Adaptation

Certain characteristics of plants and animals that increase their chances for survival are called adaptations. This chapter emphasizes the adaptations that help animals get through the winter, the special adaptations of birds and the special adaptations of plants. Some adaptations are physical features that have been retained through many generations of natural selection because they increase an organism’s fitness for survival. The bird bills and feet explored in an activity here are an example of such physical adaptations. Other adaptations seem to involve a behavior rather than a physical feature. Migration is an example of a behavioral adaptation.

What are some human adaptations? We suggest that you explore this question with your class and decide which are physical features (e.g., opposable thumb) and which are behavioral (building shelters, wearing clothing).

Teaching Ideas:

**Survival** – *Handout/Activity*

**Forelimbs** – *Discussion and Handout/Activity*

**Protective Coloration Game** – *Outside Activity*

**How Do Animals Get Through the Winter?** – *Handout/Activity*

**Getting Through the Winter Crossword Puzzle** – *Handout/Activity*

**Bird Beaks and Feet** – *Activity*

**A Year in the Life of a Bird** – *Handout/Activity*

**Migration Map** – *Discussion and Handout/Activity*

**Create-a-Seed Project** – *Activity*

**Flowers to Seeds** – *Handout/Activity*

**Animal-math** – *Handout/Activity*
An adult frog lays hundreds of eggs at one time. You would think that most ponds would be overrun with frogs. Many of these eggs will hatch, but very few offspring will survive. Most will be eaten by larger animals.

What does ADAPT mean? ____________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

What adaptations help each of these animals survive?

Deer _____________________________________________________________

Mouse _________________________________________________________

Skunk _________________________________________________________

Rabbit _________________________________________________________

Turtle _________________________________________________________

Porcupine ______________________________________________________
Forelimbs

Objectives:
• To show that vertebrate animals share the same basic skeletal features.
• To introduce the concepts of evolution through natural selection and adaptation.

Materials:
• “Forelimbs” worksheet, colored pencils or crayons.
• Optional - overhead projector, transparency made from a worksheet, and markers (six colors)
• “Forelimbs” worksheet, colored in (using the answer key) as an example.

Background
Since whales, bats and birds are all vertebrate animals, they all have a common vertebrate ancestor. Animals with a close evolutionary kinship share basic anatomical components which have similar positions in the body. The bones shown on the “forelimbs” worksheet are examples of such corresponding (homologous) structures.

Through the process of evolution, these structures develop differently in different species. Differences occur because variations that allow an individual to survive in its environment are passed on to its young genetically. Eventually the physical characteristics of the species as a whole reflect these adaptations. Features that originated from a close evolutionary kinship may appear quite different.

Here is a simple hypothetical model of how evolution through natural selection occurs:
An individual pre-whale animal born in the water with limbs thick and strong enough to propel it through this dense medium survived to maturity, and was capable of passing this trait on to its young. A pre-whale animal in the water with very thin forelimb bones could not move through the water to surface for air (whales are air-breathing mammals) and therefore died before having the chance to pass the thin-boned trait on to another generation. However, a pre-bat animal born with forelimbs thin and light-weight enough to propel it through the air (a much less dense medium than water) was able to hunt insects successfully and so survived to pass the thin-boned trait on to the next generation. A similar pre-bat animal born with thick bones was unable to fly and thus unable to compete for food with thin-boned pre-bat animals, and did not survive to pass the thick-boned trait on to the next generation.

Children may assume that all animals with the same skills or similar features have a common ancestor. This is not true. Many similar skills and features evolved independently in groups of animals that are not closely related. Although birds, bats and butterflies all have wings and fly, they are not all closely related. Although a bird’s wing is closely related to a bat’s wing — both have the same bones in the same general position on the body—birds and bats developed the ability to fly independently. Butterflies cannot be closely related to birds or bats because they have no bones at all! Their wings are made of a substance secreted by the epidermis. To find a common ancestor of birds, bats, and butterflies, one would have to look very far back in evolutionary history, and then the primitive animal ancestor would be less complex than a modern sponge!
**Activity**
Copy the “Forelimbs” worksheet and distribute with crayons or colored pencils. Using the Answer Key below and the background information above as a guide, demonstrate the relationships between the forelimb bones illustrated, and ask the children to color in their worksheets, using a different color for each type of bone. The color chosen to represent each type of bone should also be marked in the box by the bone name in the Key. Use an overhead projector to demonstrate.

EXTENSION: Clean previously cooked chicken wings by carefully removing meat and skin, and soak bones for an hour in household bleach. Rinse well with tap water and dry thoroughly. Provide *at least* one set of wing bones for every 2-3 students. Using the “Forelimbs” worksheet, have your students work together to identify each bone in the chicken wing. Using models or illustrations of human anatomy, reinforce the location of each bone on a human arm.

EXTENSION: Lead a discussion about the process of natural selection, emphasizing the role environment plays in selecting which features allow an animal to survive long enough to pass physical traits on to the next generation (refer to the hypothetical example of natural selection on the previous page).

**Answer Key**
Forelimbs

Name _____________________________________

Key:
- Upper Arm [ ] Humerus
- Lower Arm [ ] Radius
- Lower Arm [ ] Ulna
- Wrist [ ] Carpals
- Hand [ ] Metacarpals
- Finger [ ] Phalanges

BIRD
FROG
MAN
WHALE
CAT
HORSE
BAT
Protective Coloration Game

Objectives
To show several examples of adaptations that help animals hide from their enemies.

Materials
- Colored paint-chip strips from a paint store, colored construction paper or pieces of colored string or yarn
- Red cellophane (optional)

Activity
Select two areas on the playground and divide the class into two, one team in each area. Give each team an equal number of a variety of colored paint chips (or construction paper or yarn) and have them hide the chips in their designated area. Then, switch areas and have each team find as many strips as they can in 10 minutes. Make note of the number of each color the teams find. You may repeat the activity, having the children hold red cellophane over their eyes while looking for the chips. (Test the cellophane before using--red cellophane should make it hard to distinguish between reds and greens.)

Compare and graph the number of chips of each color the teams found. Discuss the value of color that blends with the environment. Discuss the advantages of color vision.
# How Do Animals Get Through the Winter?

Draw a line from the animal to the word or words which describe how the animal gets through the winter. (Use the information in the adaptation box to help you figure out the answers).

<table>
<thead>
<tr>
<th>Animals</th>
<th>Ways of Surviving Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butterfly</td>
<td>Stays Active</td>
</tr>
<tr>
<td>Wasp</td>
<td>Stays Active</td>
</tr>
<tr>
<td>Garter Snake</td>
<td>Migrates</td>
</tr>
<tr>
<td>Fence Lizard</td>
<td>Hibernates</td>
</tr>
<tr>
<td>Grasshopper</td>
<td>Lays eggs</td>
</tr>
<tr>
<td>Bird (Junco)</td>
<td>Goes into a state of torpor</td>
</tr>
<tr>
<td>Bobcat</td>
<td></td>
</tr>
</tbody>
</table>

Fill in the blanks:

1. Name two animals that spend the winter sleeping under rocks: _______________ and _______________.

2. The animal that lays eggs and dies is the _______________.

3. The Monarch butterfly _______________ in the winter to milder climates.

4. The workers and drones die, but the queen wasp _______________ over the winter in a rocky crevice.

5. _______________ is the state of temporary dormancy that describes how the lizard copes with cold winter days.

6. _______________ such as the Junco, stay active, but others migrate to find food during the winter.

7. The Bobcat _______________ during the winter. We do not see him on the trail because he sleeps during the day and is active at night.
How Do Animals Get Through the Winter?

Certain characteristics of plants and animals that increase their chance for survival are called adaptations. Winter adaptations of some animals found at Martin Griffin Preserve are listed below:

<table>
<thead>
<tr>
<th>ANIMAL</th>
<th>WINTER ADAPTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bumblebees</td>
<td>Colony dies, only newly fertilized queens survive and they are dormant.</td>
</tr>
<tr>
<td>Honeybees</td>
<td>Colony survives, feeding on stored supplies of honey and pollen. Males (drones) are greatly reduced in number or entirely absent during winter.</td>
</tr>
<tr>
<td>Wasps</td>
<td>Colony dies, only newly fertilized queens survive and they are dormant.</td>
</tr>
<tr>
<td>Ants</td>
<td>Colony survives, feeding on stored supplies. Ants move deeper underground during cold times.</td>
</tr>
<tr>
<td>Other Insects</td>
<td>Generally stop developing. Pass the winter in one of the following stages: egg, pupa, larva or adult. Adult Monarch Butterflies migrate to specific coastal locations.</td>
</tr>
<tr>
<td>Spiders</td>
<td>Many die. Some enter a rigid state of torpor. A few spiders are able to function at low temperatures.</td>
</tr>
<tr>
<td>Birds</td>
<td>Available food is the controlling factor. Many birds of MGP migrate, many others are year round residents.</td>
</tr>
<tr>
<td>Amphibians</td>
<td>Amphibians need moisture. They estivate to avoid dry weather conditions and then migrate to breeding areas during the rainy season. Able to tolerate cool, moist conditions.</td>
</tr>
<tr>
<td>Reptiles</td>
<td>Hibernation is used to avoid extremely cold temperatures. They can withstand extremely dry conditions, but are less tolerant of cool, moist weather than amphibians.</td>
</tr>
<tr>
<td>Mammals</td>
<td>Almost all mammals at MGP are active year-round.</td>
</tr>
</tbody>
</table>
• When **winter** arrives, if it is extremely cold, some animals enter a sleep called **hibernation**. Most hibernators are **cold-blooded** animals, like snakes and some insects. During hibernation, the animal's **heartbeat** and breathing slow down to a point where they are hardly noticeable. Body temperature also **drops**.

• Other cold-blooded animals such as fence **lizards**, salamanders, **spiders**, and newts go into a state of **torpor**. Torpor is a state of inactivity and dormancy. As the days warm up, the animals become more active. When night comes and temperatures drop, the animals become inactive again.

• Still other animals, such as some spiders, **frogs**, and **insects**, lay **eggs** that will **survive** the winter and hatch in the spring; even if the adult animals don’t survive, the **species** will continue to live.

• Another way some animals get through the winter is to **migrate**. Some **birds** fly south to warmer areas, then return in the spring, as temperatures rise.

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**ACROSS**

3. __________ go into a state of torpor on a cold winter day.

5. __________ is a deep sleep.

7. Some animals lay __________ so their kind will survive even if they don’t.

9. __________ is a state of inactivity and dormancy.

11. Some __________ migrate to survive winter.

12. Animals’ body temperature ______________ during hibernation.

13. To survive __________ some animals hibernate.

14. __________ is a group name for all the animals of one kind.

---

**DOWN**

1. Most hibernators are ________________ animals.

2. Many birds __________ in winter.

4. Some __________ hibernate in winter, but most die.

5. The _______ slows when a snake hibernates.

6. Many _______ die after laying their eggs.

8. Birds __________ cold weather by migrating.

10. ______________ lay their eggs in ponds.
Bird Beaks and Feet

Objective:
To enable students to experience how different shapes and sizes of bird bills or beaks allow birds to eat particular kinds of food. This kind of specialization enables a variety of birds to live in the same territories or areas.

Materials:
- Bills and Beaks - tweezers, chop sticks, spoons, spatula, pliers, nutcracker, spring-type clothespins, eyedropper, straws, toothpicks, or any other items that might represent types of bills.
- Bird Food - beans (beetles), rubber bands (worms), macaroni (bugs), cranberry sauce or jello cubes (soft food), other kinds of small uncooked pasta (grasshoppers), candy worms, and some colored water, or any other items that might represent types of food
- Stomachs - small paper or plastic cup
- A large piece of cloth or newspapers to spread the food on
- Containers for the liquid and soft food

Activity:
Hand out a “bird bill” or “beak” and a “stomach” to each student. There can be 4 to 10 people playing at a time. Start by scattering all the kinds of food on the cloth or paper in the center of the table. Include the liquid and soft food in their containers. Have the hungry “birds”, each using a different bill or beak, try to get as much food as possible into their stomachs. Allow enough time for most of the food to be collected.

At the end of the time, check the type of contents in each bird stomach, and discuss which bills and beaks worked best on which kind of food. Have the students talk about what kind of bird might have the type of bill they were using. Ask how they felt when trying to get enough food. Could many different kinds of birds share the same area?

Types of bills and beaks, a few examples:
- Insect-eating bill - (long and slender like tweezers or toothpicks) - House Wren, Nuthatch, Meadowlark, Blackbird, Warbler
- Seed-cracking bill - (strong and blunt like a nutcracker, spring-type clothespin, or pliers) -Quail, Sparrow, Finch, Towhee, Goldfinch
- Boring & picking-up bill - (long and pointed, like tongs, or chopsticks) - Woodpeckers, Stellar's Jay, Crow, Heron
- Flesh tearing bill - (sharp and hook-like, such as a fork, or ice tongs with serrated tips) -Birds of prey, Hawk, Eagle, Owl
- Nectar-sipping bill - (long and fine, like a straw or eyedropper) - Hummingbirds
- Scooping bill - (strong, broad, or flat, like a spatula or spoon) - Duck, Pelican
A Year in the Life of a Bird

Name __________________

1. Color and cut out the cards on this page.

2. Arrange the cards in sequence, starting in winter.
   (Hint: These birds spend the winter in South America and raise their families in North America.)

   - MATE
   - FEED CHICKS
   - LAY EGGS
   - FLY NORTH
   - FLY SOUTH
   - SING
   - BROOD EGGS
   - BUILD NEST
   - WINTER
   - FLEDGE CHICKS
**Migration Map**

**Objective**
Demonstrate the habits and seasonal distribution of migratory bird species.

**Background**
At ACR we have birds which are:

- **Residents** - these species have what they need to stay in one place without migrating. The Steller's Jay, Western Scrub Jay and Chestnut-backed Chickadee are examples of residents.
- **Summer Residents** - go south for the winter, and spend spring and summer here. Some examples are Wilson's Warbler, and Western Flycatcher.
- **Winter Residents** - go north to breed in the summer, and spend the winter here. They include the Golden-crowned Sparrow and the Fox Sparrow.
- We also see a great number of nonresidents who stop off at Bolinas Lagoon for a short time during their migration.

The main reasons for migrating to breeding grounds are space and food. Each pair needs a **territory** with an adequate food supply in which they can raise their young without competition from another of the same species. For example, the rich supply of insects during the warm season in Alaska and Canada make these places desirable for breeding.

The main reasons for migration to the wintering grounds are climate and food. The climate in the breeding ground may become inhospitable and/or the food supply limited or nonexistent.

One mechanism that triggers migratory flight is the change in the length of day. This stimulates hormones which lead to physical changes including a build up of fat (used as energy during the flight) and a state called migratory restlessness. In this agitated state of anticipation the bird waits for the best migratory conditions and takes off.

How birds navigate is not completely understood. The sun and stars are of major importance, but there are other clues as well, such as birds' ability to detect the magnetic fields of the earth.

**Materials**
- Copies of the "Migration Map" handout
- Colored pencils or crayons

**Activity**
Distribute the maps and have the students underline each bird's name using a different color pencil or crayon, then trace the migratory route for that bird, using the same color. (A map or a globe may be used for reference as needed.) Possible discussion topics after the exercise could include:

1. Do all birds migrate?
2. When do birds breed?
3. What do these species have in common? How do they differ?
4. How do birds navigate during migration?
5. Why is winter cold in North America?
6. Why are more insects available in summer?
7. Why are birds so beautiful?
8. What do you think each bird eats?
Migration Map

Name ____________________

Draw the migratory route for each bird on the map.
Use a different color for each bird. Label the routes.

<table>
<thead>
<tr>
<th>BIRD NAME</th>
<th>BREEDING PLACE</th>
<th>WINTERING PLACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Gull</td>
<td>Northwest Territories</td>
<td>Coastal California</td>
</tr>
<tr>
<td>Osprey</td>
<td>Northwest Oregon</td>
<td>Westcentral Bolivia</td>
</tr>
<tr>
<td>American Avocet</td>
<td>Saskatchewan</td>
<td>Northern California Coast</td>
</tr>
<tr>
<td>American Wigeon</td>
<td>Northwest Territories</td>
<td>Coastal California</td>
</tr>
<tr>
<td>Common Loon</td>
<td>Alaska</td>
<td>Coastal California</td>
</tr>
<tr>
<td>Long-Billed Curlew</td>
<td>Montana</td>
<td>Coastal California</td>
</tr>
<tr>
<td>Western Flycatcher</td>
<td>Coastal California</td>
<td>Mexico</td>
</tr>
</tbody>
</table>
Migration Game
(Reprinted with permission from the Florida Game and Freshwater Commission, Tallahassee, FL)

In this game you can pretend that you are a migrating blackpoll warbler, scarlet tanager or black-headed grosbeak. Place your player (bird) on step one. It takes eight steps to get from North America to the Tropics. Taking turns, players spin the arrow to see how many steps they may take. The first one to the tropics (step 8) wins the game.

Use small stones or buttons as your birds. Cut off the map at the dotted line to make the playing board. To make the spinner, glue the dial and arrow to thin cardboard and cut out the pieces. Poke holes through the center of the dial and arrow and using a paper clip, assemble as shown below.

Bend paper clip as shown. Insert through holes punched in dial and arrow. Secure bottom with tape, and bend over top of paper clip as shown.
Create a Seed Project

Objective: The student will be able to create a model of an imaginary seed that can be successfully dispersed by a particular method.

Activity: Give each pair or team of students an Activity Card. Review each card and the variety of construction materials offered with the whole class. Ask each team to take 5 minutes to discuss the possibilities for designing the seed they will make. They may want to sketch their plans before beginning. Have all the seed materials in a place where the students can quickly and easily find what they want and let the creativity begin! This activity takes about 30 minutes. Be sure to give them a “two-minute warning” to complete their “seed” before concluding this activity.

Suggested materials:
Activity Cards
pencils, pens & markers
paper
rubber bands
aluminum foil
straight pins
feathers, loose cotton or polyfill
scissors
plastic or wooden beads
pipe cleaners
sequins and glitter
velcro tape
construction paper scraps
felt or fabric scraps
paper clips

Equipment: a fan
Equipment: open dish of water
Equipment: a ramp
(cardboard leaning against something)

Discussion & “testing”: Have one student from each team describe to the class what their seed is and how it works. A student from each team should then be given an opportunity to test their seed, demonstrating how well it can float in a bowl of water, roll down a simple ramp, stick to a piece of fur (or fake fur), propel itself across the room, blow in the wind of a fan, etc...

Continue the discussion by exploring any or all of these questions:

o Could a seed be dispersed in more than one way? Looking at the seeds you made, which could also be dispersed in a different way than you planned?

o How would it help the plant if its seeds could be dispersed in different ways?

o What would happen if all seeds simply fell next to their parent plants?

o Is every seed going to become a new plant? What else could happen to them?

o Imagine: A new island forms far out in the ocean. How do the plants first get there? (Examples: Coconuts and other seeds may float there. Birds flying overhead drop seeds. Wind blows seeds. Soon insects can live there and pollinate the flowers and the plants multiply. People arrive and bring food crops with their seeds. Animals are introduced that may bring seeds in their hooves, fur or scat.)

o Experimentation and Investigation: Collect or buy a variety of seeds that appear to rely on different kinds of distribution “strategies”. Place a few seeds of one type in a plastic bag and label it “Seed A”. Continue with each other type of seed, labeling sequentially. Try to provide a heavy seed (acorn, walnut, buckeye, fava bean, coconut), a seed with “wings” or...
Teacher Resource Page

fluff (dandelion, milkweed, maple) and a few very small seeds (poppy, sesame) or sticky-prickly seeds (bur clover, teasel, mock orange). Give each small group of students three or four different types of seeds, bagged and labeled. Give the student this assignment:

Look closely at the seeds you have been given and think about what you learned from creating a seed of your own. Now talk together and try to guess how the different seeds you have might be distributed. Label a piece of paper with a line for each seed (e.g., “Seed A”, “Seed B”, and so forth). On each line write down your group’s guesses. What you are doing is developing a hypothesis for each seed — a guess based on your prior knowledge and observations. Your next task as a group is to test each seed. One at a time, take a seed from each bag and test it with the equipment we used when you created a seed. Does the seed float on the water? Does it stick to fur? Does the wind (fan) blow it easily? How else might it be moved? Write down the results of each test for each seed type (Does it work? Yes or No). If you notice something else about the seed that might explain how it is distributed, write that down too. Discuss your results as a group. What conclusions can you make about how each seed you were given might be distributed? Do you all agree with these conclusions? Why? If you disagree, think about what other tests might help you decide. You don’t have to do those tests, but write down other things that would help you decide how this type of seed could be distributed to new places.

A DATA SHEET LIKE THIS MIGHT BE HELPFUL:

<table>
<thead>
<tr>
<th>Seed Type (A, B, C, etc.)</th>
<th>Hypothesis: How your group thinks the seed will be distributed.</th>
<th>Test 1: Ramp Gravity is the method of distribution if this works.</th>
<th>Test 2: Water If this works, this seed can be distributed by floating on creeks, rivers or ponds.</th>
<th>Test 3: Fur If this works, the seed can be distributed by sticking to animal fur or bird feathers.</th>
<th>Test 4: Fan If this works, the wind can blow this kind of seed to distribute it.</th>
<th>Other ideas? What else do you notice about this seed that might explain how it is distributed? Clue: Does it have a sweet scent?</th>
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</table>
**ACTIVITY CARD**

**Seed Dispersal by Water**
Create a seed to float on water at least five minutes.
*Hint: air bubble, raft*

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**ACTIVITY CARD**

**Seed Dispersal – Self Propelled**
Create a seed with a mechanism that will throw the seed two feet away from the plant.
*Hint: burst, split*

---

**ACTIVITY CARD**

**Seed Dispersal – Eaten by birds or Animals**
Create a seed to attract a bird or other animal.
*Hint: bright, tasty fruits with seeds inside*

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**ACTIVITY CARD**

**Seed Dispersal by Animal or Human**
Create a seed to hitchhike on an animal or human being for 20 feet.

---

**ACTIVITY CARD**

**Seed Dispersal by Wind**
Create a seed that floats in the air and can be blown by the wind.

---

**ACTIVITY CARD**

**Seed Dispersal by Gravity**
Create a seed that could roll away from its parent plant.
Flowers are beautiful to look at and pleasant to smell, but that is because they have a very important job to accomplish. They are able to produce seeds for the plant if they become pollinated. Most flowers attract a pollinator by their smell, color or shape. A pollinator is the insect, butterfly, bird or mammal that transfers the pollen from one flower to another. A pollinator is trying to eat the nectar or the pollen of the flower and is unaware that it is also transferring some pollen to another flower. Fertilization happens when a pollen grain from the stamen of one flower lands on the pistil of another flower of the same kind and when it reaches the ovary, a seed then starts to develop. Some seeds become surrounded by fruit, while others stay dry. These seeds are then dispersed in many different ways and will hopefully grow into new plants.

What would happen if we picked all the wildflowers?

Color each flower part the color on the chart. Label each part.

<table>
<thead>
<tr>
<th>Flower Part</th>
<th>Description</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>pistil</td>
<td>A large center stalk, often shaped like a water bottle, where the pollen lands.</td>
<td>yellow</td>
</tr>
<tr>
<td>stamen</td>
<td>A tall, thin stalk with a knotted tip. It holds grains of pollen.</td>
<td>brown</td>
</tr>
<tr>
<td>petal</td>
<td>Brightly colored and sweet-smelling leaves that attract pollinators.</td>
<td>red</td>
</tr>
<tr>
<td>sepal</td>
<td>Small leaflike part at the base of the flower that protects the flower buds before they open.</td>
<td>green</td>
</tr>
<tr>
<td>ovary</td>
<td>Ball-shaped part at the base of the pistil. This is where the seeds develop.</td>
<td>blue</td>
</tr>
</tbody>
</table>
Animal-math

Student Name _______________________

What would your life be like if you were an animal, like a bird, spider, mammal or other inhabitant at the Martin Griffin Preserve, instead of a human being? It would be the same in some ways – you would still need a good home, food and water. But in other ways, things would change a lot. Want to know more? Do the math!

1. If you were an earthworm, you would have ____ (2 + 3) hearts. In one acre there could be more than a million of you, eating ____ (5 + 5) tons of leaves, stems and dead roots a year and turning over ______ (20 + 20) tons of soil.

2. If you were a hummingbird, your heart would beat ____ (60 x 10) times per minute and you could beat your wings about ____ (200 +500) times in 10 seconds as you hover, fly forward, or even backward.

3. If you were a spider, you would have (2 x 2) ____ pair of legs. How many total is that? (4 x 2) ____ legs.

4. If you were a banana slug, you would have continuously growing radula, which can be as many as ______ (300 x 100) backward pointing teeth.

5. If you were a ladybird beetle, you could eat as many as ______ (500 x 10) aphids during your lifetime.

6. If you were a honeybee, you would fly approximately ______ (1000 ÷ 2) miles in your brief lifetime of _____ (7 x 5) days.

7. If you were a ground squirrel, your heart could beat __________ (1050 ÷ 3) times per minute when active, but drop to ____ (2 + 3) beats per minute while hibernating.

8. If you were a turret spider, your home would be in a burrow in the soil, which you would extend vertically above ground by weaving a tube. You could live for ____ (3 x 2) months without eating and you could shed your skin to get smaller if need be!

9. If you were a harvester ant, you could carry something _____ (25 + 25) to ______ (10 x 10) times your weight.

10. If you were an orb weaver spider, you would spend ____ (1 x 1) hour spinning an orb web that could catch _______ (500 x 8) times your own weight.

11. If you were a red-bellied newt, you would have ______ (2 + 2) toes on your front feet and _______ (5 x 1) toes on your back feet.

12. If you were a deer, you could be standing still, and within seconds you could be running ______ (20 + 25) miles per hour. You could leap across streams __________ (6 x 5) feet wide and jump over fences ______ (5 + 5) feet high.