

# *It's What's Inside that Counts.*

## Background Information for Teachers

Skulls can tell us many things - what the animal ate, if it was an herbivore, omnivore, or a carnivore. Skull characteristics such as eye placement, teeth types (dentination), and jaw structure, can help tell us if the animal was a predator or prey. The skull may be one of the most important features of an animal, housing the brain, providing major protective and nutritional features (mouth and teeth), and containing sensory-communication features (eyes, ears, and nose).

**"Eyes in front for the hunt - Eyes on side must run and hide."**

The eye placement can tell us whether the animal was a hunter or hunted, or if lived in the trees, on the ground, or even in the water. Animals with forward facing eyes generally hunted and/or lived in the trees. Forward facing vision allows animals to triangulate, either their next meal or their next move among the branches. Eyes towards the top of the head point to an aquatic existence, so they can see above the water as they swim. Eyes on the side allow a wider field of view to look out for predators.

Herbivores are designed to eat plants. Herbivore mammals (BITE-CHOMP) need to cut and grind their plant food. To cut plants, this nutria uses its front 2 pairs of incisors (top and bottom). These teeth like many rodents' teeth are colored orange. This orange enamel covering contains calcium, phosphorus and other mineral salts, as well as, iron. The iron in the tooth enamel turns a rusty color because it is like rust! Mammalian herbivores tend to lack canines and have an empty space between their large incisors and flattened pre-molars, called a diastema. Birds that eat only plant material have a variety of bill types to enable them to get to their food - the broad flat bills of ducks to crush and tear aquatic plant material, the long slender bills of hummingbirds to sip nectar from deep inside flowers, and the seed and nut crushing bills of doves. Eye placement on these animals, mammal or bird, tends to be on the sides to enable them to have a wide field of vision and see any approaching predators. Sometimes however, eye placement is in front to enable them to triangulate their next jump or flight among the branches of the trees.

Carnivores tend to have pointed sharp teeth, long canines, and pointed molars (if they have any). Carnivorous mammals (BITE-RIP-TEAR) have specialized teeth to bite and kill, and to rip and tear flesh. The pre-molars (in front of the molars) and the molars are sometimes developed into large pointed teeth called carnassials, that fit together on the upper and lower jaws like scissors to tear flesh apart. The eyes tend to be forward facing allowing binocular vision for good depth perception to catch their prey. The skull of this coyote

## **Time to Experiment: INTRODUCTION TO A MICROSCOPE -**

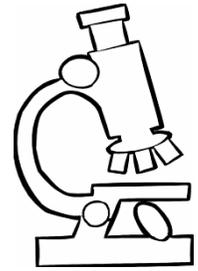
**Materials:** (you must provide materials unless otherwise noted)

Skull Tic-Tac-Toe puzzle (provided)

Skull Matching and Fill-in (provided)

Animal and Menu Matching Puzzle (provided)

Crayons/pens/pencils



### **Procedure:**

1. Read the "Parts of a Skull and their Function" sheet and point out the differences of the types of teeth, and beaks animals have that are adapted to the type of food they eat. Have the students hold and study the skulls while they're reading and working on the worksheets.
2. Using "Parts of a Skull" sheet provided as a guide, photocopy so each student has their own sheet and help them complete their own Tic-Tac-Toe (older and younger templates), and Matching sheets, after you point out the adaptations of the skull development.
3. Check your student's knowledge, by having them match the animal to its food in the Menu sheet provided.

### **Extensions:**

1. Have your students design their own animals, and the skulls their animals would need to do all the things they do.
  - a. If their animals rammed into each other like mountain goats - they would need extra thick skulls, lower eyes, etc.
  - b. If they used antlers to attract a mate, they would need them - but would they get in the way of eating?
  - c. If they lived underground, would they need big eyes? Animals like mole rats have lost their eyes because they spend all their time underground, and don't want to get dirt in them!

### **Conclusions:**

Your students should be able to understand and identify some of the parts and functions of the skull and teeth or beaks, after they completed the following experiments.

Skull pictures and information <http://www.skullsunlimited.com/educational-resources.html>

## Parts of a Skull and Their Function

### The EYES:



When you first look at a skull, what's the first thing you notice?

Usually you'll find the eye sockets. The eye sockets will tell you a lot about the animal you're looking at. Pick up the skulls and look at them!



Image

Credit:

**BIG EYES** - the animal may be active at night (nocturnal) like this owl monkey (on left).



Image

Credit:

**EYES ON TOP** - the animal may be an animal that lives in water, like this beaver (on left), eyes on top will help it see anyone trying to hunt it (predators) while it is swimming.



Image

Credit:

**EYES IN FRONT** - the animal may be a hunter (predator) like this owl (on left) or live in trees and need to see the next branch to jump to.



Image

Credit:

**EYES ON SIDE** - the animal may be hunted (a prey animal) like this cottontail rabbit (on left).

*"Eyes in the front, the animal hunts. Eyes on the side, the animal hides."*

# Parts of a Skull and Their Function

## The TEETH:

When you first look at a skull, what's the first thing you notice? Maybe the first thing you notice will be the TEETH! The teeth will tell you a lot about the animal you're looking at. Look at the bottom picture of human teeth, so you'll know the different type of teeth. Pick up the skulls and look at them!

### ***Mammals that eat only meat - carnivores***

#### ***BITE-RIP-TEAR***



**SHARP CANINES (FANGS)** - the animal is probably a hunter (predators) carnivore using the sharp canine (fang) teeth to grab, hold, and kill its prey, like the smilodon, (pictured on left).

**SHARP MOLARS** - uses the sharp back teeth to rip and tear the meat. Most predators don't chew their meat they swallow it in chunks or even whole, and digest it later when it's safe from other predators.

**SHARP INCISORS** - uses the sharp front teeth to first grab and kill its prey.

### ***Mammals that eat only plants - herbivores***

#### ***BITE-CHOMP***

**LONG INCISORS** - the animal is probably an herbivore, like the Nutria (pictured on left) uses its long flattened incisors to cut grasses.

**DIASTEMA** - lacks canines, and instead has an empty space (called a diastema).

**FLAT MOLARS** - uses the flat surface to grind down the plants that they've eaten.

### ***Mammals that eat both meat and plants - omnivores***

#### ***BITE-CHEW-CHOMP***

**FLAT INCISORS** - the animal is probably an omnivore, like the human (pictured below), using its teeth to rip and tear plants.

**SHARP CANINES** - uses the canines (fangs) to rip and tear meat.

**FLAT MOLARS** - uses the flat surface to grind down plants.



Image

Credit:

<http://geomaps.wr.usgs.gov/sfgeo/geologi>

[c/stories/diablo\\_cenozoic.htmlpage=157](http://stories/diablo_cenozoic.htmlpage=157)



Image Credit: The Nutria picture was kindly made available to me through the generosity of Dr. Val Lance

# Parts of a Skull and Their Function

## The BEAK:

When you first look at a skull, what's the first thing you notice? You might notice the type of animal - not a mammal, not a reptile (like an alligator) but a bird. Birds don't have teeth they have beaks, and the beak will tell you a lot about the animal you're looking at. Pick up the skulls and look at them!



Image

Credit:



### *Birds that eat only meat - carnivores*

**SHARP CURVED BEAK** - the bird is probably a hunter (predator) carnivore using the sharp curved beak to kill and tear its prey, like the eagle, (pictured on left).

**SHARP TALONS** - uses the sharp talons, to grab, hold and sometimes even kill its prey, like the eagle talon (pictured on left).

### *Birds that eat only plants - herbivores*

**SHORT BEAK** - an herbivore, like the dove (pictured on left) mainly seeds and nuts. They plants move their babies around (seeds).

**LONG SLENDER BEAK** - an herbivore, like the hummingbird sip mainly nectar from flowers, and their long slender beaks allow them to go to the bottom of the flower. They plants have babies (fruit and seeds).

**LONG FLAT BEAK** - the animal is probably an herbivore, like the duck (pictured on left) using its long flattened beak to sift through the water and filter out food, like duckweed, cypress seeds, sedges, grasses and acorns.

### *Birds that eat both meat and plants - omnivores*

**SHARP SHORT BEAK** - like the blue jay (pictured on left), uses its beak to feed on berries, insects, and worms.



Image

Credit:



Image

Credit:



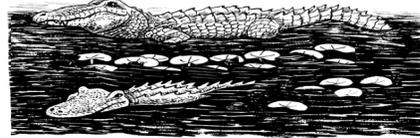
# Skull Tic-Tac-Toe Template

<p>I am a reptile predator, I feed on other animals when they come to the water or those that live in the water. (carnivore)</p>	<p>I eat living plants, I have huge orange front teeth. (herbivore)</p>	<p>I eat both plants other animals. (omnivore)</p>
<p>I am a predator, with beak and talons for ripping and tearing. (carnivore)</p>	<p>I am a plant eating bird with a bill for nibbling water plants (herbivore)</p>	<p>I am a bird that eats everything, from insects to seeds. (omnivore)</p>
<p>I am a plant eating bird with a bill for crushing seeds and nuts. (herbivore)</p>	<p>I am a mammal predator, I feed on many other animals, I have long sharp fang-like teeth. (carnivore)</p>	<p>I am a bird that drinks nectar from flowers with my long slender bill. (herbivore)</p>

# Skull Tic-Tac-Toe Younger Template



FIND MY EYES THEY  
FACE FORWARD!



FIND MY SHARP TEETH  
I AM THE KING OF THE SWAMP!



FIND MY SHARP BEAK  
IT'S CURVED

FIND YOUR EYES  
WHERE ARE THEY?



FIND MY TEETH  
THEY ARE BIG AND  
ORANGE!



FIND MY LONG FAN-  
LIKE TEETH!  
LIKE A DOG'S TEETH.



FIND MY TALON  
IT'S LONG AND SHARP!



FIND MY BEAK IT'S SHORT BUT  
SHARP FOR EATING SEEDS AND  
NUTS!



FIND MY LONG FLAT  
BEAK FOR  
EATING DUCKWEED!

# Swamp Skull Sleuth Sheet

I am the king of the swamp. I am a big reptile that lives in the water. I eat fish and other animals that come to drink near the water. I am a carnivore, and top predator other than man.

\_\_\_\_\_ WHO AM I?

I am visitor to Louisiana, I came from Argentina, and I can be trouble here because only one animal eats me. I am a rodent and I have lots and lots of babies. I am a herbivore, with long orange front incisor teeth. I eat a lot of plants in the marsh plants, sometimes entire areas are bare after I and the family have finished eating.

\_\_\_\_\_ WHO AM I?

I am a plant eater, I nibble on water plants, and my favorite is duckweed. I have a long flat bill. I am a bird (avian) herbivore.

\_\_\_\_\_ WHO AM I?

I eat a little of everything: insects, fruits, nuts, crawfish, frogs, dead mice (carrion) and small birds if I can catch them. I am known for getting into trouble, because I am smart enough to get into garbage cans and make trouble.

\_\_\_\_\_ WHO AM I?

I am a predator, I eat other animals. I have long sharp fang-like canines. I even look like a dog. I eat rabbits, insects, lizards, dead animals (carrion). I am a mammalian predator.

\_\_\_\_\_ WHO AM I?

I eat mainly fish but I will sometimes eat dead animals (carrion). I have a long sharp curved beak and strong talons for ripping and tearing. I am a carnivore. I am a bird (avian) predator.

\_\_\_\_\_ WHO AM I?

I eat seeds and nuts. My bill is shaped for crushing and grasping seeds. I am a bird (avian) herbivore.

\_\_\_\_\_ WHO AM I?

I am an avian omnivore. I eat a little of everything. I have a strong generalized bill for eating many different types of food, like fruits, nuts, eggs, insects, crawfish, mice, even other small birds.

\_\_\_\_\_ WHO AM I?

## Word Selection

Alligator      Nutria      Duck      Raccoon      Coyote      Eagle      Dove      Blue jay



## *Menu Le Barataria*

Try to match our patrons (restaurant customers) to their favorite delicacy:

*Raccoon the Great*

*1. fresh fillet of fish, with the occasional dead animal (carrion)*

*Lord Coyote*

*2. marsh grass, tender shrubs*

*Sir Blue Jay*

*3. fruits, nuts, crawfish, frogs, mice, small birds*

*Professor Alligator*

*4. rabbits, insects, lizards, carrion*

*Duchess Dove*

*5. seeds*

*Senora Nutria*

*6. fruits, nuts, eggs, crawfish, mice, small birds*

*Miss Eagle*

*7. fish, turtles, deer, raccoons, dragonflies, carrion*

Name:

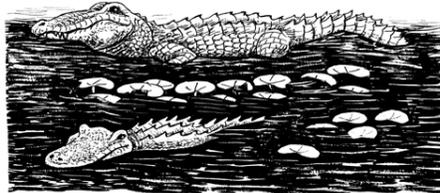
Date:

# Student Sheet

**MAGNIFICENT MAMMALS, FACINATING FISH, BODAOUS BIRDS, AWSOME ANPHIBIANS,  
INTERESTING INSECTS OR RADICAL REPTILE??**

***Draw lines from the animals to the characteristics that fit. Some characteristics will fit more than one animal.***

Breathes with lungs



Warm-blooded

Breathes with gills



Cold-blooded

Has live young



Breathes underwater

Lays eggs



Breathes at the surface

Has Scales



Has Fur

Teeth



Beak

# Skull Tic-Tac-Toe *Instructor's* Template

<p>I am a reptile predator, I feed on other animals when they come to the water or those that live in the water (<i>alligator</i>)</p>	<p>I eat living plants, I have huge orange front teeth. (herbivore) <i>nutria</i></p>	<p>I eat both plants other animals. (omnivore) <i>raccoon</i></p>
<p>I am a predator, with beak and talons for ripping and tearing. (<i>eagle</i>)</p>	<p>I am a plant eating bird with a bill for nibbling water plants (<i>duck</i>)</p>	<p>I am a bird that eats everything, from insects to seeds (<i>blue jay</i>)</p>
<p>I am a plant eating bird with a bill for crushing seeds and nuts (<i>dove</i>)</p>	<p>I am a mammal predator, I feed on many other animals, I have long sharp fang-like teeth (<i>coyote</i>)</p>	<p>I hunt animals, I use sharp talons to catch them. (<i>eagle talon</i>)</p>

# Skull Tic-Tac-Toe Younger Template



FIND MY EYES THEY  
FACE FORWARD!

(raccoon)



FIND MY SHARPTTEETH  
I AM THE KING OF THE SWAMP!

(alligator)



FIND MY SHARP BEAK  
IT'S CURVED

(eagle)



FIND YOUR EYES  
WHERE ARE THEY?

(YOU! In front.)

FIND MY TEETH  
THEY ARE BIG AND  
ORANGE!

(nutria)



FIND MY LONG FANG  
LIKE TEETH!  
LIKE A DOG'S TEETH.

(coyote)



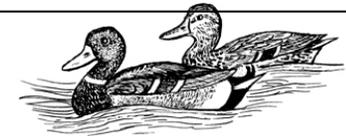
FIND MY TALON  
IT'S LONG AND SHARP!

(eagle)



FIND MY BEAK IT'S SHORT BUT  
SHARP FOR EATING SEEDS AND  
NUTS!

(dove)



FIND MY LONG FLAT  
BEAK FOR  
EATING DUCKWEED!

(duck)

# Swamp Skull Sleuth Sheet

I am the king of the swamp. I am a big reptile that lives in the water. I eat fish and other animals that come to drink near the water. I am a carnivore, and top predator other than man.

Alligator WHO AM I?

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Nutria WHO AM I?

I am a plant eater, I nibble on water plants, and my favorite is duckweed. I have a long flat bill. I am an avian herbivore.

Duck WHO AM I?

I eat a little of everything: insects, fruits, nuts, crawfish, frogs, dead mice (carrion) and small birds if I can catch them. I am known for getting into trouble, because I am smart enough to get into garbage cans and make trouble.

Raccoon WHO AM I?

I am a predator, I eat other animals. I have long sharp fang-like canines. I eat rabbits, insects, lizards, dead animals (carrion). I am a mammalian predator.

Coyote WHO AM I?

I eat mainly fish but I will sometimes eat dead animals (carrion). I have a long sharp curved beak and strong talons for ripping and tearing. I am a carnivore. I am an avian predator.

Eagle WHO AM I?

I eat seeds and nuts. My bill is shaped for crushing and grasping seeds. I am an herbivore.

Dove WHO AM I?

I am an avian omnivore. I eat a little of everything. I have a strong generalized bill for eating many different types of food, like fruits, nuts, eggs, insects, crawfish, mice, even small birds.

Blue jay WHO AM I?

## Word Selection

Alligator Nutria Duck Raccoon Coyote Eagle Dove Blue jay

# Menu Le Barataria

Try to match our patrons (restaurant customers) to their favorite delicacy:

Raccoon the Great

1. fresh fillet of fish, with the occasional dead animal (carrion)  
(eagle)

Lord Coyote

2. marsh grass, tender shrubs  
(nutria)

Sir Blue Jay

3. fruits, nuts, crawfish, frogs, mice, small birds  
(raccoon)

Professor Alligator

4. rabbits, insects, lizards, carrion  
(coyote)

Duchess Dove

5. seeds  
(dove)

Senora Nutria

6. fruits, nuts, eggs, crawfish, mice, small birds  
(blue jay)

Miss Eagle

7. fish, turtles, deer, raccoons, dragonflies, carrion  
(alligator)

## **Time to Experiment: INSECTS AND SPIDERS-**

**Materials:** (you must provide materials unless otherwise noted)

Story of Dragonfly (provided)

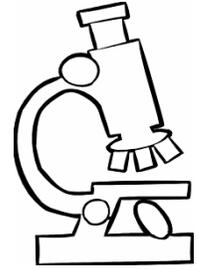
Dragonfly sample (provided)

Story of Spiny Spider (provided)

Spiny Spider sample (provided)

Ruler with centimeters and inches

Pencils, Pens, or Crayons for students to write or draw with



### **Procedure:**

1. Read the story of Dragonfly 482 words long.
2. Using the dragonfly sample provided as a guide, have students complete the worksheet provided
3. Read the story of Spiny Spider 482 words long.
4. Using the spider sample provided as a guide, have students complete the worksheet provided

### **Conclusions:**

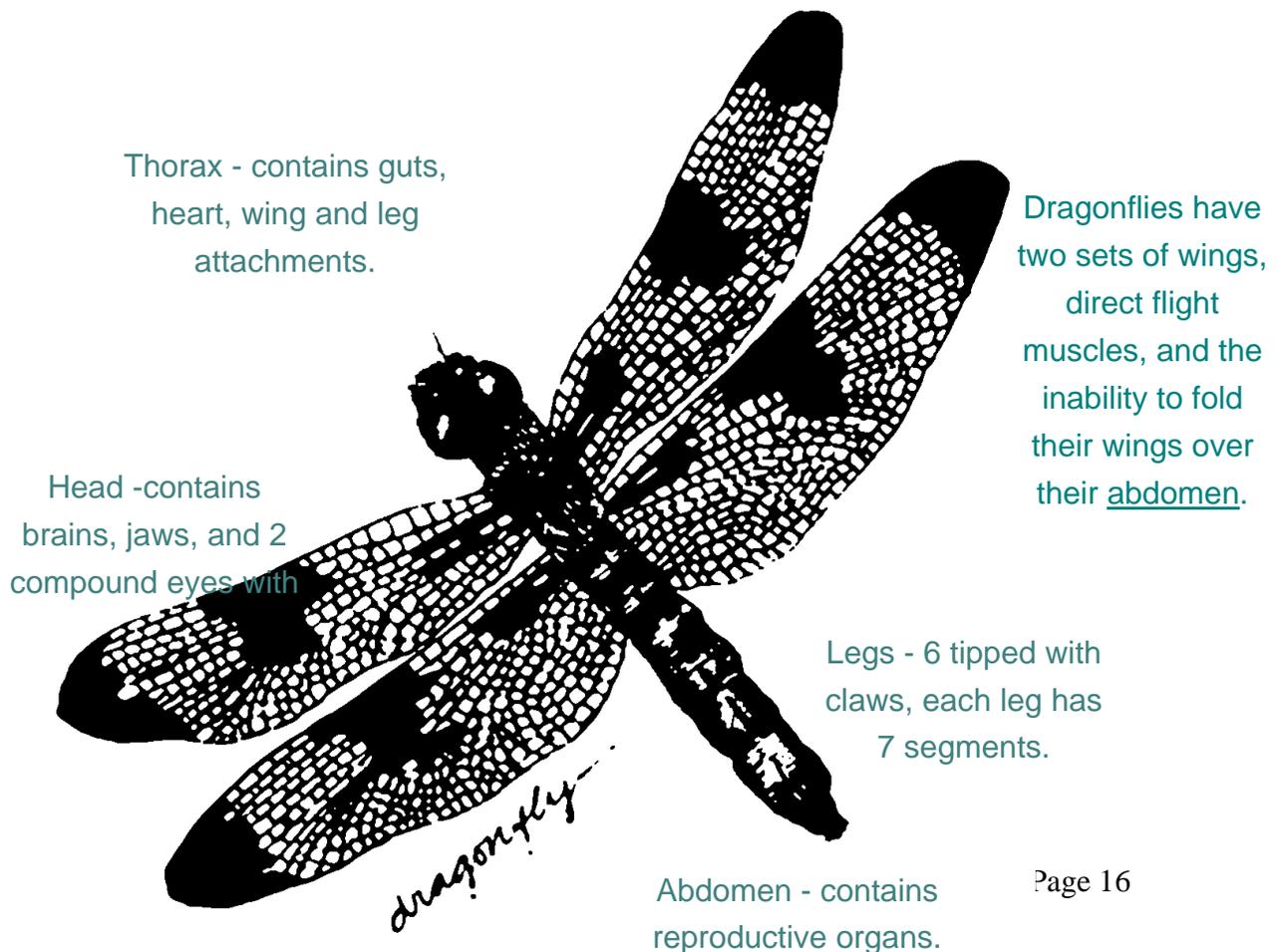
Your students should be able to identify and label all the parts of the spider and dragonfly worksheets after they complete the following experiments.

## The Story of Dragonfly

# I am a Dragonfly.

I am a dragonfly, and like all insects I started life as a cool egg. Mom laid me in Bayou Coquille along with my brothers and sisters. Our egg-mass was clustered underwater on the stem of the beautiful prickle-weed plant. Soon we hatched out and each of us became a nymph (baby insect).

As nymphs, we live underwater, sitting quietly until breakfast, lunch, or dinner swims by, then we lunge out and grab it! Our favorite meals are mosquito nymphs (baby mosquitoes). Like all babies we eat and grow, eat and grow, eat and grow, until 1 day we're big enough to leave the bayou. I crawled onto the trunk of a huge cypress tree where I blended in perfectly with the trunk. There I waited for my outside skin to open up and let me out. My wings unfurled and I flew away - I was an adult now!



Name:

Date:

**Student Sheet**

# Dragonfly

Insects are Special they can:

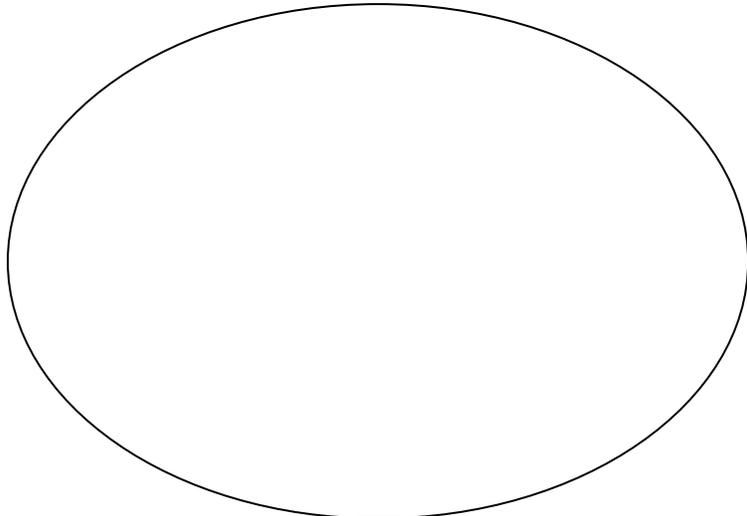
Lay eggs in the ground, in the water, on plants, and even in other animals.

Baby insects do not look like adults, they usually start off very differently, then go through metamorphosis (change) into adult form.

Have a hard exoskeleton (a skeleton on the outside)

Have 6 legs, with special claws at the ends.

### Draw Your Dragonfly



**Body Length**

Measure in

---

Inches

---

Centimeters

**Wing Length**

Measure in

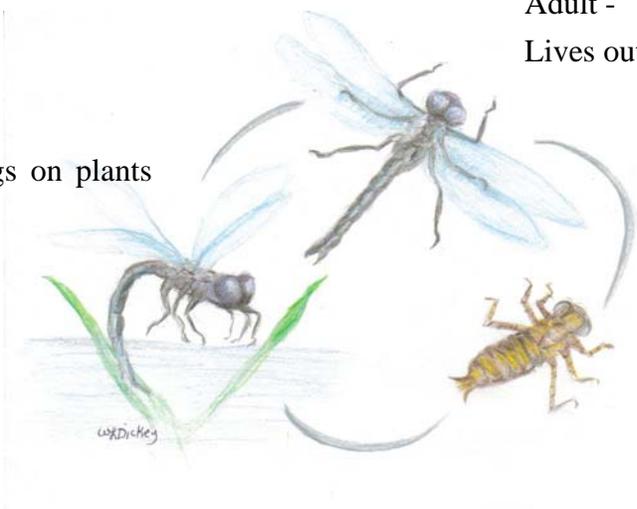
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Inches

---

Centimeters

Eggs -  
Adult lays eggs on plants  
underwater.



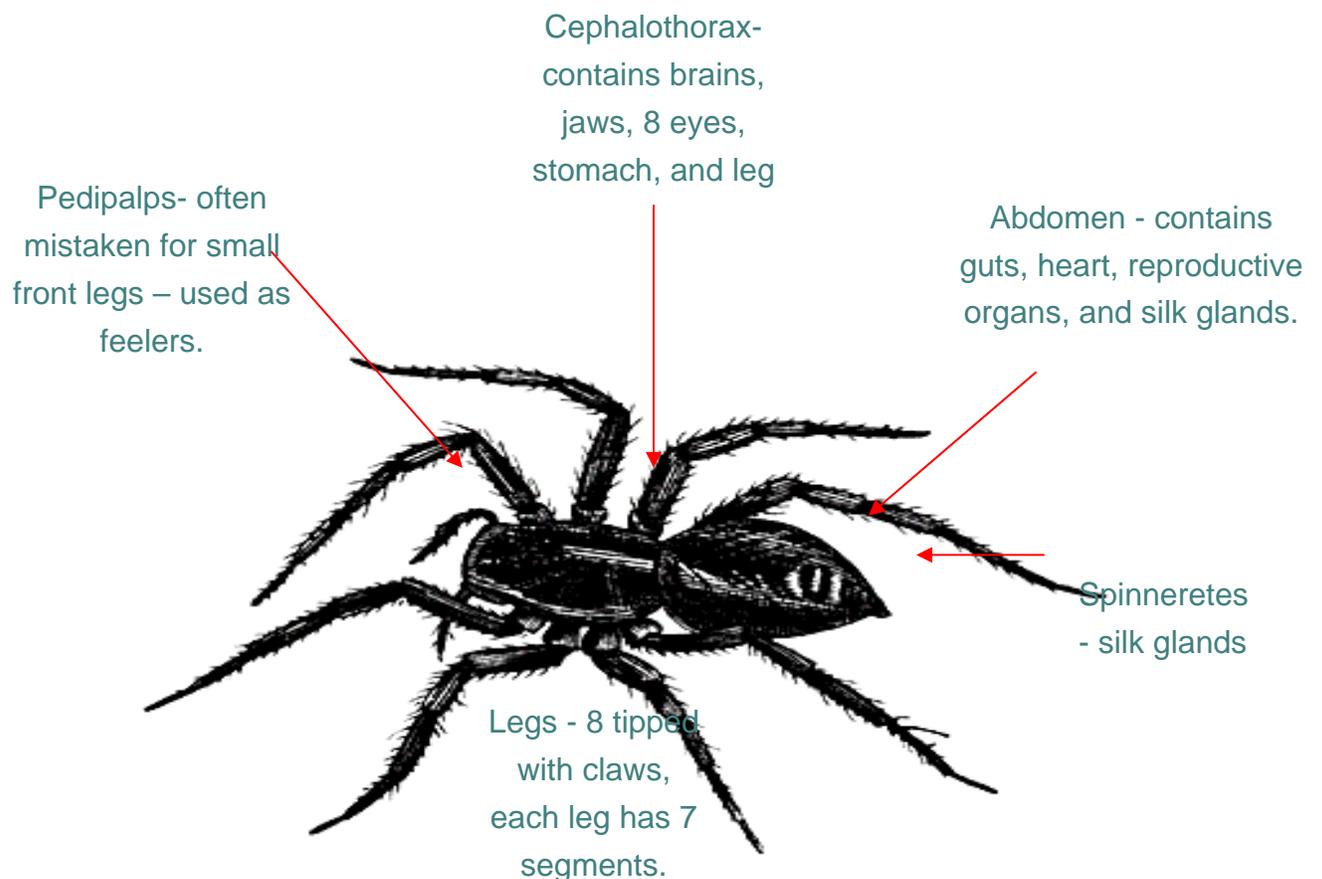
Adult -  
Lives outside water.

Larva -  
Underwater predator of other  
insect larva, goes through  
metamorphoses  
into adults.

## The Story of Spiny Spider

I am a spiny spider, and like all spiders, I started life as a cool egg with my brothers and sisters. My mom laid us in her web and wrapped us in an awesome silk wrap (called an egg sac). We stayed there all through the cold winter, and when spring warmed us up, we climbed out, sent out a long line of silk, and took off into the wind. After a short time, our silk strand catches on a plant and we land. We then begin to build a web of our own.

In my web I catch insects, they get stuck in the sticky strands of my web. I climb on the radii structural strands, down to my dinner. I inject venom into the insect and wait. Venom is different from poison, in that venom actually helps start digesting my dinner for me. Once dinner is ready I just suck it out - YUM! If I get too full, I just wrap the insect in silk, and come back to snack on it later. I am special, I'm not like an insect - I'm much cooler! Find out how...



Name:

Date:

## Student Sheet

# Spiny Spider

“You are never more than 3 feet from a spider.”

There are thousands of types of spiders that live all over the planet in practically every type of habitat. Wherever there are insects you'll find these cool hunters! They lie in wait, and blend in - in colors like black, brown, white, gray, red, yellow, green, and orange, because sometimes they're close to the ground, and sometimes they hide in plants and flowers. Spiders come in all shapes and sizes from tiny to huge, depending on who they're hunting. Spiders are carnivores (meat eaters), eating mostly insects, but some big spiders can eat small animals, like birds.

### Draw Your Spider

Body Length

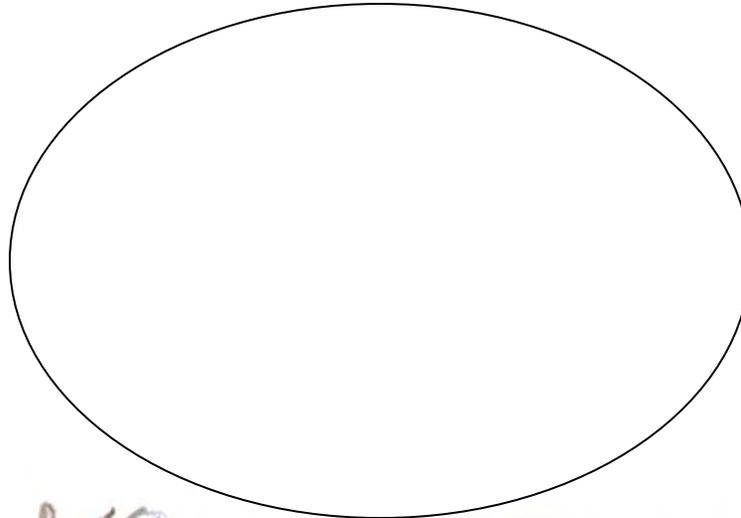
Measure in

\_\_\_\_\_

Inches

\_\_\_\_\_

Centimeters



Leg Length

Measure in

\_\_\_\_\_

Inches

\_\_\_\_\_

Centimeters

Spiderlings

Look just like  
miniature adults,  
do not go through



Egg sac

Adult covers eggs  
in silk to protect

Eggs

Adult lays eggs  
in the web, or a  
web sac.



Adult

Lives on land, either  
in a web or  
undercover.

# Benchmarks and Grade Level Expectations

## Benchmarks K-4

### Science as Inquiry

#### A. Abilities Necessary to do Scientific Inquiry

- SI-E-A1 asking appropriate questions about organisms and events in the environment.
- SI-E-A2 planning and/or designing and conducting a scientific investigation.
- SI-E-A3 communicating that observations are made with one's senses.
- SI-E-A6 communicating observations and experiments in oral and written formats.
- SI-E-A7 utilizing safety procedures during experiments.

#### B. Understanding Scientific Inquiry

- SI-E-B5 presenting the results of experiments.
- SI-E-B6 reviewing and asking questions about the results of investigations.

### Life Science

#### A. Characteristics of Organisms

- LS-E-A2 distinguishing between living and nonliving things;

### Science and the Environment

- SE-E-A2 understanding the components of a food chain (1, 3, 4);
- SE-E-A3 identifying ways in which humans have altered their environment, both in positive and negative ways, either for themselves or for other living things (1, 2, 3,4, 5);

### Life cycles of organisms

- LS-E-B1 observing and describing the life cycles of some plants and animals (1, 3);
- LS-E-B2 observing, comparing, and grouping plants and animals according to likenesses and/or differences (1, 2, 4);
- LS-E-B3 observing and recording how the offspring of plants and animals are similar to their parents (1, 2, 3, 4);

### Language Arts: Reading

- ELA-1-E1 Gaining meaning from print and building vocabulary using a full range of strategies (i.e. self-monitoring and correcting, searching, cross-checking), evidenced by reading behaviors using phonemic awareness, phonics, sentence structure, and meaning
- ELA-1-E2 Using the conventions of print(e.g., left-to-right directionality, top-to-bottom, one-to-one matching, sentence framing)

## Grade Level Expectations K-4

### Science as Inquiry

#### Abilities Necessary to do Scientific Inquiry

K 1 2 3 4

- |               |  |
|---------------|--|
| 1 1 1 1 1     | Ask questions about objects and events in the environment  |
| 2 2 2 2 2     | Pose questions that can be answered by using students' own observations, scientific knowledge, and testable scientific investigations  |
| 4 5 6 6 7     | Use the five senses to describe observations   |
| 6 7 8 8 9     | Select and use developmentally appropriate equipment and tools (e.g., magnifying lenses, microscopes, graduated cylinders) and units of measurement to observe and collect data                  |
| 7 8 9 9 10    | Express data in a variety of ways by constructing illustrations, graphs, charts, tables, concept maps, and oral and written explanations as appropriate  |
| 8 9 10 11 12  | Use a variety of appropriate formats to describe procedures and to express ideas about demonstrations or experiments (e.g., drawings, journals, reports, presentations, exhibitions, portfolios) |
| 9 10 11 12 13 | Identify and use appropriate safety procedures and equipment when conducting investigations (e.g., gloves, goggles, hair ties)   |

#### Understanding Scientific Inquiry

K 1 2 3 4

- |       |  |
|-------|--|
| 13 14 | Identify questions that need to be explained through further inquiry               |
| 14 15 | Distinguish between what is known and what is unknown in scientific investigations |
| 20    | Determine whether further investigations are needed to draw valid conclusions      |

### Life Science

#### Characteristics of Organisms

K 1 2 3 4

- |       |   |
|-------|---|
| 22 28 | Classify objects in a variety of settings as <i>living (biotic)</i> or <i>nonliving (abiotic)</i> |
|-------|---|

### Physical Science

#### Properties of Objects and Materials

K 1 2 3 4

- |    |  |
|----|--|
| 16 | Observe and describe common properties of solids, liquids, and gases   |
| 17 | Sort and classify objects by their state of matter   |
| 22 | Investigate and explain conditions under which matter changes physical states: heating, freezing, evaporating, condensing, boiling |

### Earth and Space Science

#### Properties of Earth Materials

# *A Whole New Way of Seeing Things!*

## Background Information for Teachers

Over a century ago, Wilhelm Konrad Roentgen discovered the X-ray, he called it that because X meant he didn't know what it was. This began the use of energy to visualize medical problems in patients.

An x-ray is a picture special doctors take to see the bones inside your body. These pictures can only show hard things like bones and teeth. The dentist can x-ray your teeth to look for cavities. An X-ray is a picture of the inside of the body made with special radioactive rays.

These days special X-rays can show bones, tissues or even parts of organs. Since Rontgen's discovery that X-rays can identify bony structures, X-rays have been developed for their use in medical imaging. Radiology is a specialized field of medicine. Radiographers employ radiography and other techniques for diagnostic imaging.

It is probably the most common use of X-ray technology.

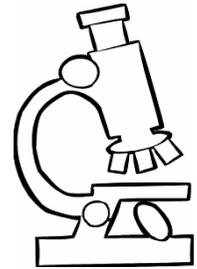
But it not the only use, astronomers also use x-ray imaging to look at distant stars and galaxies, and even our own star the sun.

**Time to Experiment: X MARKS THE SPOT -**

**Materials:** (you must provide materials unless otherwise noted)

Student Worksheet [provided].

X-Rays (provided)

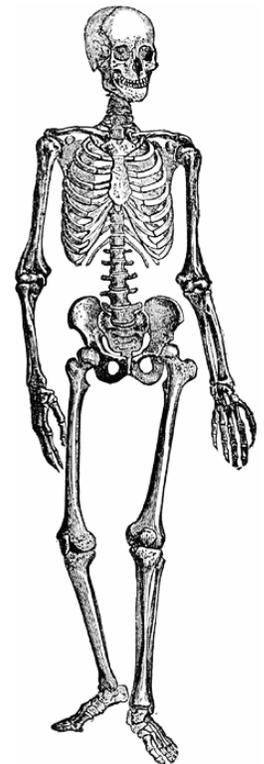


**Procedure:**

Have the student s find the images on the X-rays listed on the worksheet and answer the questions about how they are the same/different from the animals in the x-rays.

**Extensions:**

Have your students create their own "X-ray" images with black construction paper and white chalk. For example have them draw an outline of their hand, then add the bones from the image below. Have the students measure the Length and width of their hands, then graph all the information.



Width	Length
5	7
3	5
4	6

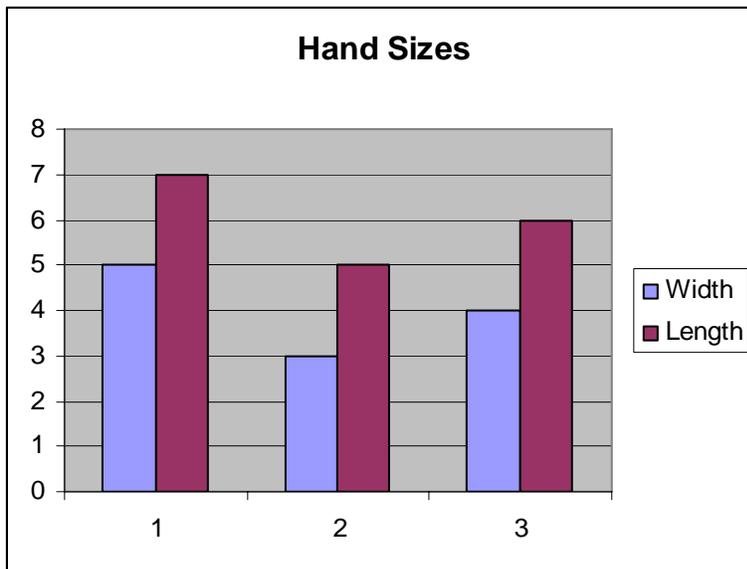


Image credit: University of South Florida, Educational Technology Clearinghouse

**Conclusions:**

Your students should be able to understand and identify some of the elements of the X-ray, after they completed the following experiments.

## Find My X-ray

X-rays are a special type of picture of hard material (like bones and teeth) inside an animal (including us). Cut along the solid lines and use the description below and try to match it to the correct x-ray.

I am a pit viper; I have long sharp fangs at the front of my mouth.  
I catch my prey, usually small mice, and inject my venom, then swallow them whole. See if you can find me, long and slender with my dinner inside me!

We are alligator eggs  
why do you think you can't see inside us? Think of eggs you eat for breakfast – are they hard or soft - x-rays can only pass through soft tissue.

I am a rabbit:  
can you see my sharp teeth?  
They are really long. How are they different from your teeth, are yours as big?

I am a turtle and I lay eggs  
how many eggs do I have to lay? I come from an egg, is that different from you?

I am a frog  
can you see my long, strong, legs?  
How are they different from yours?

I am a baby red-tailed hawk:  
can you see my 2 wings, and my sharp beak and talons? How is my beak different from your mouth?

Benchmarks K-4

**1303. Benchmarks K-4**

A. In Grades K-4, what students know and are able to do includes:

1. characteristics of organisms, which includes:

- a. LS-E-A1: identifying the needs of plants and animals, based on age-appropriate recorded observations (1, 2, 3, 4);
- b. LS-E-A2: distinguishing between living and nonliving things (1, 2, 3, 4);
- c. LS-E-A3: locating and comparing major plant and animal structures and their functions (1, 3);
- d. LS-E-A4: recognizing that there is great diversity among organisms (1);
- e. LS-E-A5: locating major human body organs and describing their functions (1, 4);
- f. LS-E-A6: recognizing the food groups necessary to maintain a healthy body (1, 2, 4, 5);

2. life cycles of organisms, which include:

- a. LS-E-B1: observing and describing the life cycles of some plants and animals (1, 3);
- b. LS-E-B2: observing, comparing, and grouping plants and animals according to likenesses and/or differences (1, 2, 4);
- c. LS-E-B3: observing and recording how the offspring of plants and animals are similar to their parents (1, 2, 3, 4);
- d. LS-E-B4: observing, recording, and graphing student growth over time using a variety of quantitative measures (height, weight, linear measure of feet and hands, etc.) (1, 3);