Information and Activities About Mealworms

IT WILL "WORM" ITS WAY INTO YOUR HEART

(not sure where this came from)

No one, I repeat, NO ONE, is more repulsed by bugs and creepy crawlies than I am...and yet the lowly mealworm is given the distinct honour of crawling all over my hands and wending its way into three weeks of experiments and investigation as the first science unit of the new term.

So read on, don't let the word "worm" turn you away, and find out how you, too, can come to appreciate this tiny creature as a vehicle for you to teach "learning and behaviour" and the "scientific method" to start off your school year in September. What's so wonderful about this study is that it can be applied to
any grade level, it is investigative, hands-on, and invites the student to design his/her own experiment to discover the behaviour and characteristics of the mealworm. It is an introduction to the scientific method and lays the groundwork for the term's work in all science experimentation.

For this unit you will need:

1. mealworms (larvae of beetles) which you can purchase by the cupful at a local pet shop for about $1.75/per 100
2. a plastic shoebox to keep them in- make air holes in the lid
3. a box of corn flakes will provide all the nutrients the mealworm needs
4. each student will need a plastic container to keep their personal mealworms in (the kind that margarine comes in)
5. a small piece of raw potato (for added moisture)

Place three mealworms and some cornflakes in each student's container.

Have them punch a few air holes in the lid with the point of a scissors.

There are dozens of activities you may choose from, in any order you wish to present them:

A. Observe the mealworms with a hand lens and draw it

During observation, answer the following:

Can you find a way to tell your mealworms apart?

Does a mealworm walk more to the right or to the left?

How far can it walk in a minute?

Can it walk up on a slant?

Can it walk backwards?

How does it move?

Does it have legs?

If so, do they all move at once?

Is there a pattern to their movement?

Stress the need to observe an activity many, many times before you can draw a conclusion and determine what is a fact. This is part of the scientific method.

B. Do some math lessons- for lower grades, e.g. if each student receives 3 mealworms, how many will have been distributed? What fractional part of the mealworms have you gotten? The box of cornflakes contains ____oz. If we divide it equally among you, what

fractional part will you get? If the mealworm eats about 1/6 of a flake per day, how long will it take it to eat the entire flake? etc., etc. Convert the numbers on any chart you make to percentages.
C. Have each student create a simple experiment to find out any of the following:
Do mealworms prefer a certain colour?
Do they respond to light and dark?
Do they react to hot and cold?
Do they have a sense of smell?
How do they eat?
Do they drink water?
Do they react to sound?
Can they find food?
Can they be taught anything?
Can you determine the sex?
**These rules must be kept in mind for good experimentation with animals and living things:
1. In order to know if the animal is doing something different, one must first know its usual behaviour.
2. An animal must be given a choice if it is to show a preference for one thing over something else.
3. What is done to an animal must be described in as much detail as necessary.
4. The description of what the animal does in the experiment must be as complete as possible.
5. The same experiment usually should be done many, many times.
6. The conditions should be controlled so that the results are reliable.
D. Here are some topics and words to research:
Vocabulary: mealworm, react, observe, antennae, segment, metamorphosis, secretion, shed, inactive, pupae, vestigial
Topics:
What are the stages of the mealworm development?
What are the eggs like? How long does it take them to hatch?
Why do mealworms shed their skin? How often do they do that?
How long is the larval stage and how do they behave during it?
How long is the pupa stage and what is happening during it?
What are the characteristics of the beetle?
What is metamorphosis and what creatures go through the process?
Are there any patterns in the mealworm's life cycle that can be determined from the changes to different stages?
Find the mass of the potato each week and explain the changes.
Devise a way to accurately determine the length of each stage in the mealworm's life cycle.
Have students brainstorm more areas they wish to learn about.
E. Some charts and tables that you can develop:
*Number of creatures in each stage as weeks progress (chart, bar or line graph)
*Record of reactions to stimuli
*Classify and count sample in class container according to life stages

The areas of study are endless for this versatile little mealworm. You can try:
http://www.aculink.net/~catholic/mealworms.htm
http://www.icomm.ca/~dragon/mealworm.htm
http://www.cobleskill.edu/nabs/mealworm.htm
And just to show you its real versatility, one link I found began:
"Mealworms are easy to prepare and are tasty additions to any recipe. They have an oily, nutty flavour." Now how's that for integration of curriculum areas!! Family Studies move over!
Have fun!

Insects - Mealworms

Mealworms are popular classroom observational insects. They are easy to obtain, and they undergo complete metamorphosis. The 4 stages of complete metamorphosis are egg, larva, pupa, and adult.

Mealworms are the larval stage of darkling or flour beetles. They can be purchased very inexpensively from most pet stores where they are sold as food for fish, turtles, frogs, toads, lizards, and birds.

It's easy to observe how mealworms grow and change form. Here's how:

1. Purchase a scoop of mealworms from a local pet store
2. Fill a large glass jar with bran (a cereal grain available in grocery stores) or whole wheat flour or corn meal
3. Add a slice of apple, potato, or other moist fruit or vegetable to the jar for moisture (remove and replace it if it gets mouldy or dries out)
4. Pour in the mealworms

This is what should happen:

1. The mealworms will begin to burrow into the bran or flour
2. The mealworms will grow. As they grow, they will shed their exoskeleton (hard outer covering). You will be able to see these used exoskeletons on the surface of the bran. You can even pour some of the bran from the jar onto a piece of paper and gently sort through it to see that the mealworms have grown and to find more of their shed exoskeletons. Each mealworm will shed its exoskeleton from 9 to 20- times depending upon environmental conditions such as temperature and moisture. They will stay in this larval stage for about 10 weeks.
3. The larva will turn into pupa more quickly if it is warm; it may take longer if temperatures are cooler. Mealworms can even survive over winter in their larval

form if it is very cold. The pupa of the beetle is a small and firm. It does not move or eat. Inside it, the larva is slowly changing form into an adult beetle.

4. In 2-3 weeks, the skin of the pupa will split open and the adult beetle will emerge. At first, the beetle will be lighter in colour and soft. Within a few hours, its skin will darken and its exoskeleton will harden.

With enough room, you can keep the adults beetles, which will mate and produce eggs. The eggs will hatch into mealworms (larvae) in about 2 weeks, and the cycle will continue.

Mealworms in the Classroom

Activity Time: Months to years, ongoing
Concepts Taught: Decomposition, Metamorphosis, Niches, Habitats

This is a classroom display that may be used for collecting data or sketching but mainly provides an interesting source for discussion.

Purchase a dozen or so mealworms at a bait shop or pet store and place them in a large transparent container such as an empty pretzel or large juice jar. Add the cereal, oatmeal or other kind of feed. The feed needs to be more or less powdered so, if need be, blenderize it first. Toss in an apple core, banana peel, or potato (this is for water and trace minerals) and the culture is in business.

Eventually, the kids will notice the mealworms changing into white, hard pupae and some time later into beetles. The beetles seem to die quickly and many kids will assume the culture has died. Later, depending on conditions in the culture, movement will be detected which is soon found out to be very small mealworms. And life goes on. My culture has

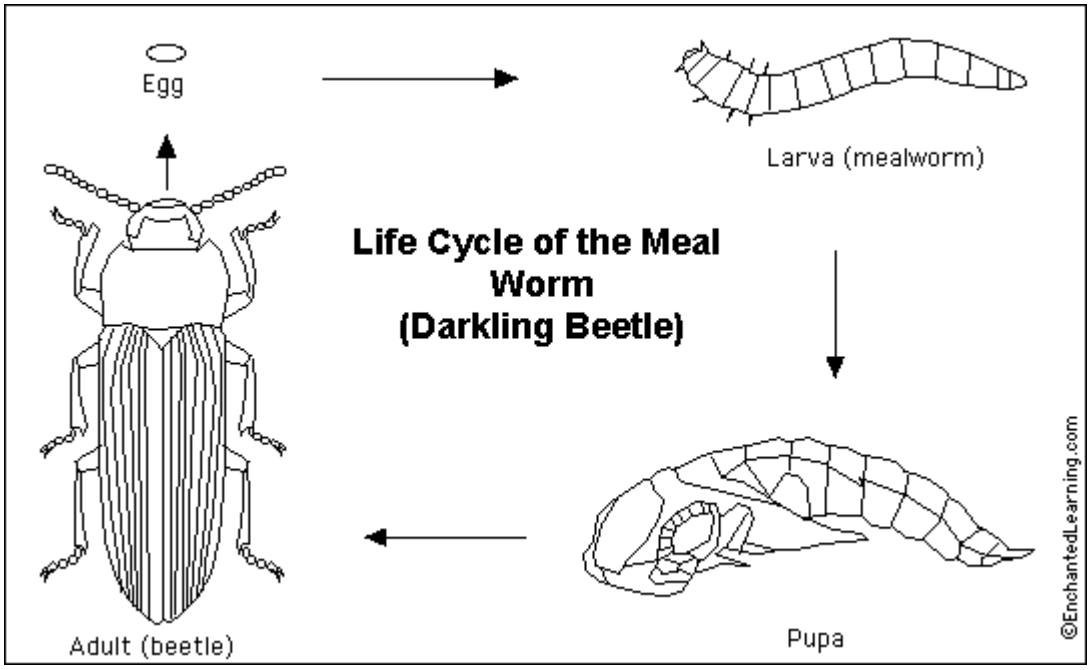
been going since 1985, has nothing done to it over summer except a dose of feed added just before the end of school year. I put more feed and a potato in when returning in August and things start right up again.

Things to note :
1) Mealworms are of the genus Tenebrio and won't escape from the container. Some members of this genus are actually used in preparing skeletons because they are carnivores.
2) The three metamorphosis stages are all easily seen. The adult beetle stage doesn't eat but, like salmon, quickly reproduces and dies young,
3) The mealworms are excellent decomposers, immediately finding whatever vegetable matter is placed in the culture. It's fun to toss a banana peel or apple core in and let the kids see how long it takes for the first hole to be drilled.
4) These guys are pretty good experimental animals for seeing how they sense different things - attracted or repulsed - and also for different kinds of nutrition. E.g. give each group 10 and weigh them occasionally when they have different breakfast cereals for food.

Have fun. If you get too many, you can use some for fish bait.

Mealworm Lifecycle

Tenebrio molitor



The mealworm is NOT a worm. It is the larval stage (grub) of the yellow mealworm beetle, also called the darkling beetle (*Tenebrio molitor*). Although the grub looks a bit like a worm, the mealworm has six small, jointed legs. Both the larva and the beetle are nocturnal (active at night), but they are also active during the day.

Life Cycle: The mealworm undergoes complete metamorphosis. The female mealworm lays hundreds of tiny, white, oval eggs, which hatch into tiny mealworms (the larval stage) - it takes from 4 to 19 days to hatch. Each mealworm eats a tremendous amount and grows a lot, moulting (shedding its exoskeleton) many times as it grows. It then enters the pupal stage (they often over-winter in this stage; this stage lasts up to 9 months). The pupa does not eat and seems inactive, but it is transforming itself into an adult. After pupating, a white adult darkwing

beetle emerges from the pupa -- it soon turns brown and then almost black. The adult lives for a few months. The entire life cycle takes about a year.

Anatomy: The tiny, white, bean-shaped eggs are about 2 mm long by .9 mm wide. Larvae are dark yellow with brown bands; they are up to about 35 mm long, have a segmented body, six legs (towards the front of the body) and two antennae. The pupa is white/cream with a large head and a pointed tail (it darkens as it grows). Like all insects, this beetle has a hard exoskeleton, six jointed legs, two antennae, compound eyes, and a body divided into three parts (the head, thorax, and abdomen). The adult is from 12 to 25 mm long and is dark brown.

Diet/Enemies: Both the adults and the larvae are scavengers that eat grains (hence the name mealworm) and some seedlings. Because of this, it is considered a pest. They also eat decaying material, like decomposing animals and dead plants. They get all the water they need from the food they eat. Mealworms are eaten by many animals, including many birds, rodents, spiders, lizards, and some other beetles.

Range: This beetle is found in temperate and other regions around the world. They usually live in dark, cool, moist places, like under rocks and logs.

Classification: Kingdom Animalia (animals), Phylum Arthropoda (arthropods), Class Insecta (insects), Order Coleoptera (beetles), Family Tenebrionidae, Genus Tenebrio, Species *T. molitor*.

What Can You Learn From A Mealworm?

Objective:

To practice collecting metric data using mealworms.

Materials needed:

A Balance, 5x7 index card, mealworms, 2 rulers and graph paper.

Strategy:

Begin the lesson by discussing the metric system. It is a decimal system scaled on the powers of 10. Pick up a metric ruler and look carefully at the scale. You will see many little lines and every so often a much longer line marked with a number. The longer lines are centimetre (cm) marks and the shorter lines are one tenth of a centimetre (0.1) or millimetre marks.

Answer the following questions:
1. Using your metric ruler, draw a line that is 8 centimetres long. Put a small mark on the line for each centimetre length.
2. Draw a line that is 8 millimetres long.
3. What do you notice about the relationship between the lengths of these lines?
4. Measure the length of the following line: _____.
   length = _____mm and length = _____cm.

After the students understand how to determine metric units, have them measure the length of the mealworm (anterior to posterior) in cm. Using a balance, weigh the worm. Record the data in table form on the blackboard.

Example: Name Length Weight Race I Race II Race III Avg.

Set up a racing card in the following manner:
A. Construct a track 1 cm. wide and 10 cm. long in the centre of the 5x7 card.
B. Place two rulers on either side of the track to restrict movement of the mealworm.
C. Record the time it takes the worm to reach the finish line at the end of the track. Race the worms three times and then determine the average time. RECORD THE TIME IN SECONDS!
D. Record your results on the blackboard.
E. Using the data collected, graph the weight of the mealworms and the timings of the mealworms.

Questions:

A. What are mealworms? Where are they found?
B. Which worm was the fastest? Slowest?
C. Was there a relationship between weight or length and speed?
D. What is the difference between a spider and an insect?

Mealworm Activities

Meet the mealworm. It's the larva (early stage) of a type of beetle. You're more likely to see this insect in an old box of cereal than in the movies. But mealworms can still do some amazing things. First, get to know your mealworm and its natural behaviours.

ACTIVITY 1: INTRODUCTION

What You Need:

- mealworm
- small clear container (If it has a top, poke holes in it so your mealworm can get air.)
- flat toothpick
- uncooked oatmeal
- slice of potato (It should be about the size of a potato chip. You can also use an apple.)
- lab sheet

Think: What are a mealworm's basic needs?

Your teacher will give you a mealworm in a container.

Observe your mealworm. You can look at it in or out of the container. To lift it out, gently nudge the flat end of a toothpick under its legs. Your mealworm should grab hold. Lift the toothpick and mealworm carefully.

Record these observations on your lab sheet: What does your mealworm look like? What does it do? How many legs does it have? Does it move quickly or slowly?

Next, you'll make your mealworm's habitat. If your mealworm is in the container, gently "pour" it onto a sheet of paper.

Fill the container about half full of oats.

Place a potato slice on top of the oats.

Place your mealworm on top of the oats. What does it do? Can your mealworm crawl up the sides of the container?

Write down any more observations on your lab sheet.

Wrap-up: What basic things does your mealworm need to live? Where is your mealworm's source of water? Based on your observations, do mealworms prefer light areas or dark areas? Did your mealworm have an easier time moving when it was on a smooth surface or in the oats?

Bonus: Keep your mealworm in its habitat and record what it does every day. How does it change over time?

ACTIVITY 2: ACTIONS AND REACTIONS

What You Need:

- your mealworm
- tray or sheet of paper
- flat toothpicks
- watch with a second hand
- cotton swab
- peppermint extract (Or use another strong-smelling liquid, like vanilla or vinegar.)
- flashlight
- paper towel
- water
- book
- straw
- lab sheet

Think: A stimulus (STIM-yoo-luss) is something that can cause an animal to react. What's one stimulus your mealworm has encountered?

Take your mealworm out of its container with the flat end of a toothpick.

Place it on an empty tray or a piece of paper.

Put your mealworm through stimulus tests A-G at right. Record your mealworm's reactions on your lab sheet. If you are unsure of its reaction, try the test again.

Wrap-up: How did your mealworm react to each test? If you tried the same test more than once, did your mealworm react the same way each time? Did each mealworm in the class react the same way?

How do these tests mimic things that could happen to a mealworm in the wild?

Bonus: Can you think of another stimulus that your mealworm might react to? When you have an idea, check it with your teacher. Then test your mealworm. Record your results on your lab sheet.

A) Touch Test: Use a toothpick to gently touch your mealworm's antennae (the two tiny stubs on its head).

B) Drop Test: Carefully pick up your mealworm using a toothpick. (See step 2 on page 11.) Lift the mealworm about 10 cm (4 in.) off the desk. Hold it in the air for 30 seconds, then let it drop.

C) Light Test: Shine a flashlight so that only the front half of your mealworm is in the beam.

D) Edge Test: Place a book on your desk. Place your mealworm next to the book's spine.

E) Wind Test: Aim a straw at your mealworm's head. Blow gently.

F) Water Test: Wet a small piece of paper towel. Place a dry piece next to it. Put your mealworm in between the two pieces.

G) Smell Test: Dip a cotton swab in peppermint extract and hold it in front of your mealworm.

(Think: Will my mealworm act the same when it grows up and becomes a beetle?)

Fast or Slow

How fast is your mealworm? Measure the distance your mealworm moves in ten seconds.

My mealworm moved _____ in ten seconds.

Will your mealworm climb? Lay your pencil on your desk and see if your mealworm will climb on or over it. Record your result. _____

Try different objects to see if the mealworm will climb on or over them. What objects did the mealworm climb on?

Measure your mealworm. How long is it? _____

Compare the length of your mealworm to other mealworms in the classroom. What did you discover?

With your teacher, make a bar graph showing the sizes of the mealworms in your classroom.

Lab Sheet - Mealworms

Ronald keeps some pet birds at home. He feed the birds with mealworms which are the larvae of a beetle (*Tenebrio*). The mealworms are so called because they eat mainly oatmeal. They are available in pet shops for birds. Ronald, however, cannot go to the bird shops for buying the mealworms everyday. He wants to design a compartment where he can keep the mealworms in good conditions. Before doing this, he needs to have some information about the behaviour of the mealworms.

Carry out an investigation to study the responses of mealworms to three external stimuli. On the basis of your findings, try to design a compartment for Ronald for keeping the mealworms.

Note

- Treat the mealworms in a humane way.
- Do not handle the mealworms with your fingers.
- Wash your hands after the experiment.

A. Identifying problem

1. State precisely what you want to find out in this investigation.

B. Planning

1. For each of the conditions you want to study, what is the independent variable? How would you manipulate it?
2. What is the dependent variable? How would you measure it? How many measurements will you take?
3. What assumption(s) do you hold when choosing this method of measurement?
4. What other variables need to be controlled?
5. Give a concise account of your procedure, including the apparatus and materials you would use.
6. Draw a table for entering your results. The table should indicate clearly the treatments in the different set-ups.

C. Carry out your investigation

D. Recording and presenting results

1. Enter your results into the table.
2. What is the best way to present your results?

E. Evaluating evidence/data and drawing conclusions

1. What conclusion(s) can be drawn from your results?
2. Based on your conclusion, design a compartment for keeping the mealworms.
3. What are the possible sources of error when making the measurements? Suggest ways of improvement.
4. What would you like to do next to extend your study?