parent organisms to their offspring, and that sometimes the offspring may possess variations of these traits that may help or hinder survival in a given environment.

Objective 1

Using supporting evidence, show that traits are transferred from a parent organism to its offspring.

- a. Make a chart and collect data identifying various traits among a given population (e.g., the hand span of students in the classroom, the color and texture of different apples, the number of petals of a given flower).
- b. Identify similar physical traits of a parent organism and its offspring (e.g., trees and saplings, leopards and cubs, chickens and chicks).
- c. Compare various examples of offspring that do not initially resemble the parent organism but mature to become similar to the parent organism (e.g., mealworms and darkling beetles, tadpoles and frogs, seedlings and vegetables, caterpillars and butterflies).
- d. Contrast inherited traits with traits and behaviors that are not inherited but may be learned or induced by environmental factors (e.g., cat purring to cat meowing to be let out of the house; the round shape of a willow is inherited, while leaning away from the prevailing wind is induced).
- e. Investigate variations and similarities in plants grown from seeds of a parent plant (e.g., how seeds from the same plant species can produce different colored flowers or identical flowers).

Day 1

Read the “Background Information” on each organism. Students should gain an understanding of each organism’s normal environment and how their physical characteristics provide a survival advantage. Have students also list behaviors that would be instinctual for each organism. Place damp paper towels in the freezer (see “Temperature Stimulus” below) for Day 2 investigations.

Day 2

Conduct the investigations of how each organism responds to black and white surfaces, light, touch, barriers, moisture and temperature.

Day 3

Place the mealworms and earthworms in containers without food for 24 hours so they are hungry.

Day 4

Conduct the investigations of how each organism responds to food. Discuss inherited versus learned behaviors. If you are not going to watch the mealworms complete their metamorphoses, compare and contrast mealworm larvae, pupae and adults.

A Two-Week Period

Build a mealworm habitat and watch the mealworms complete their metamorphoses into darkling beetles.

Procedures

Engage students in the following investigations with mealworms and earthworms. Have them record their observations, questions and conclusions in their science journals.

1. Divide students into cooperative groups.
2. Place a live mealworm and a live earthworm on a tray for each group.
3. Allow students to observe these organisms moving around on the tray.
4. Have students sketch each organism, measure how long each is, record how each one moves about, and chart any kind of noise made as it moves.
5. Have students discuss which end is the head and which is the tail of each organism. Have them give observable evidence to justify their reasoning.
6. Encourage students to gently pick up each organism and describe what it feels like on their hands.
7. After allowing students to make their initial observations, gather the trays, and return the worms to their containers.

Investigations

Black and white surface stimulus

1. Give each group a tray with half of the surface covered with black paper and the other half with white paper.
2. Have students predict whether mealworms will prefer the black or white surfaces and justify their predictions.
3. Place several mealworms directly on the dividing line between black and white.

4. Allow 5-10 minutes for students to observe the mealworms' behaviors. Have students record their observations with an explanation for the mealworms' behaviors.
5. Repeat this process with earthworms.

Light and touch stimulus

1. Have students predict the mealworms' response to light from a flashlight, and to being gently touched with a chenille stem. Have them justify their predictions.
2. Put mealworms on trays and give one to each group.
3. Shine a flashlight directly on the mealworms and observe their behaviors.
4. Gently touch the mealworms with a chenille stem that has a small loop at that end and observe their behaviors.
5. Allow 5-10 minutes for students to observe the mealworms' behaviors. Have students record their observations with an explanation for the mealworms' behaviors.
6. Repeat this process with earthworms.

Barrier stimulus

1. Give each group several items to act as barriers (a pencil, a clothespin, a block of wood, a crumbled piece of paper or a pile of soil, etc.).
2. Have students predict the mealworms' responses to these barriers. Will they initially go around a barrier? Crawl over it? Burrow underneath it? Try to keep going forward? Go backwards? Will their responses differ for different barriers? Have students justify their predictions.
3. Give each group a tray and have the students arrange 3 or 4 barriers on it.
4. Place several mealworms on the tray.
5. Allow 5-10 minutes for students to observe the mealworms' behaviors. Have the students record their observations with an explanation for the mealworms' behaviors.
6. Repeat this process with earthworms.

Moisture stimulus

1. Have students predict whether mealworms will prefer a moist surface or a dry surface and justify their predictions.
2. Give each group a tray with half of the surface covered with a moist paper towel and the other half covered with a dry paper towel.
3. Place several mealworms directly on the dividing line between moist and dry.
4. Give each group a pipette or eyedropper and a small container of water. Have students gently place one drop of water on each mealworm and make observations of its response. Have students record their observations in their journals with an explanation for the mealworms' behaviors.
5. Repeat this process with earthworms.

Temperature stimulus

1. The day before this activity, place several slightly damp paper towels in a freezer. Place layers of waxed paper in between the

- damp paper towels for easy separation.
2. Prior to this activity, slightly moisten several paper towels and leave them at room temperature.
 3. Just before this activity, place several slightly damp paper towels in a microwave to heat them.
 4. Have students predict how mealworms will react to a cold surface, a room-temperature surface and a hot surface, then justify their predictions.
 5. Give each group a tray and a cold, a hot, and a room-temperature paper towel.
 6. Place several mealworms on each paper towel.
 7. Allow 5-10 minutes for students to observe the mealworms' behaviors. Have students record their observations with an explanation for the mealworms' behaviors.
 8. Repeat this process with earthworms.



Food stimulus

1. The day before this activity, put mealworms and earthworms in a container with no food for 24 hours.
2. Have students predict how hungry mealworms will react when a food source is placed at the other end of a tray. Will they follow a direct route to the food? Will they meander around until they find it? Will they ignore it?
3. Give each group a tray with a small pile of bran flakes at one end.
4. Place several mealworms on the opposite end of the tray from the bran flakes.
5. Allow 5-10 minutes for students to observe the mealworms' behaviors. Have students record their observations with an explanation for the mealworms' behaviors.
6. Repeat this process with earthworms, using carrot tops or celery leaves instead of bran.

Questions for Discussion, Investigation & Assessment

1. As a class, list examples of instinctual and learned behaviors in other organisms and humans.
 - Examples of instinctual behaviors include: wolves living in a pack, moths flying toward the light, and bird and salmon migrations.
 - Examples of learned behaviors include: riding a bike, dogs scratching at the door to be let outdoors, and cats meowing to be fed.
2. Discuss the role that instinctual and learned behaviors might play in providing an organism with a survival advantage or disadvantage in a particular environment.

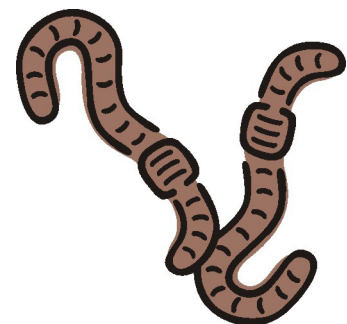
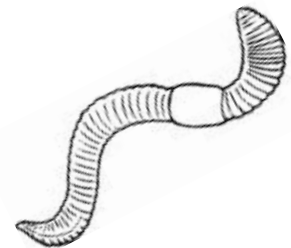
Comparing Mealworm Life Cycle Stages

Do one of the following:

- Construct a mealworm habitat and observe mealworm larvae undergoing metamorphoses to become adults (see "Building a Mealworm Habitat").
- Purchase an assortment of larvae, pupae and adults (see "Additional Resources"). Have students observe each of the life stages, comparing and contrasting their similarities and differences.

Additional Activities, What's Next?

- Prepare a bird observation area by hanging one or more bird feeders near a classroom window. If using multiple bird feeders, use different types of food to attract different types of birds. Have a bird identification book and a pair of binoculars placed where students can use these tools for observation and identification.
- Integrate social studies concepts by having students examine Old and New World plants and animals. Did these plants need to adapt to new climates and conditions or were there greater changes in the culture of the people? Use the Internet to find information on Teosinte, a native grass that was changed over time to eventually become maize, a staple for the Native American diet.
- Have students explore how a changing environment provided different survival advantages for the English peppered moth. These moths occur in two forms: a light gray form with dark splotches, and a uniformly dark form. Peppered moths rest during the day on trees and rocks encrusted with light-colored lichens which camouflage the light form, but expose the dark form to increased predation by birds. Before the Industrial Revolution, the dark moths were very rare. Pollution from the Industrial Revolution darkened the countryside in the late 1800s, killing the lichens. In this changed environment, the dark moths were concealed from birds, and the light moths became very rare.



Additional Resources

- Mealworms can be purchased at your local pet store. They are inexpensive and most are sold in amounts of 50, 100 or 200. The large mealworms cost more, but are more lively and easier for students to observe. The large mealworms are often treated with hormones so they will NOT become adult beetles. The small mealworms will change into adult beetles within a month or two. Carolina Science and Math (www.carolina.com), Nasco (www.enasco.com/prod/Home) are also possible sources for mealworms.
- Earthworms, or night crawlers, can be purchased cheaply and easily at your local fishing tackle shop. They are sold by the dozen. They can also be purchased from Carolina Science and Math.
- *The Honey Files, A Bee's Life, A Teaching Guide* and video. Available from the National Honey Board, 390 Lashley Street, Longmont, CO, 80501-6045, or www.honey.com/consumers/kids/. This shows the life stages of bees and their survival behaviors.
- *Honey Bee Study Prints*, twelve over-sized pictures of the life cycle of honeybees. Borrow from Utah Agriculture in the Classroom www.agclassroom.org/ut or purchase from Dadant & Sons, *Honey Bee Study Prints*, twelve oversized (13" x 18") pictures of the lifecycle of honey bees. Available from Dadant & Sons, click on online catalog and the search "study prints." www.dadant.com.

This lesson was created by Agriculture in the Classroom at Utah State University and is part of the Fifth Grade Science Teacher Resource Book (TRB3) <http://www.usoe.org/curr/science/core/5th/TRB5/>. The TRB3 was designed as a textbook for teaching science curriculum. This book covers all the objectives of each standard and benchmark. Students who comprehend the content in this lesson should do well on the End-of-Level (CRT) tests.

Mealworms - Background Information

Introducing *Tenebrio molitor*, otherwise known as the mealworm, the darkling beetle, or the stink bug. Mealworms are part of the very large beetle family of insects. Of the three million species of insects, one million are some type of beetle. An amazing 25% of all species on earth are beetles. The darkling beetle is related to the well-known ladybug and firefly.

The darkling beetle is found worldwide, but is more common in warm, dry climates. In nature, they are found under the bark of decaying logs and trees. They are also found in towns and cities, usually infesting flour, cereals and grains. Although they are not common in homes, they are often present in flour mills or barns where livestock feed is stored.

Like all insects, the darkling beetle goes through a metamorphosis or change during its life cycle. Like all organisms that go through metamorphoses, the darkling beetle does not initially look like its parent organism. Its life cycle is a sequence of changes from egg to adult. Most animals have specialized structures that help them collect information about their environment. Humans use their senses of smell, touch, hearing, sight, and taste to perceive their surroundings. Mealworms have simple eyes that can sense changes in light brightness but cannot give the mealworm a clear picture of its surroundings. It seems mealworms mainly use their senses of touch to find their way around. They crawl with their legs and appear to sense an edge with both their legs and antennae. A mealworm's survival depends on its finding sufficient food and hiding from predators. Its ability to assess its environment and move depends on its body form and the senses it possesses. Mealworms will shed their skin (molt) several times during the larval stage in order to grow larger. How often they molt depends on the temperature of their environment. The darkling beetle goes through the following four stages of development:

Egg

The eggs of the mealworm are too small to see with the naked eye. The hatching of these eggs marks the beginning of the larval stage.

Larva

Most of this insect's life is spent in the larval or food finding stage. The larva stage of the darkling beetle is commonly known as the mealworm. Although it looks very much like a worm, it is not one. It is an immature darkling beetle in the larva stage. Several other organisms also go through a worm-like larva stage. For example, maggots are the larvae of flies, and caterpillars are the larvae of butterflies.

Pupa

During this stage, the darkling beetle is relatively inactive and is going through the final change between larva and adult. Some insects' pupa stage is spent in a cocoon, but this is not true of the mealworm. The pupa stage lasts about 1-3 weeks. The pupa is inactive but will move if touched. The head structure and other adult body parts can be seen developing.

Adult

As the pupa first changes into an adult darkling beetle, it is beige in color. As it matures, it turns brown and then black. The beetles have wings which are protected by a hard covering. The adults mate and the female can lay about 500 eggs, which begin the life cycle of the next generation.

Adult Appearance

- * Black with hardened front wings
- * Antennae arise under ridge near eyes
- * Antennae many-segmented, enlarging near tip
- * Shape quite variable, from almost parallel-sided to round
- * Mealworm averages an inch in length
- * They have a tough, yellowish-brown exoskeleton and are cylindrical

Natural History of Mealworms

Food

The beetles and larvae eat decaying leaves, sticks, grasses and occasionally new plant growth. As general decomposers, they also eat dead insects, feces and stored grains.

Habitat

Mealworms live in areas surrounded by what they eat under rocks, logs, in animal burrows and in stored grains. They clean up after plants and animals, and therefore can be found anywhere where "leftovers" occur.

Predators

Many animals eat mealworms including rodents, lizards, predatory beetles, spiders and birds.

Interesting Behaviors

When disturbed, some beetles assume a defensive posture in which they stand on their head and release chemicals from a scent gland in the rear that produces noxious odors and turns skin brown. Mealworms prefer darkness and to have their body in contact with an object.

Impact on Ecosystem

Positive

Clean up organic materials not readily used by others. Mealworms are food for other animals.



Negative

Sometimes mealworms feed on seedlings and clip plants off near soil line. Mealworms can be pests to stored grain.



Earthworms - Background Information

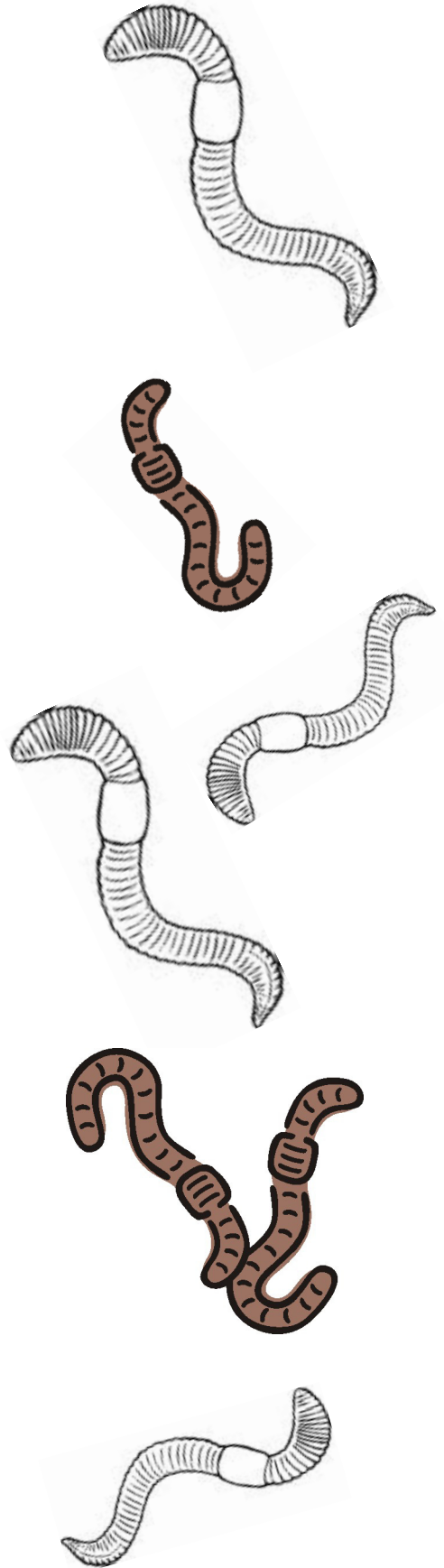
Earthworms are members of the ringed animals or Annelida. There are approximately 1,800 species of earthworms worldwide. Some species are tiny; no more than 2 centimeters or 1 inch when fully grown. At the other end of the scale are giant earthworms in Australia that average 3 meters or 10 feet in length. The record holder for earthworms is found in South Africa. It measures 7 meters or 22 feet in length. Don't worry though. The largest earthworms or night crawlers in North America grow to about 30 centimeters or 13-15 inches.

Earthworms are fairly simple life forms. They are put together from a number of disk-like segments stuck together like a long flexible roll of Lifesavers™. Earthworms do not have an internal skeleton as we do, and they do not have a protective hard exoskeleton as does an insect. They are flexible, long bundles of muscle, especially designed for life underground. The characteristic wriggling of earthworms is done with two kinds of muscles. One set allows the earthworm to become thinner and longer while the other set enables it to become shorter and fatter. Earthworms can move very effectively in either direction, headfirst or tail first.

Earthworms have specialized structures that help them live very successfully in their environment. Instead of having lungs to pump oxygen, they have five sets of simple hearts. Their blood flows close to their outer surface, absorbing oxygen and releasing carbon dioxide through a thin skin. This is why worms leave the soil and crawl out on the sidewalks during a heavy rain...they are seeking oxygen.

Earthworms have a nervous system that controls their senses and detects vibrations, heat, cold, moisture, light and the presence of other worms. However, they have no brain, so earthworms do not ponder their lowly lot in life, nor do they plan out a strategy for obtaining their next meal or crossing the sidewalk safely.

Earthworms are pros at burrowing. They feed on decomposing organic material, mostly vegetation, from the surface of the soil and underneath the soil. As they burrow and feed, they process tons of soil and improve its quality for plants and other animals. So please be considerate of these valuable little animals. The next time you see them on a sidewalk after a rainstorm, help them back into the ground.



Building a Mealworm Habitat

Habitat

- A clear plastic cup with a cover, or a margarine tub or deli container.
- 1/8" wheat bran or crushed wheat flakes in bottom of container.
- A crumpled piece of paper, pinecone or empty film canister
- Piece of apple or potato. Replace before it becomes moldy.
- Small air holes in the lid since a dry climate is important.

Food

Wheat bran, crushed wheat flakes, oatmeal and a piece of apple or potato.

Water

Mealworms do not need water. They will obtain all the of the water they need from the piece of potato or apple.

Handling

To pick up a mealworm, use a plastic spoon or a folded 3 x 5 card to scoop it up. If you choose to pick it up with your fingers, use your thumb and forefinger on either side of the worm and gently squeeze. Use a firm hold since they are very smooth and may squirm and wiggle the tip of their abdomen. When holding mealworms, keep your hand over the container or table to avoid dropping the mealworm on the floor.

Raising Young

Mealworms are very easy to raise in the classroom. The larvae grow to 25 mm before pupating. After pupating, the adults emerge in two to three weeks. In seven to ten days, the females may lay eggs. In about fourteen days, the eggs hatch and the larvae begin to eat and develop.

Precautions

Mealworms will not bite. Dead mealworms are stiff and dark brown and should be removed from the container. Provide plenty of room for the large mealworms since they will eat each other in a constrained container. Small mealworms can be stored in the refrigerator door for several weeks to delay pupation or to extend their lives.

