

# MEET A MEALWORM

## **BIG IDEA 16: HEREDITY AND REPRODUCTION**

### **BENCHMARKS AND TASK ANALYSES**

**SC.1.L.16.1** Make observations that plants and animals closely resemble their parents, but variations exist among individuals within a population.

The student:

- observes that animals closely resemble their parents.
- observes that plants closely resemble their parents.
- observes that variations can exist among individuals within a population.

**SC.1.L.17.1** Through observation, recognize that all plants and animals, including humans, need the basic necessities of air, water, food, and space.

The student:

- observes and recognizes that all plants and animals, including humans, need the basic necessities of air, water, food, and space.

**SC.1.N.1.1** Raise questions about the natural world, investigate them in teams through free exploration, and generate appropriate explanations based on those explorations.

The student:

- raises questions about the natural world.
- explores questions about the natural world with a team of students through free exploration and generates appropriate explanations for what was observed.

**SC.1.N.1.2** Using the five senses as tools, make careful observations, describe objects in terms of number, shape, texture, size, weight, color, and motion, and compare their observations with others.

The student:

- uses the five senses as tools to:
  - make careful observations.
  - describe objects in terms of number, shape, texture, size, weight, color, and motion.
  - compare own observations with observations of others.

**SC.1.N.1.3** Keep records as appropriate - such as pictorial and written records - of investigations conducted.

The student:

- keeps records, such as student-drawn illustrations, science notebooks, or digital media, of investigations conducted.

### **KEY QUESTION**

How do mealworms change as they grow?

### **TEACHER BACKGROUND INFORMATION**

Mealworms are the larva stage of the meal beetle. The larva is brownish-yellow and has 13 segments and 6 legs. Mealworms develop through a complete metamorphosis. The stages are egg, larva, pupa, and adult. Eggs are white spheres too small to be seen even with a hand lens. Newly hatched larvae are almost threadlike, but grow, leaving their old skins behind. Pupae are the resting stage when internal cell changes are taking place. They do not move or eat as pupae. It takes 4 to 8 weeks for the larvae to mature into adult beetles.

Basic food for the mealworms can be uncooked bran, oatmeal, or Cream of Wheat. For moisture, place a slice of raw potato, apple or citrus rind in the container. Replace food as needed. (Potato slices will last a week or more; apple pieces should be replaced more frequently.)

Mealworms can be kept in plastic containers without a lid. They will chew through cardboard boxes. Keep the container out of direct sunlight.

## **MATERIALS**

### **Teacher**

prepared plastic container for mealworms  
class chart  
daily observation chart  
poster of mealworm stages (egg, pupae,  
larvae, beetle) for reference

### **Per pair of students**

mealworm larvae (at least 2)  
oatmeal, bran or Cream of Wheat cereal  
potato or apple slice  
paper towel  
cup with their names on it  
masking tape  
string

### **Per student**

mealworm journal  
magnifier  
drawing paper

## **SAFETY**

- Student goggles are recommended when working with mealworms due to dust which might be found in meal worm food.
- Students should always wash hands thoroughly after handling mealworms or growing media.

## **TEACHING TIPS**

1. Mealworms can be purchased from a science supply house or from certain local pet stores. (They're very inexpensive - about \$1.50 per 100.)
2. You will need to locate or draw a picture of a mealworm egg to show the students, since they will not be able to see this stage. Mealworm eggs are tiny white spheres.
3. Mealworms are living creatures. Children should be taught that all living creatures must be treated with respect. Remind students to handle the mealworms carefully and not to do anything that might injure them.
4. Students will write and draw daily in their mealworm journals their observations of the mealworms including size, color, and shape. Journals can be made from folding half sheets of paper in half and stapling together or they can record in their spiral science journal if they have one.
5. Prepare cups with students' names on them to house their mealworms. Include food and moisture.
6. Prepare a *Daily Observation Chart* (chart paper or transparency) as shown in the Extend and Apply section.
7. Teacher will need to demonstrate how to carefully measure the mealworm with string.
8. This lesson is the first in a series of lessons on mealworms that continue Big Idea 16 and begin teaching concepts from Big Idea 17.
9. This lesson is naturally extended into a discussion of the needs of a mealworm in a future lesson *Learning About Mealworms*.

## **ENGAGE**

1. Display a closed container of mealworms. Ask students to guess what is inside.
2. Open the container and show the mealworms. Ask if anyone knows what kind of animals are in the container.
3. Ask: *Is a mealworm a living or non-living thing? How do you know?*

## **EXPLORE**

1. Distribute mealworms on a paper towel to each pair of students. They will need to watch them closely so that they do not crawl away. Teach them to gently move them with their fingertip if the mealworms get too close to the edge of the paper towel.
2. Give students magnifiers to help them observe the mealworms.
3. Ask students what they are observing and record observations on a class chart.
4. Give each student a mealworm journal. Ask students to draw their mealworms, name them, and record observations.
5. Students should be given time daily to observe the mealworms. Have them continue drawing the mealworms, noting changes in shape, size and color. Students should continue recording observations until the mealworms have completed metamorphosis into a beetle.
6. Have students cut a string once every 3 days to measure the length of their mealworm. Tape or glue the strings in their journals on the measuring days.
7. Have students share each day how many larvae, pupae, and beetles are in their container.
8. At the end of each daily observation, have students place their mealworms in the cup with their names on them.

## **EXPLAIN**

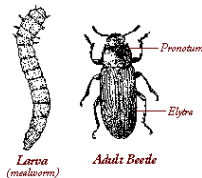
1. Have students report the number of mealworms, pupae, and beetles and record the class total on the *Daily Observation Chart*.
2. Through questioning, develop the concept that mealworms change as they grow. (Children may refer to their journals.) Ask:
  - *How did the mealworm look when you first saw it? Did it look like its parents, the beetle?*
  - *What changes did you notice as your mealworm developed?*
  - *How many legs does your mealworm have?*
  - *What color is your mealworm?*
  - *Did its color change?*
  - *Did the size of the strings differ? How?*
  - *How much food did your mealworm eat?*
  - *What similarities do you notice between your mealworm and others'?*
  - *What differences do you notice between your mealworm and others'?*
  - *Does your mealworm look the same now as when you first saw it?*
  - *Now does your mealworm look like its parents?*

## **EXTEND AND APPLY**

1. Make a chart of the stages of the mealworm's life by folding a piece of drawing paper into fourths. Label the parts with teacher direction.
2. Write a class poem about mealworms.
3. Students can make models of the stages of mealworms using clay. Encourage them to make careful observations first so their models will be accurate.

## **ASSESSMENT**

Have students write or tell two true statements from the *Daily Observation Chart*.



**DAILY OBSERVATION CHART  
(Number of living organisms each day)**

|               |           |           |           |           |           |           |           |           |           |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|               | <b>1</b>  | <b>2</b>  | <b>3</b>  | <b>4</b>  | <b>5</b>  | <b>6</b>  | <b>7</b>  | <b>8</b>  | <b>9</b>  |
| <b>Larvae</b> |           |           |           |           |           |           |           |           |           |
| <b>Pupae</b>  |           |           |           |           |           |           |           |           |           |
| <b>Beetle</b> |           |           |           |           |           |           |           |           |           |
|               | <b>10</b> | <b>11</b> | <b>12</b> | <b>13</b> | <b>14</b> | <b>15</b> | <b>16</b> | <b>17</b> | <b>18</b> |
| <b>Larvae</b> |           |           |           |           |           |           |           |           |           |
| <b>Pupae</b>  |           |           |           |           |           |           |           |           |           |
| <b>Beetle</b> |           |           |           |           |           |           |           |           |           |
|               | <b>19</b> | <b>20</b> | <b>21</b> | <b>22</b> | <b>23</b> | <b>24</b> | <b>25</b> | <b>26</b> | <b>27</b> |
| <b>Larvae</b> |           |           |           |           |           |           |           |           |           |
| <b>Pupae</b>  |           |           |           |           |           |           |           |           |           |
| <b>Beetle</b> |           |           |           |           |           |           |           |           |           |
|               | <b>28</b> | <b>29</b> | <b>30</b> | <b>31</b> | <b>32</b> | <b>33</b> | <b>34</b> | <b>35</b> | <b>36</b> |
| <b>Larvae</b> |           |           |           |           |           |           |           |           |           |
| <b>Pupae</b>  |           |           |           |           |           |           |           |           |           |
| <b>Beetle</b> |           |           |           |           |           |           |           |           |           |

# HOW DO WE CHANGE AND GROW?

## **BIG IDEA 16: HEREDITY AND REPRODUCTION**

### **BENCHMARKS AND TASK ANALYSES**

**SC.1.L.16.1** Make observations that plants and animals closely resemble their parents, but variations exist among individuals within a population.

The student:

- observes that animals closely resemble their parents.
- observes that plants closely resemble their parents.
- observes that variations can exist among individuals within a population.

**SC.1.N.1.1** Raise questions about the natural world, investigate them in teams through free exploration, and generate appropriate explanations based on those explorations.

The student:

- raises questions about the natural world.
- explores questions about the natural world with a team of students through free exploration and generates appropriate explanations for what was observed.

### **KEY QUESTION**

How do living things change as they grow?

How are offspring similar and different in appearance compared to their parents?

### **TEACHER BACKGROUND INFORMATION**

Every living thing comes from another living thing of the same kind. Heredity is the passing on of traits and characteristics from parents to offspring. Some characteristics may be good, and some may be undesirable.

### **MATERIALS**

#### **Teacher**

several pictures of the teacher that span from infancy to adulthood  
colored circle stickers or Post-it notes  
bathroom scales  
measuring tapes or sticks  
1 large sheet of butcher paper  
various photos of plants in seedling and adult stages  
marker

*Animals and Their Babies* (Benchmark Education Co.)

*Growing Older* (Benchmark Education Co.)

*Growing Up* (Dominie Press)

#### **Per student**

student's photographs from infancy to present  
1 sheet construction paper  
markers

### **SAFETY**

Practice safety when using scissors.

### **TEACHING TIPS**

Plan ahead:

1. Ask a parent or an older student to help measure and weigh each student. You may want to measure and weigh the students early in the year and again near the end of the year in order to discuss how the students have changed.
2. Send home a letter to parents requesting several pictures of the student from infancy to present.

### **ENGAGE**

1. Display your personal photographs in random order. Ask students what they notice about these photographs.
2. Select students to put the photographs in order by when they were taken. The class should agree with the order of the photographs. Students should continue to arrange the photographs until they come to a consensus about the order. Ask students how they decided which photograph came first, second, etc.

### **EXPLORE**

1. Display the students' photos one at a time. Have students guess whose photo is displayed. Continue for all students. (This activity could also be done in small groups with parent helpers.)
2. Discuss the similarities and differences between baby photos and the way students look now. Ask: *What do you think caused these changes?* (Eating – supplying energy for growth)
3. Measure the height and weight of each student. To measure height, hang white butcher paper on the wall. As students come up one at a time, the teacher should mark the student's height by placing a dot with the student's name on the paper. Record student's weight next to the dot. (This part of the activity may be done in small groups or with parents assisting.) If weight is an issue, omit that part.

### **EXPLAIN**

1. Show students how to fold the construction paper to make a tri-fold book. Students should draw themselves at 3 stages of life-as an infant, as a first grader, and as an adult. They should then write and complete the appropriate sentence under each picture.
  - a. When I was a baby, I ...
  - b. In first grade, I ...
  - c. When I grow up, I ...
2. Through questioning and discussion, help students recognize that they change as they grow and that children resemble their parents. Ask:
  - *Do people change as they grow?*
  - *What similarities do you notice about all people? What are some characteristics that are different among people?*
  - *How have you changed since you were born?*
  - *How have you stayed the same?*
  - *How are humans like animals? How are they different?* (If possible, show a set of animal photos (e.g., egg, baby bird; kitten, cat).)
3. Share the book *Animals and Their Babies*.
  - *What similarities did you notice between the adult animals and their babies?*
  - *Do babies usually look like their parents?* (yes, a kitten looks like a cat; a puppy looks like a dog, etc.)
  - *What about plants? Do plants look like the plants which produced the seed?* (yes, a bean plant produces a seed that produces a bean plant; a sunflower produces a seed that produces a sunflower, etc.)
  - *Are you taller now than you were as a baby? Do you weigh more now?*

- *Can you think of any other ways you have changed as you have grown older?*
  - *How are you like your parents? How are you different?*
4. Through questioning and discussion help the students recognize that every human action requires energy that comes from food.  
Ask: *What have you done to help your body grow?* (Energy comes from food.)

**EXTEND AND APPLY**

1. Have students observe people in different stages of growth. Students may wish to bring in magazine pictures or family photos to share.
2. Share the poem, "Me", with the class.

ME  
 I am bigger than a baby.  
 I am bigger than a flea.  
 I am happy I am growing,  
 Happy as can be.  
 When I become a grown-up,  
 I hope that I will be-  
 Older, Bigger, Smarter,  
 And still be glad I'm me.

by Beth Crampton

3. Share the books listed in the teacher materials list.

**ASSESSMENT**

Students pair photos of babies with their parents.

| <b>Novice</b>   | <b>Basic</b>  | <b>Expert</b>  |
|---|---|--|
| Student does not successfully make any pairs of photos and cannot give any reasonable explanations. | Student puts one or two of the photos in the correct pair and gives a reasonable explanation for those. | Student puts all of the photos in the correct pairs and gives reasonable explanations for the entire activity. |

# HOW DO ANIMALS CHANGE AND GROW?

## **BIG IDEA 16: HEREDITY AND REPRODUCTION**

### **BENCHMARKS AND TASK ANALYSES**

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The student:

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**SC.1.N.1.1** Raise questions about the natural world, investigate them in teams through free exploration, and generate appropriate explanations based on those explorations.

The student:

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- explores questions about the natural world with a team of students through free exploration and generates appropriate explanations for what was observed.

### **KEY QUESTIONS**

How do animals change as they grow?

How are offspring similar and different in appearance compared to their parents?

### **TEACHER BACKGROUND INFORMATION**

Every living thing comes from another living thing of the same kind. Heredity is the passing on of traits and characteristics from parents to offspring.

### **MATERIALS**

#### **Teacher**

picture of a young animal when it is a baby  
and when it is older  
class observation chart  
Venn diagram  
*Animals and Their Babies* (Benchmark Education Co.)

#### **Per pair of students**

*Animals and Their Babies* activity sheet  
2 pairs of scissors  
crayons or markers

### **SAFETY**

Practice safety when using scissors.

### **TEACHING TIPS**

Cut out of magazines a wide selection of pictures of animals and glue them to file cards.

### **ENGAGE**

1. Show a picture of a young animal (e.g., your pet) for the students.
2. Ask students to describe the animal. List observations on a circle map or chart paper.
3. Ask how old the animal is and have them tell how they know.
4. Show the picture of the same animal at an older age and discuss how the pictures are alike and how they are different.
5. Discuss any changes.

## **EXPLORE**

1. Give each pair of students a copy of the *Animals and Their Babies* picture sheets. Tell them to color and cut out all the pictures, then sort them into piles. (They may decide how to sort them.)
2. Allow some students to explain how they sorted the pictures.
3. Tell students they may work with their partners to play a memory game—matching the adult animals with the animal babies. Student pairs will mix up one set of pictures and lay them face down on the floor. One at a time each student will pick 2 pictures. If the pictures match—adult animal to baby animal—the student should keep the 2 pictures and take another turn. If the pictures are not an adult/baby match, the student will turn the pictures back over and let the partner take a turn. The game is over when all pictures have been matched.
4. Tell the students to sort the pictures into two groups:
  - the offspring that look like their parents
  - the offspring that do not look like their parents

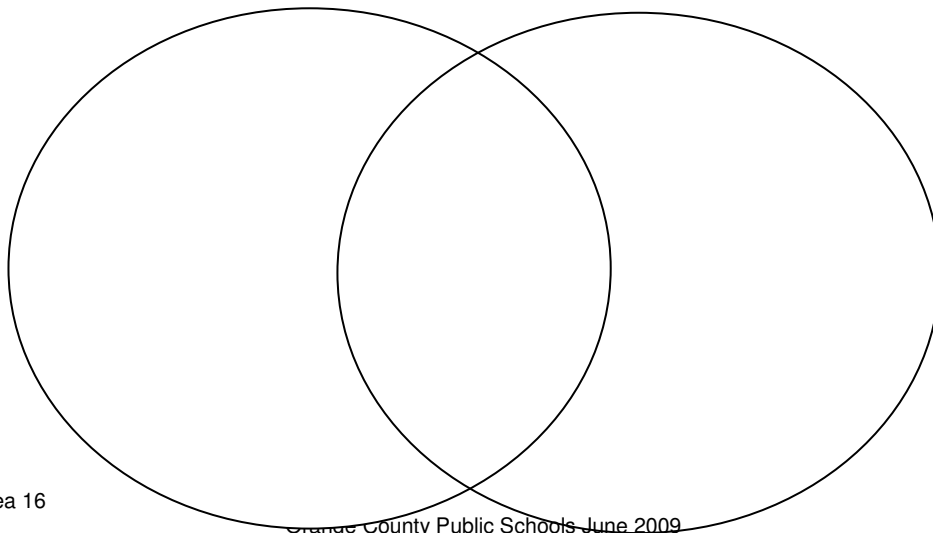
## **EXPLAIN**

Ask:

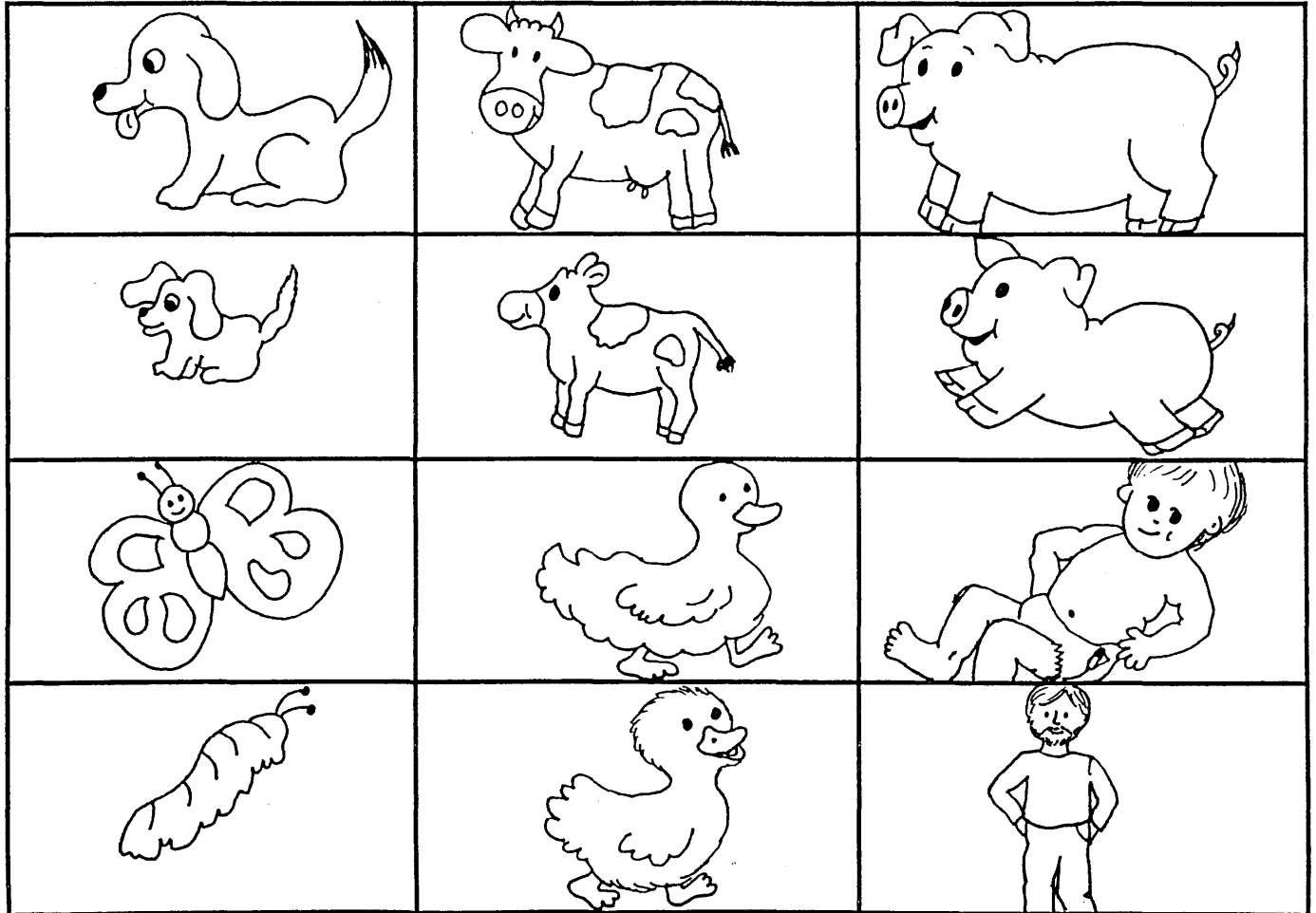
- *Do animals change as they grow?*
- *How do some animals change as they grow?*
- *Do all animals change in the same ways?*
- *Do you change as you grow?*
- *Do animal babies move like adult animals? If not, what are the differences in movement?*
- *Do animal babies eat the same things as their parents?*
- *Which offspring look like their parents?*
- *Which offspring do not look like their parents?*
- *Will they ever resemble their parents?*
- *What are some ways you look like your parents?*

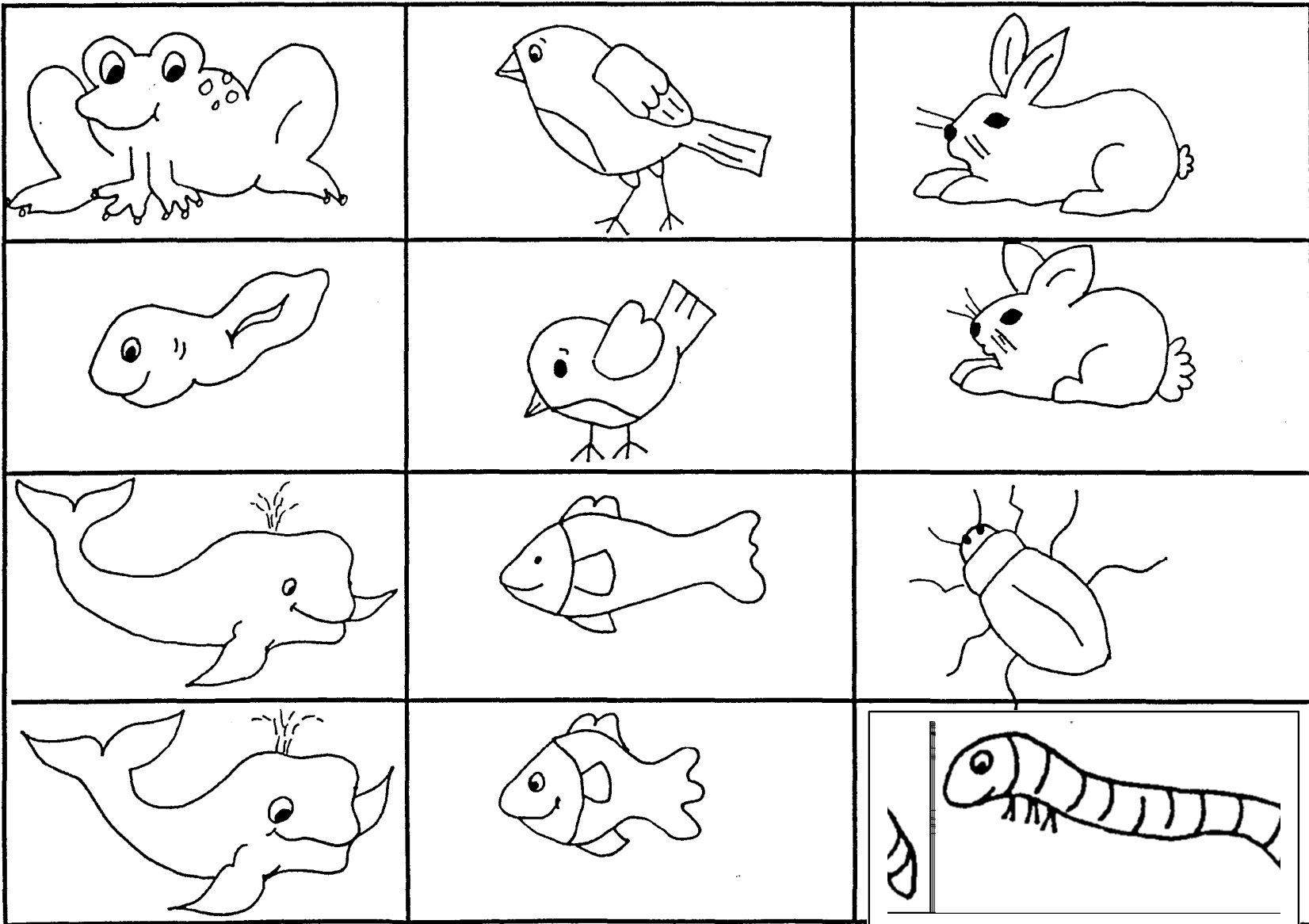
## **EXTEND AND APPLY**

On the board, draw a Venn Diagram or Double Bubble Map. Ask students to suggest things a baby can do, what an adult can do, and what both can do. Use the headings, *Babies* and *Adults*. Help students think about why animals change as they make their suggestions and discuss them. Put the words in the proper place on the Venn Diagram or Double Bubble Map.



# ANIMALS AND THEIR BABIES





# LEARNING ABOUT MEALWORMS

## **BIG IDEA 16: HEREDITY AND REPRODUCTION**

### **BENCHMARKS AND TASK ANALYSES**

**SC.1.L.16.1** Make observations that plants and animals closely resemble their parents, but variations exist among individuals within a population.

The student:

- observes that animals closely resemble their parents.
- observes that plants closely resemble their parents.
- observes that variations can exist among individuals within a population.

**SC.1.E.6.2** Describe the need for water and how to be safe around water.

- describes the need for water.

**SC.1.L.17.1** Through observation, recognize that all plants and animals, including humans, need the basic necessities of air, water, food, and space.

The student:

- observes and recognizes that all plants and animals, including humans, need the basic necessities of air, water, food, and space.

**SC.1.N.1.1** Raise questions about the natural world, investigate them in teams through free exploration, and generate appropriate explanations based on those explorations.

The student:

- raises questions about the natural world.
- explores questions about the natural world with a team of students through free exploration and generates appropriate explanations for what was observed.

**SC.1.N.1.2** Using the five senses as tools, make careful observations, describe objects in terms of number, shape, texture, size, weight, color, and motion, and compare their observations with others.

The student:

- uses the five senses as tools to:
  - make careful observations.
  - describe objects in terms of number, shape, texture, size, weight, color, and motion.
  - compare own observations with observations of others.

**SC.1.N.1.3** Keep records as appropriate - such as pictorial and written records - of investigations conducted.

The student:

- keeps records, such as student-drawn illustrations, science notebooks, or digital media, of investigations conducted.

### **KEY QUESTION**

What makes a mealworm unique?

How do mealworms change as they grow?

### **TEACHER BACKGROUND INFORMATION**

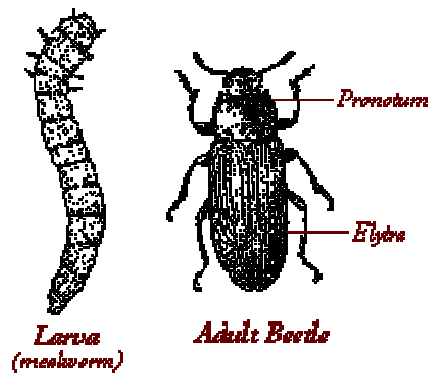
Mealworm Information:

Phylum, *Arthropoda*; Class, *Insecta*; Order, *Coleoptera*

*Appearance (Morphology):*

#### Adult Beetle

- Black with hardened front wings (elytra)
- Antennae arise under ridge near eyes



- Antennae many-segmented, enlarging near tip
- Shape quite variable, from almost parallel-sided to round
- Head visible from top, followed by pronotum and elytra about same width
- Mealworm (larva) averages an inch in length. They have a tough yellowish brown exoskeleton and are cylindrical.
- It is difficult to tell the difference between the males and females without a microscope and dissection.

#### Immatures (different stages)

- The egg is white.
- The larval stage (referred to generally as mealworms) is worm-like and somewhat hardened for burrowing.
- The pupa is 1/2 to 3/4" long., white initially then darkening just before the beetle emerges. Length of the life cycle is 3-5 months. The larval stage may molt 9-20 times.

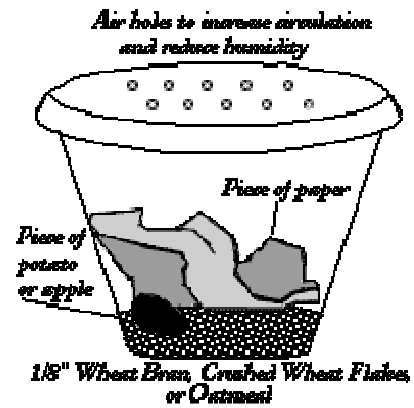
#### *Food:*

- In the wild, 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.
- In the classroom, mealworms enjoy a home with wheat bran, crushed wheat flakes, and/or oatmeal. They also need a slice of potato or apple.

*Water:* They do not drink water, but get their water from their food. Mealworms obtain their water from the potato or carrot.

#### *Habitat:*

- In the wild, mealworms live in areas surrounded by what they eat under rocks, and logs, in animal burrows and in stored grains. They clean up after plants and animals, and therefore can be found anywhere where "leftovers" occur.
- In the classroom, create a habitat as follows:
  - Get a clear plastic cup with a cover, or a margarine tub or deli container.
  - Add 1/8" wheat bran or crushed wheat flakes in bottom of container.
  - Place a crumpled piece of paper and a piece of apple or potato in the container. Replace before it becomes moldy.
  - Create small air holes in the lid since a dry climate is important.
  - See illustration.



*Predators:* Many predators eat mealworms including rodents, lizards, predatory beetles, spiders, and birds.

*Raising Young:* Mealworms are very easy to rear 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.

*Interesting Behaviors:* When disturbed, some beetles (genus *Eleodes*) 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.

*Handling Mealworms:* To pick up a mealworm, use a plastic spoon or a folded 3x5" card and scoop them up. To pick them up with your fingers, hold 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 hands over the container or table to avoid dropping the mealworms on the floor.

*Other Concerns:* 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 a refrigerator door for several weeks to delay pupation or to extend their life.

## **MATERIALS**

### **Teacher/Class:**

*A Mealworm's Life*, John Himmelman  
(from magazines or books)  
Replacement mealworms  
Be Nice to Spiders, Martha Graham  
Chart paper

### **Per group:**

small plastic containers with lids  
bran flakes or oatmeal  
pieces of potato or apple  
labels or markers for writing on each  
container

### **Per student**

Mealworms  
Hand lens  
Student notebook

## **SAFETY**

- Student goggles are recommended when working with mealworms due to dust which might be found in meal worm food.
- Students should always wash hands thoroughly after handling mealworms or growing media.

## **TEACHING TIPS:**

- This lesson continues a series of lessons on mealworms that continue Big Idea 16 and begin teaching concepts from Big Idea 17. Students should have been doing observations of mealworms prior to this lesson. This lesson is an extension and begins the discussion of what mealworms need to survive.
- Gather materials for mealworm containers. Prepare the individual containers with bran flakes or oatmeal, pieces of potato, and one mealworm. Use labels on the containers so that each student in the class can identify their mealworm. Identify and prepare a place in the classroom for the insects to live. Avoid areas with direct sun, air vents or cold drafts.
- Rather than spend time looking for mealworms in the wild, purchase them. Most pet stores and many fish tackle shops sell small and large mealworms. They are sold individually or 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 often are treated with hormones so they will NOT become adult beetles. The small mealworms will change into adult beetles within a month or two. Mealworm larvae and adults can be purchased from: Berkshire Biological Supply Company, The Biology Store (pupae also available), Carolina Biological Supply Company, Connecticut Valley Biological Supply Co., Inc., Nasco (pupae also available), Science Kit and Boreal Laboratories (larvae only), and Ward's Biology (pupae also available).

- Do not leave the containers in the sun. The containers can be stored in the refrigerator for a couple of days if the mealworm is provided with a little bran. Keep in mind, adding the bran also adds a new variable to the experiment. After the experiment is completed, dismantle the containers and give the mealworms food.
- Collect assorted photographs of arthropods from magazines or books.
- Take care when guiding and directing discussions (particularly in Closure Activity) about sensitive experiences that may surface when talking about feelings.
- Gather remaining materials and books (see Bibliography).

## **ENGAGE**

1. Have the mealworm containers ready. Remind students of their observations of mealworms.
2. Discuss what they think and feel about these insects from looking at them.
3. Explain to the students that they will each be given their own mealworm to care for. If you wish, the mealworms can be introduced with: "You will be the mealworm's caretaker for the next week. You will take care of it, feed it and make sure that it is okay." Note: Because of the bonding and attachment that will develop between the students and their mealworms, death of an individual mealworm may be traumatic. Have several extra mealworms to 'replace' the deceased, if the need arises.
4. Say: "Today, you will spend some time observing your insect, and you will learn how to use a hand lens to look at it very carefully." Demonstrate the use of the hand lens and gentle handling of the mealworms. Encourage the students to handle their insects if they feel comfortable doing so. Have students draw in detail what they see in their science notebook.
5. Give the students the mealworms, and allow time for observations.
6. After about 10-15 minutes of observation, collect the mealworms in their individual containers, have the students' names on the containers to identify which mealworm will be "theirs" to care for.

## **EXPLORE**

1. Ask: *How many of you have a pet? What needs does your pet have to keep it alive and healthy?* (students should mention food, water, shelter, and space)
2. Ask: *Is the mealworm a living or non-living thing?*
3. Ask: *Since it is a living thing, like your pets, what types of needs do you think that the mealworm has?* (food, water, shelter, space)
4. Read the book *A Mealworm's Life* by John Himmelman. Tell students to pay particular attention to the needs of the mealworm.
5. Ask: *What do the mealworms need?* (food, water, shelter, space)
6. Ask: *What is food for the mealworm?*
7. Ask: *Where do mealworms get their water?* (this may be an area where students need to be told that mealworms get water from the food they eat and do not have to drink water like many other organisms)
8. Ask: *Do mealworms need water to survive?* (yes)
9. Ask: *What shelter did we provide for the mealworms?* (the container)
10. Ask: *What types of things did we do in the container?*
11. In teams, carefully remove mealworms and place on a piece of paper with food.
12. Have the students observe mealworms and record observations in their journals.
13. Return mealworms to their containers of bran flakes and observe their behavior.
14. Ask:
  - *Do you think they remain on top?*
  - *Where do they go?*
  - *How long does it take?*

- *Why do you think they go under the flakes?*
  - *Do you think they want more food or to hide?*
  - *Why do you think they hide?*
  - *If we give them a choice, do you think they will go into the dark or stay in the light?*
15. Have the students brainstorm as a group: What can we do to find out the answers to your questions? Listen to the students' questions and have the teams choose one question that they want to find out the answer to.

### **EXPLAIN**

1. Review the decisions and consequences from the story discussion in the Introduction.
2. Ask: If we create an empty container with bran flakes on one side and oatmeal on the other, predict what you think the mealworm will do.
3. Carefully place mealworms in the center of the empty containers and observe.
4. Allow 5 minutes for each trial and time for students to record observations in their journals.
5. Have the students report to their teams and present their findings to the class.
6. Ask: *What does this tell us about the mealworm?*
7. Make a bar graph for the class representing what the mealworms did in the containers using either the page of mealworm pictures (BLM) provided or mealworms cut out by the students.
8. Remind students that they are now going to care for their mealworm for a period of time when they come to class.
9. Ask: *How are you going to be sure that your mealworm stays alive?*
10. Ask: *What does a mealworm need to stay alive?*

### **EXTEND AND APPLY**

1. Run the same mealworm choice trial with dark/light, warm/cold, or obstacle courses.
2. Have the students keep the mealworms in the classroom until they complete their metamorphosis. Keep your mealworms in a container with sufficient food for several weeks. Examine them regularly, at least once a week. The larvae should turn into white pupae that wiggle vigorously when picked up. In one to two weeks, adults should appear. They are dark brown and very agile. This process of changing form is called metamorphosis. Read a book about metamorphosis in insects. Observe the students' reactions. Discuss how the mealworms change to become a pupa and then a beetle. "How do they look?" Have them draw each stage. Make sure they note the non-moveable legs in the pupa.

### **ASSESSMENT**

Teacher assessment through observation should include the following criteria:

- Tasks have been completed by the student.
- Student journal entries should show growth and understanding.
- Student demonstrates understanding through successful completion of the activities and in class discussions.
- Data collection and organization of data was effective.
- Use of science tools enhanced their learning.
- Science safety rules were observed.

# MEALWORMS

