Butterflies and Moths

Teacher's Guide
Classroom Activities

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Teacher's Guide

TITLE: Butterfly Rainforest

GRADE LEVEL: Kindergarten through 12th grade

PROGRAM DESCRIPTION: Students will explore an outdoor walk-through environment and visual displays where they will learn more about the life cycle of a butterfly, and gain a better understanding of how important camouflage and adaptive methods are for survival.

LEARNING GOALS: Activities are designed to integrate science, language arts, math and social studies. At the conclusion of the museum program, kindergarten through 2nd grade students should

1. Use listening strategies effectively (LA.C.1.1)
2. Understand the patterns of function in living things (SC.F.1.1, SC.F.1.2, SC.F.1.3, SC.F.1.4)
3. Understand the competitive, interdependent, cyclic nature of living things in the environment (SC.G.1.1, SC.G.1.2, SC.G.1.3, SC.G.1.4)
4. Understand the consequences of using limited natural resources (SC.G.2.1, SC.G.2.2)
5. Understand the scientific processes and habits of mind to solve problems (SC.H.1.1, SC.H.1.5)

In addition, 3rd through 5th grade students should

1. Know that all living animals depend on plants. (SC.F.1.2.3)
2. Know that all living things compete in a climatic region with other living things and structural adaptations make them fit for an environment. (SC.G.1.2.2)
3. Know that all living things must compete for earth's limited resources; organisms best adapted to compete for available resources will be successful and pass their adaptations (traits) to their offspring. (SC.G.2.2.1)
4. Know that the size of the population is dependent upon the available resources within the community. (SC.G.2.2.2)

In addition, 6th through 8th grade students should

1. Understand the process and importance of genetic diversity (SC.F.2.3)
2. Understand the consequences of using limited natural resources. (SC.G.2.3, SC.G.2.3.3, SC.G.2.3.4)

In addition, 9th through 12th grade students should

Understand how genetic variation of offspring contributes to population control in an environment, and that natural selection ensures that those who are best adapted to their surroundings survive to reproduce. (SC.G.2.4.3)

Contents

Teacher Information

Butterflies and moths are second only to beetles as the largest group of animals in the world. Even with the 165,000 species of butterflies and moths that have been described, there are still an estimated 100,000 species that have not. Butterflies and moths are insects that scientists call **Lepidoptera**, meaning, "scale winged" in Greek. They get this name from the tiny scales covering their wings and body. Like all insects, Lepidoptera have a hard outer covering called an exoskeleton, which is divided into sections and has joints so the animal can move. Also like other insects, moths and butterflies have six legs, a head, a thorax, and an abdomen.

Fun Fact: There are 125 Lepidoptera families and about 12 times as many moths as butterflies – approximately 240,000 moths and 20,000 butterflies.

Anatomy

Butterflies and moths have three major body sections, a head, a thorax, and an abdomen.

On the **head** are two compound eyes, a proboscis, and the points of attachments for two antennae.

Eyes: Lepidoptera eyes have hundreds of lenses, each focusing on a narrow area of the surrounding environment. This is known as a compound eye.

Proboscis: The proboscis is a long straw-like tube that unrolls from the head when the butterfly needs to take either food or water for its liquid diet.

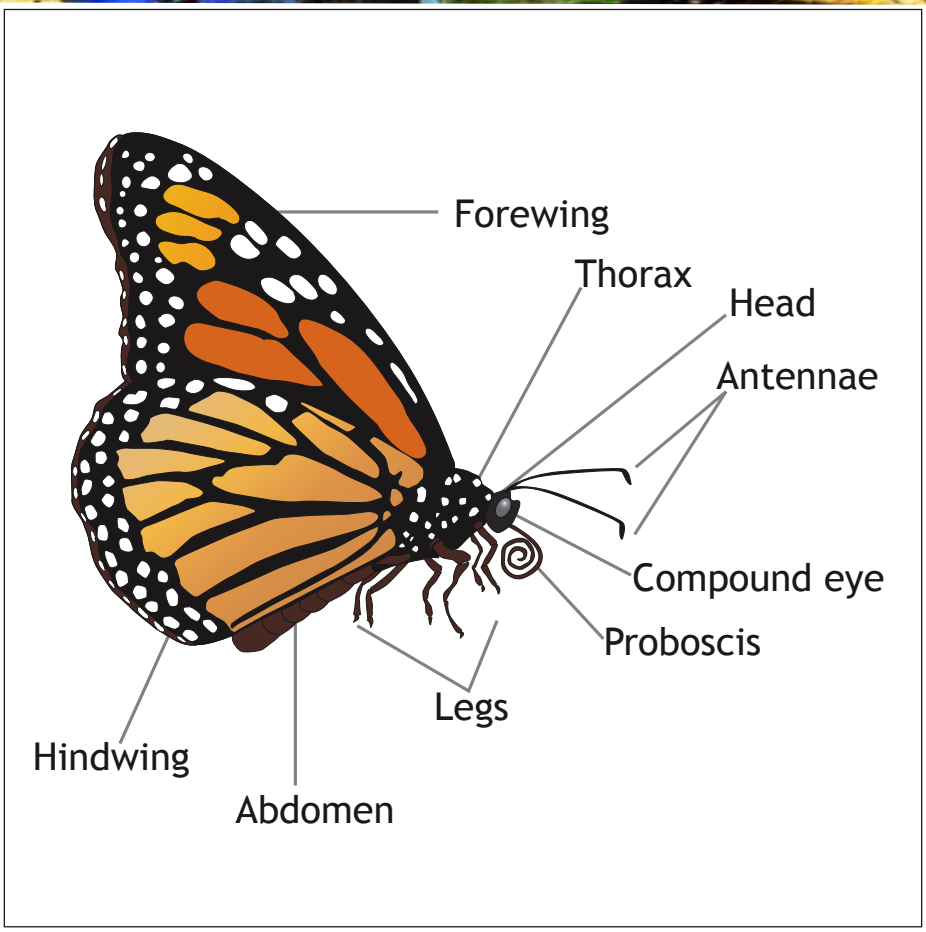
Antennae: Antennae extend out of the dorsal side of the head, from between the eyes. These organs act as the insect's nose and aid in finding food, mating, and balancing during flight.

The **thorax** is divided into three segments, each with a pair of legs. The four wings of a butterfly or moth are also attached to the thorax which houses the muscles needed for making these wings and legs move.

Legs: Butterflies and moths have six segmented legs.

Wings: The wings are composed of two membrane layers that are supported by tubular veins and are covered in thousands of colorful scales. Wing color and pattern serve a variety of purposes, from attracting mates to warning predators or providing camouflage.

The **abdomen** is composed of ten segments and contains the majority of the insect's organs such as the heart, breathing pores or spiracles, most of the digestive system, and reproductive organs.



Butterfly or Moth
There are three major differences between butterflies and moths;

1) Butterflies are often more colorful than moths because butterflies are active during the day. Moths, active at night, have earthy colors to camouflage them while they sleep during the day.

2) Most butterflies have club-shaped antennae while a moth's antennae are feather-like or taper to a point.

3) Moths have a thicker coating of scales than butterflies, gving them a furry appearance. This differs from butterflies because moths fly at night and are not usually active during the day when the sun would warm their bodies.

Food and Finding It
Butterflies and moths feed on a wide variety of liquids for energy and reproduction. Though famous for their affinity to flower nectar, butterflies and moths often feed on less appetizing items, such as feces, sap, rotten fruit and decomposing animals. All butterflies drink water, but male butterflies also drink liquids to obtain minerals vital to reproduction.

Teacher Information

Butterflies and moths rely on different senses to help them find food. Because butterflies are active during the day, color plays an important role in survival. Brightly colored flowers advertise food sources. However, moths are usually only active at night and cannot rely on visible color to help them find food. Instead, moths rely on smell. Moths' feather-like antennae have greater surface area than the club-shaped antennae of butterflies. This allows them to detect scents. Moths are often attracted to night-blooming flowers with strong smells.

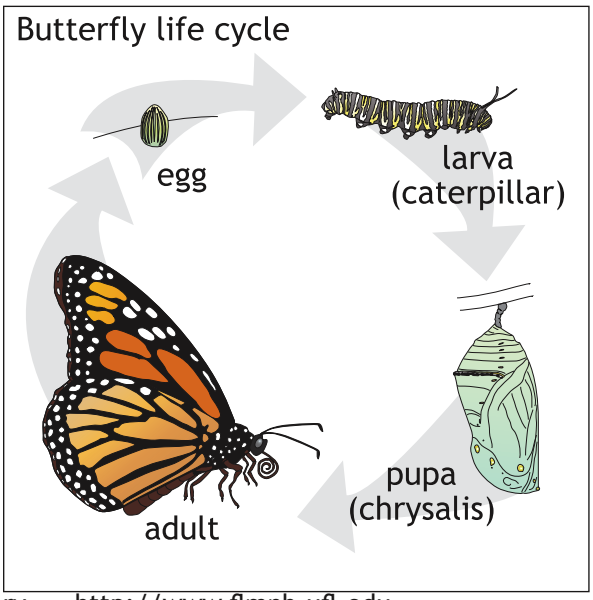
Mating

For butterflies, bright display colors are important in mating rituals and courtship displays. Male butterflies are often much brighter than females because they use their colors to attract the attention of potential female mates. Since finding a mate at night or in dimly lit forests can be troublesome, female moths and some species of butterflies produce large amounts of pheromones, a kind of chemical perfume. Using their antennae, males can detect the pheromones of potential mates from great distances.

If the courtship display of the male is successful, the female will alight on a leaf or the ground and let the most aggressive or most colorful male mate with her. After mating, a female carefully searches for the correct food plant for eggs and future larvae. Because each species of butterfly or moth is adapted to eat specific species of plants, females are very selective about where they lay their eggs. These plants are called "host plants." The female butterfly instinctively recognizes the correct leaf shape, color, odor, taste, and appearance of this host plant. Once satisfied, she lays her eggs, coating them with an adhesive that fastens them to the leaf.

Life Cycle

There are 4 life cycle stages for all butterflies and moths: *egg*, *larva* (or caterpillar), *pupa*, and *adult*. This cycle is called complete metamorphosis.



Teacher Information

The first stage of an insect's life is an egg. When the egg hatches the young butterfly or moth is called a caterpillar or larva. A caterpillar spends most of its time feeding on plants and growing very quickly. When it has reached its full size, the caterpillar stops feeding and becomes a pupa. A moth pupa transforms inside a cocoon and a butterfly pupa transforms inside a chrysalis. During this immobile, but metabolically active stage, the butterfly or moth makes its transformation from wingless larva to winged adult.

Predator Avoidance
Some animals (for example, birds, bats, spiders, dragonflies, and mice) rely heavily on Lepidoptera for food. Butterflies and moths have evolved several ways to avoid being eaten. These include:

Warning coloration- a bold pattern and bright contrasting colors. Bright warning coloration, especially yellow-and-black, orange, or red, warn birds and other predators that such insects may bite, sting, or taste bad.

Camouflage- Moths and many butterflies, particularly females, have earth-tone colors or patterns that resemble tree bark, lichens, or leaves. This "cryptic coloration" allows them to avoid predators by blending into their surroundings.

Mimicry- Some butterflies and moths deter predators by mimicking the color pattern of other less edible species or other insects, plants, and animals.

There are two types of mimicry:

1) Batesian Mimicry
Some harmless Lepidoptera species mimic the appearance of other species that are poisonous or distasteful. They "pretend" to be poisonous and predators avoid them.

2) Mullerian Mimicry
Sometimes two species look alike and both are poisonous or distasteful. When a predator attacks one of the two, it remembers the color pattern and is unlikely to attack either, avoiding insects with that color pattern.

Defense patterns- Alarm Patterns: Eyespots on wings intimidate predators, especially small birds, who think they see the eye of a larger bird that might harm them.

Habitat
Butterflies and moths can be found all over the world. However, the world's greatest diversity of butterflies and moths can be found in tropical rainforests. This means that there are a great number of different species in areas close to the equator.

Teacher Information

Tropical rainforests are home to such diversity for several reasons. The first is that over the past 100 million years, lands near the equator remained fairly undisturbed by sea level change, climate change, or glaciation. This allowed many different animals and plants to evolve over long periods of time. Because there are no seasons along the equator, only constant high temperatures, lots of humidity and rainfall, and intense sunlight, conditions are perfect for the growth of thousands of plant species. Diverse rainforest plants provide highly varied resources for animal life, and have evolved into thousands of species.

Butterfly and moth species live at specific heights in the rainforest. In a typical rainforest there are at least 4 layers or strata:

1) Ground layer or Forest Floor- herbs, ferns, and low shrubs
2) Understory layer- shade-tolerant small trees, mosses, lichens, ferns
3) Canopy layer- tops of tall trees, as many as 400 species per square mile
4) Emergent layer- extraordinarily tall species that rise above the canopy layer.

Most Lepidoptera species rarely leave a familiar environment. Some live hundreds of feet high in the rainforest canopy, while others fly close to the ground or rest in leaf litter. Each is adapted to a certain temperature, humidity, and light range, and stays at its favorite strata.

Words to Know

arthropod- an animal grouped in Phylum Arthropoda; invertebrates such as insects, spiders, and crustaceans. Arthropods have a segmented body, jointed legs, and an exoskeleton.
butterfly garden- a garden designed to attract butterflies and provide food for their larvae
conservation- planned management of a natural resource to prevent exploitation, destruction, or neglect; wise use of resources
cocoon- the outer covering of a moth's pupa
compound eye- an insect eye which is made up of many separate (6-sided lens) units
cryptic coloration- an animal that is colored to blend in with it's surroundings
diversity- the number and variety of species present in an area and their spatial distribution
egg- the first stage in the life cycle of an insect
endangered- a species whose numbers are so low that the entire species is at risk of extinction
evolution- the process of change in life forms over many generations that can lead to new species
exoskeleton- external skelton usually made of chitin
extinct- no longer existing
insect- an animal grouped in Class Insecta of Phylum Arthropoda with well-defined head, thorax, and abdomen, three pairs of legs, and typically one or two pairs of wings
Invertebrate- an animal without a backbone or spinal column
larva- (plural: larvae) A young butterfly or moth (or other insect) from the time that it hatches from the egg until it becomes a pupa, or chrysalis. During this time it usually molts several times, and may change its form or color each time.
Lepidoptera- insects grouped in Order Lepidoptera are butterflies and moths. They have four wings covered in scales, six legs, an exoskeleton, two antennae, compound eyes, three body parts- head, thorax, abdomen, and undergo complete metamorphosis
light pollution- lights that confuse, distract, and disrupt animals at night
microlepidoptera- minute or tiny moths
metamorphosis- the transformation of a larval insect into it's winged adult form
mimicry- when plants and animals and plants look or act like another species to gain protection and increase survival
proboscis- the straw-like sucking mouthpart of butterflies and moths
pupa- (plural: pupae) the stage of an insect's life when it transforms from larva into adult
rain forest- a forest with annual rainfall of at least 100 inches (254 centimeters) and tall evergreen trees forming a continuous canopy
spiracle- the breathing holes in the abdomen of a butterfly or moth
vertebrate- an animal with a spinal column
warning coloration- an animal that is brightly colored (usually yellow, black, and/or red) to warn other animals that it is dangerous or toxic

What is an Insect?

Lesson One
Ages Primary and Intermediate

Objective: Students will understand the characteristics of insects

Materials:
Picture of beetles (Figure 1)
Picture of human skeleton (Figure 2)

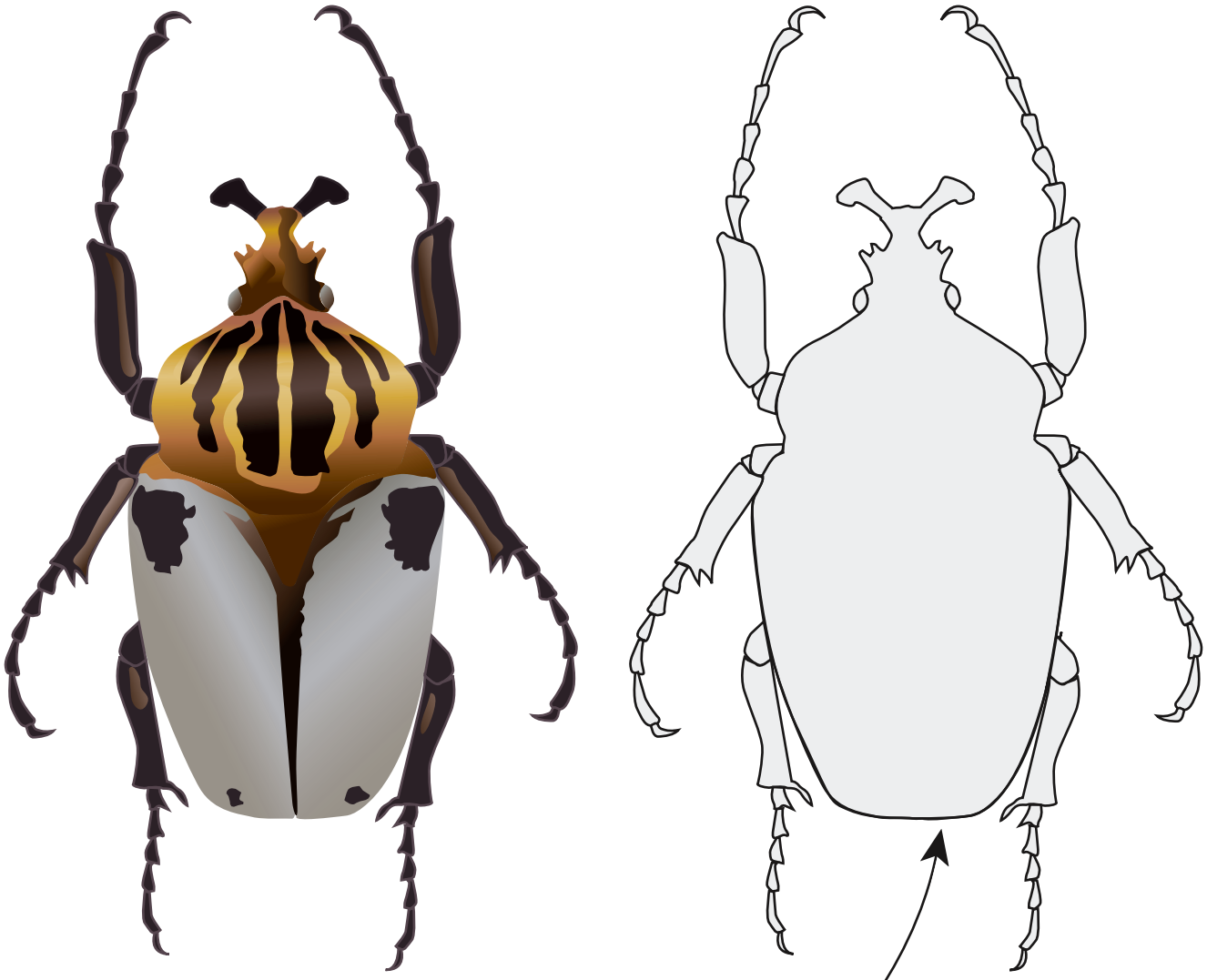
Suggested approach:
Ask the children "What is an insect?" Listen to their responses. Explain to them that insects have several major characteristics:

Part 1
Insects do not have an internal skeleton but instead have a hard outer covering called an exoskeleton. This exoskeleton is made up of a series of overlapping segments, allowing flexible motion.

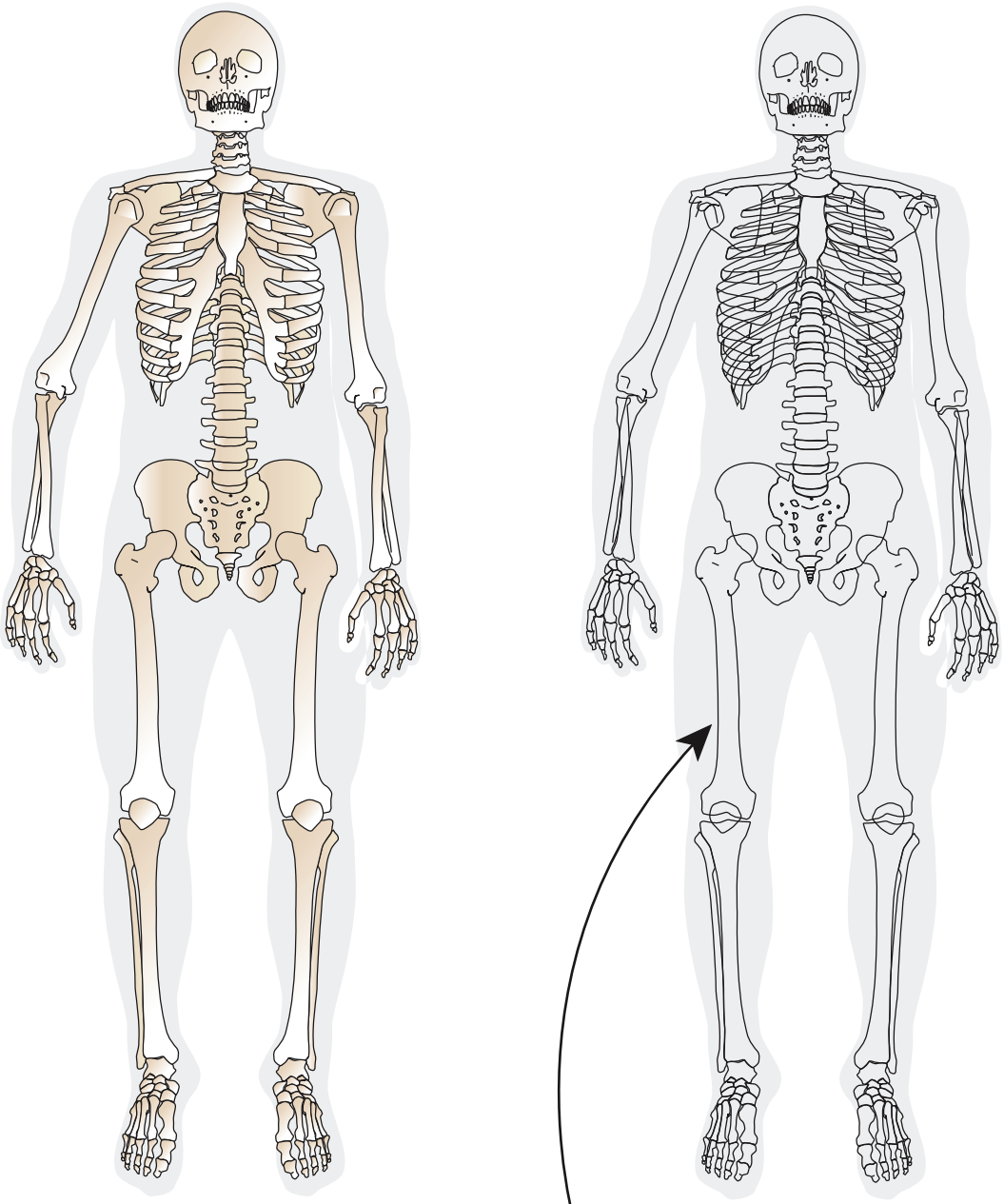
Show the children a picture of a skeleton (see attached sheet). Explain to them that people have bones like this inside of them and that all these bones make up a skeleton. Our skeleton is important because it supports our body and anchors our muscles. Without it we could not stand or move. We would just be a pile of mush. Insects are not like people. They do not have bones. Their skeleton is on the outside of their body. This hard shell is called an exoskeleton. Have the children say the word "exoskeleton."

Show the children a picture of a beetle (see attached sheet). See the exoskeleton? This hard shell helps protect the insect's body and organs. Think of a football helmet or a bicycle helmet. These helmets work like an exoskeleton because they protect what's inside.

Part 2
Insects are in a group of animals called arthropods. The word arthropod is a Greek word that means "jointed feet." Insects also have six jointed legs. People have joints too. A joint is the place where two bones come together. Bend your arm at the elbow. Now point to your elbow. This is a joint. Joints allow your body to bend and move. Can you think of another joint? Your knee is another joint. People have joints in their legs just like insects.



exoskeleton
external skeleton



endoskeleton
internal skeleton

Objective: Students are able to describe Lepidoptera (butterfly and moth) anatomy and relate it to our own anatomy

Materials:
4 kaleidoscopes
labeled butterfly illustration (Figure 3)
copies of the butterfly anatomy activity sheet (Activity Sheet 1)

Suggested approach:
Begin a discussion of butterflies and moths. Ask your students to give you examples of insects. Explain that butterflies and moths are both insects that belong to the same group or order of insects. This order is called Lepidoptera. Like other insects, butterflies and moths have three major body sections, a head, a thorax, and an abdomen.

Ask the children if they have those three body sections. Tell them that they have all of them. Have the children put their hands on their heads. What do we have on our heads? Have the children point to their eyes, nose, ears, mouth, and hair.

What do butterflies and moths have on their heads? Show them a picture of a butterfly labeled (see attached page).

Butterflies and moths have two eyes. People have two eyes too but each of our eyes only has one lens. This means we only see one picture. Butterflies and moths have hundreds of lenses on each eye. This means that they see lots of little images. This kind of eye is called a compound eye. Pass around the kaleidoscopes and have the children look through them. Tell them this is how a butterfly sees the world.

Fun Fact: Though the ability to see detail is very poor compared to humans, butterflies are capable of seeing a greater range in the color spectrum from ultra-violet through all visible light to infrared wavelengths.

Butterflies and moths have two antennae between their eyes. Point to the antennae on the picture. They use their antennae to feel and smell. What do we use to feel and smell? Insects do not have hands and noses like we do, so they use their antennae.

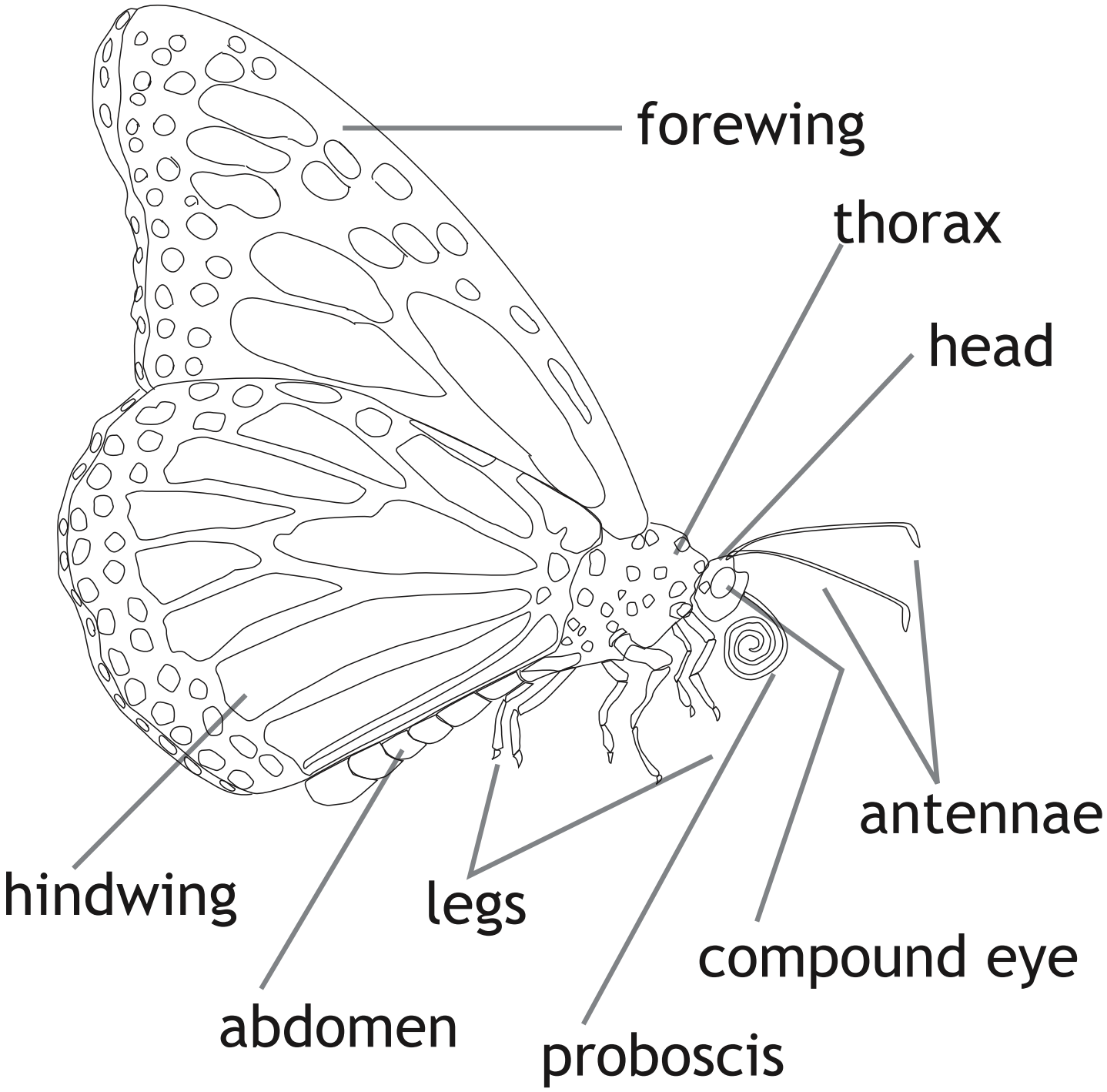
Point to your mouth. Butterflies and moths have a different kind of mouth. Their mouth is called a proboscis. The proboscis is a long straw-like tube that unrolls from the head when the butterfly needs to take either food or water for its liquid diet.

Where do you think our thorax is? Have the children put their hands on their chest. This is our thorax. What is attached to a butterfly's or a moth's thorax?
Point to the legs. Butterflies and moths have six legs.

Point to the wings on the picture. Butterflies and moths (Lepidoptera) have four wings. The top two are called the forewings and the bottom two are called the hind wings. Each wing is covered in thousands of colorful scales. The colors and patterns on their wings are always symmetrical. This means that each wing is a mirror image of the other. Hold out your hands with your palms up. Now look at your hands side by side. Your hands are symmetrical. Place the palms of your hands together. See how your fingers line up perfectly together. This is how butterfly wings line up when they come together.

Where do you think your abdomen is? Have the children hold their stomach below their belly button. This is your abdomen. An insect's abdomen is usually long. Just like our abdomen a butterfly's abdomen contains the stomach, helps produce baby butterflies, and gets rid of waste.

Have the children read and fill out the diagram of a butterfly's anatomy (Activity Sheet 1) on the following page.


forewing
thorax
head
antennae
hindwing
legs
compound eye
abdomen
proboscis

Read the definitions and label the diagram below.

Abdomen - The abdomen is the segmented tail area of an insect that contains the heart, trachea (breathing tubes), reproductive organs, and most of the digestive system.

Antenna - An antenna is a sensory appendage that is attached to the head of adult insects. Antennae are used for the sense of smell and balance. Butterflies have two antennae with clubs at the end.

Compound Eye - Insect compound eyes are made up of many hexagonal lenses.

Forewing - The fore wings are the two upper wings.

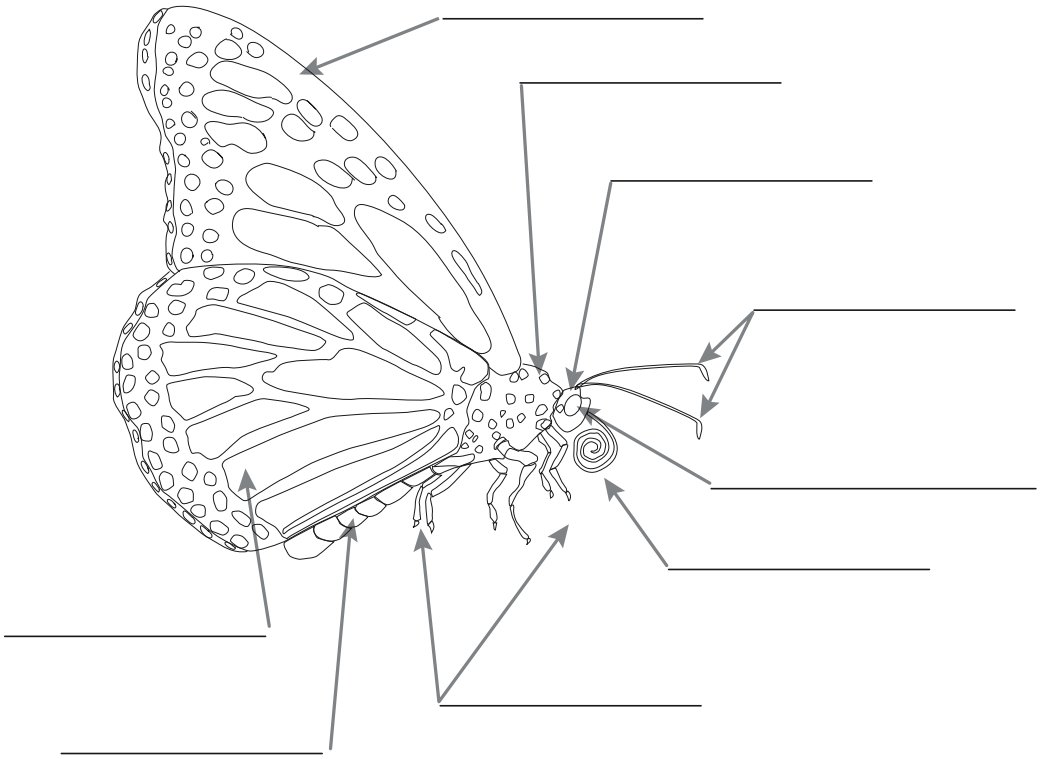
Hindwing - The hind wings are the two lower wings.

Head - The head is the part of the insect that contains the brain, two compound eyes, the proboscis, and the pharynx (the start of the digestive system). The two antennae are attached to the head.

Leg - Adult Lepidoptera (butterflies and moths) have six legs. The two forelegs of some butterfly species are tiny.

Proboscis - Adult butterflies sip nectar and other liquids using a spiral, straw-like proboscis located on their head.

Thorax - The thorax is the body section between the head and the abdomen. The legs and wings attach to the thorax.



Butterfly Anatomy: Candy Butterflies

Lesson Three
Ages Primary and Intermediate

Objectives: Children will make butterflies to help them understand the anatomy of a butterfly.

Materials for each child:

1 paper plate
4 toothpicks
2 unbroken pretzels
2 mini M&Ms
1 two-inch piece red shoelace licorice
6 half inch pieces black shoelace licorice
3 Tbs. vanilla frosting
1 candy fruit slices
1 gumdrop
1 large marshmallow
paper towels

Note: Make sure to buy a little extra in case pieces get dropped on the ground or broken.

Before Class

1. Buy enough candy and supplies for each child in your class to have the materials listed above.

2. Place the appropriate amount of candy on a paper plate and make one for each child in the class.

3. Place one half container of vanilla frosting at every workstation (the children will use this to "glue" body parts together).

4. Make sure to place plenty of paper towels at each workstation.

5. Write a key on the board or place a printout of it at each desk as to what piece of candy represents what butterfly body part.

During Class

1. Start class by showing them a picture of a butterfly (see Figure 4, p.18).

2. Review the three main body sections (head, thorax, and abdomen) and their components (See following page for review sheet and key).

3. Tell the class that everyone is going to build their own butterfly out of candy but they have to make sure not to eat the pieces until everyone is finished.

Making the Candy Butterfly

1. Put the head (gumdrop) on the end of one of the tooth picks.

2. Slide the thorax (large marshmallow) on the tooth pick just below the head.

3. Slide the abdomen (candy fruit slice) behind the thorax.

4. Attach the two wings (pretzels) by pushing the bottom of the pretzel into the topsides of the thorax (large marshmallow).

5. Attach the legs (black shoelace licorice) by pushing them into the bottom sides of the thorax.

6. Insert two antennae (toothpicks) close together into the very top of the head.

7. Take the proboscis (red shoelace licorice) and coil it.

8. Stick the end of the proboscis into the bottom front of the head.

9. Dip the eyes (mini M&Ms) in the frosting and attach them to the head right beside the antennae.

Review Sheet and Key

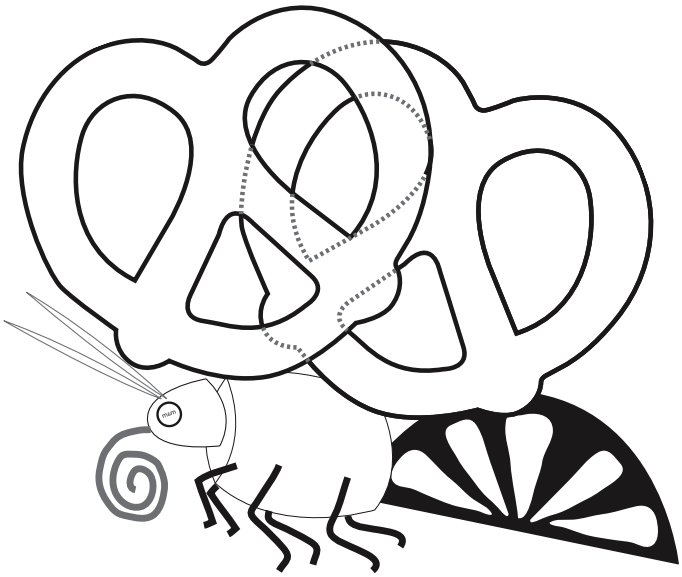
The **head** (gumdrop) is has two compound eyes, a proboscis, and two antennae.

Eyes: (mini M&Ms)
Each eye of a butterfly has hundreds of lenses. This is known as a compound eye
Proboscis: (red shoestring licorice)
The proboscis is a long straw-like tube that unrolls from the head when the butterfly needs to take either food or water for its liquid diet.
Antennae: (toothpicks)
The antennae extend out of the top of the head, from between the eyes and end in a thickened or club like structure. These organs act as the insect's nose and aid in finding food, mating, and balancing during flight.

The **thorax** (large marshmallow) is divided into three segments, each with a pair of legs. The four wings of a butterfly or moth are also attached to the thorax which houses the muscles needed for making the wings and legs move.

Legs: (black shoestring licorice)
Butterflies and moths have six segmented legs.
Wings: (pretzels)
Butterflies and moths have two sets of wings. The front two are called forewings while the rear two are called hind wings. The wings are covered in thousands of colorful scales.

The **abdomen** (candy fruit slices) is long and contains the majority of the butterfly's organs such as the heart, breathing pores or spiracles, most of the digestive system, and reproductive organs.



Butterfly vs. Moth: Do you see the difference?

Lesson Four
Ages Primary and Intermediate

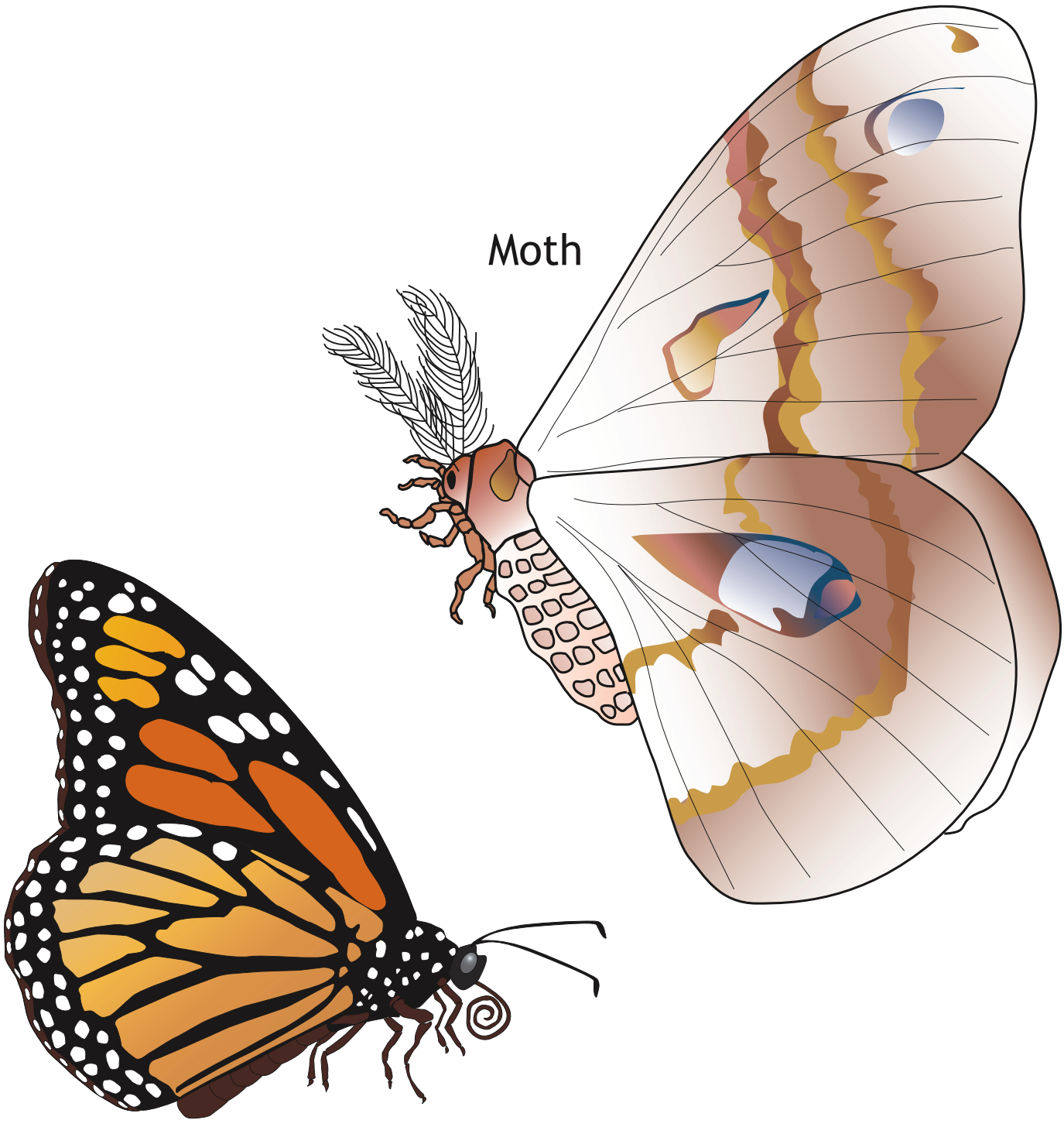
Objective: Students know the differences between butterflies and moths

Materials:
Picture of butterfly and a moth (Figure 4)
Butterfly vs. Moth activity sheet (Activity Sheet 2)

Suggested Approach:
Show your class a picture of a butterfly and a moth (Figure 4). Say to them: "Do you see any differences between the two?" Tell your class, "There are three major differences between moths and butterflies."

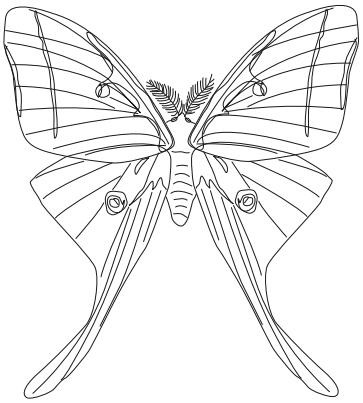
1) Butterflies are often more colorful than moths because butterflies are active during the day. Moths are active at night and have earthy colors to camouflage them while they sleep during the day.
2) Most butterflies have club-shaped antennae or antennae with knobs on the end while a moth's antennae are feather-like or taper to a point.
3) Moths have a thicker coating of scales than butterflies, giving them a furry appearance. These heavy scales help keep them from losing heat during the night when they are most active.

Have the children complete Activity Sheet 2 on the following page to see if they know the differences between butterflies and moths.


Moth
Butterfly

Butterfly vs. Moth: Do you see the difference?

Identify each insect by writing butterfly or moth under each picture.



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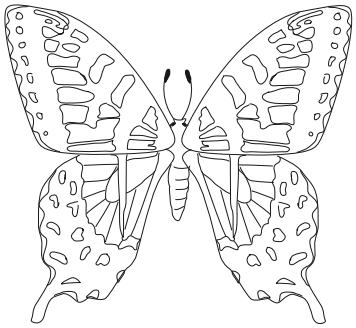

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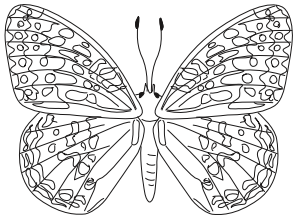

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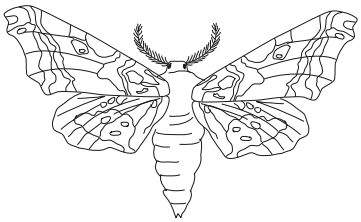

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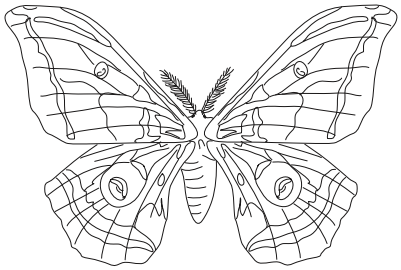

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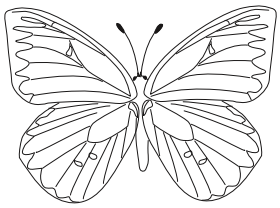

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Butterfly vs. Moth: Antennae Activity

Lesson Five
Ages Primary

Objective: Students review the differences beween moth and butterfly anatomy

Materials:
Picture of butterfly and moth antennae (Figure 5)
Aluminium foil
Different colors of pipe cleaners
Clear tape
Markers and/or crayons
Scissors
Drawing paper

Suggested Approach:
Ask your class if they remember where the antennae are located on the butterfly or moth. Tell them that antennae are located on the head. Ask the students if they remember the difference between butterfly and moth antennae. Hold up the picture of butterfly and moth antennae (Figure 5). Butterfly antennae are long and thin with a little knob at the end. That is why they are called club-shaped antennae. Moth antennae are usually thick and feathery. Smell is especially important to moths because they fly at night and need some extra help to find food and mates. The extra hairs on moth antennae provide a greater surface area on which to pick up scents.

Tell the class that they are going to make their own antennae.

Making the Antennae:

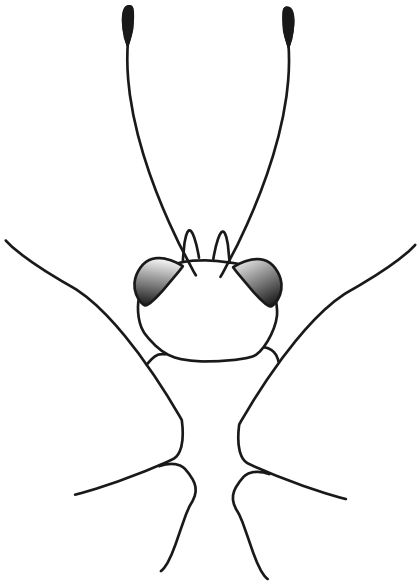
1. Pass out drawing paper, marker and/or crayons, scissors, pipe cleaners, tape and two long (3”x12”) pieces of aluminum foil to each child.

2. Roll and twist the long pieces of aluminum into a headband.
3. Let the children decide whether they want to make butterfly or moth antennae.

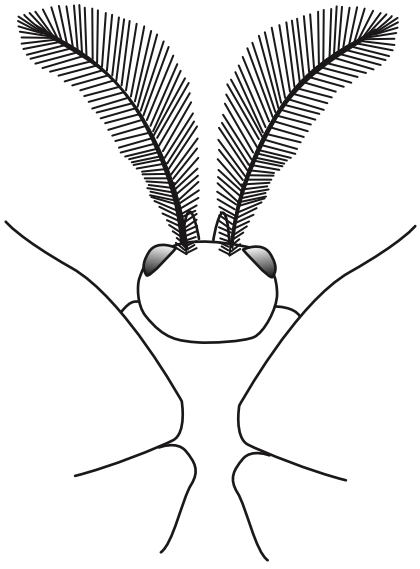
For the Butterfly
4a. Cut a teardrop shape out of the drawing paper. This will be the knob on the end of the antennae.
4b. Color both sides of the paper.
4c. Tape one end of a pipe cleaner to the pointed end of the tear-drop cutout.

For the Moth
4d. Have the children cut two peices of paper in the shape of an eye that are just a bit longer than half the length of the pipe cleaner.
4e. Have them color both sides of the paper.
4f. Tape a pipe cleaner lenthwise down the middle of the paper.

For Both
5. Wrap the bare end of the pipe cleaner around the aluminum headband and wear!



Butterfly



Moth

Activity Extension

Materials: (enough for each child)

- 1 copy of the left front wing on thick/stiff paper (Figure 6.3)
- 1 copy of the left rear wing on thick/stiff paper (Figure 6.4)
- 1 copy of the right front wing on thick/stiff paper (Figure 6.5)
- 1 copy of the right rear wing on thick/stiff paper (Figure 6.6)
- Crayons and/or markers
- Scissors
- Glue
- Tape
- 3 18" pieces of string
- 1 copy of the butterfly body (figure 6.1) or 1 copy of the moth body (figure 6.2) on thick/stiff paper

Suggested Approach:
Ask your class if they remember two other differences between butterflies and moths. Write the differences on the board. Most butterflies have very brightly colored wings while most moths have dull, earthy colored wings. Most butterflies have long, narrow, and smooth bodies while most moths have short, fat, and furry looking bodies.

Making the Wings and Body:

1. Give each child two copies of the forewing page, two copies of the hindwing page, crayons and/or markers, scissors, glue, tape, three 18" pieces of string, and one copy of either the moth body or the butterfly body to match the antennae they made in Lesson Five.

2. Post Figure 5 prominently in the classroom or draw the images on the board so that the children can see the butterfly and moth antennae.

3. Have the children cut out the images along the solid black line. Make sure they do not cut the dashed line. As they do this have them put their forewings in one pile and their hindwings in another pile.

4. Tell the children the side with the letters and the dashed line will be the underside of their butterfly's or moth's wings. Keeping that in mind, have the children color both sides of each image. Remind the children that both butterflies and moths have symmetrical wings.

Butterfly Traits:

Symmetrical patterns and colors on the wings
Bright colors like yellow, red, blue, etc…

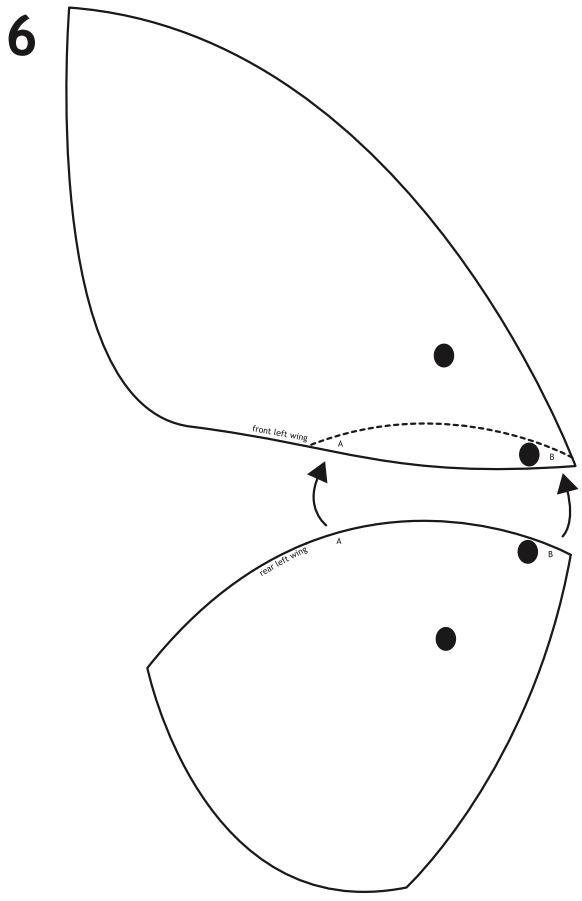
Moth Traits:

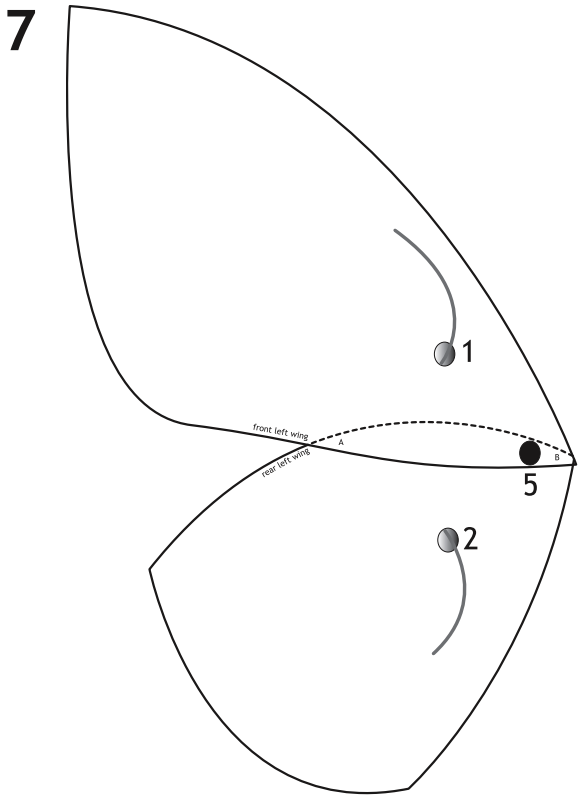
Symmetrical patterns and colors on the wings
Earth-tone colors like brown, pale green, pale orange, pale yellow, etc…
Fuzzy looking abdomen

5. Poke a hole through all circles on the images.

6. Match up the letters A and B on the left forewing and hindwing and glue. The edge of the hindwing should line up with the dashed line on the forewing. Do the same for the right forewing and hindwing.

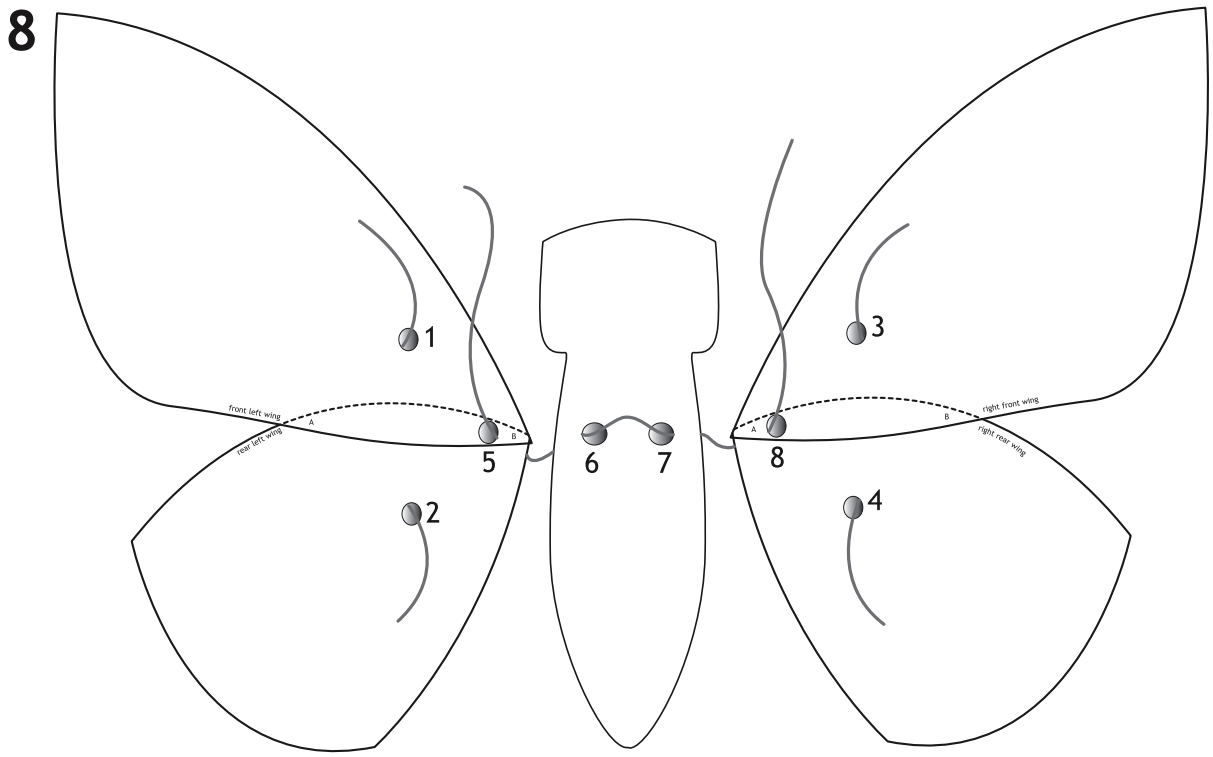
7. Take one piece of string and run it through holes 1 and 2 on the left wing set. Take another piece of string and run it through holes 3 and 4 on the right wing set. Do not tie the strings but wait to be sure they fit the child.



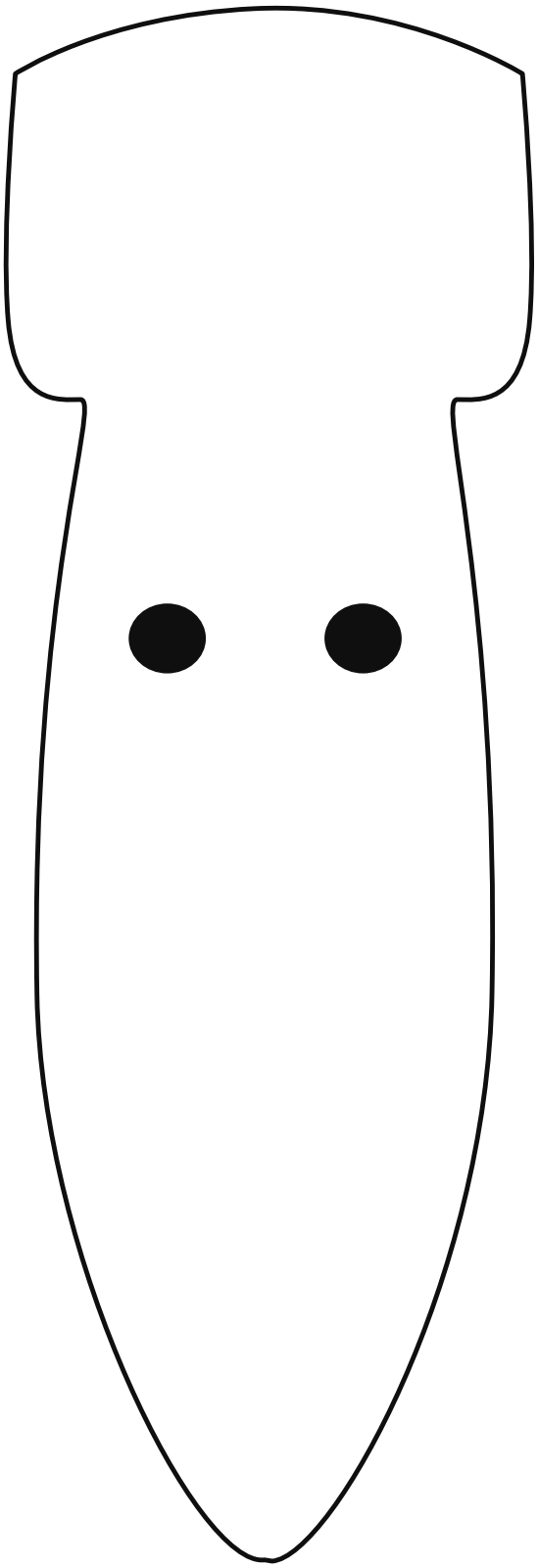


8. Run the last string through holes 5, 6, 7, and 8 as shown below. This will connect the left wing set, the body, and the right wing set. Tie the string so it will not slip out of the holes.

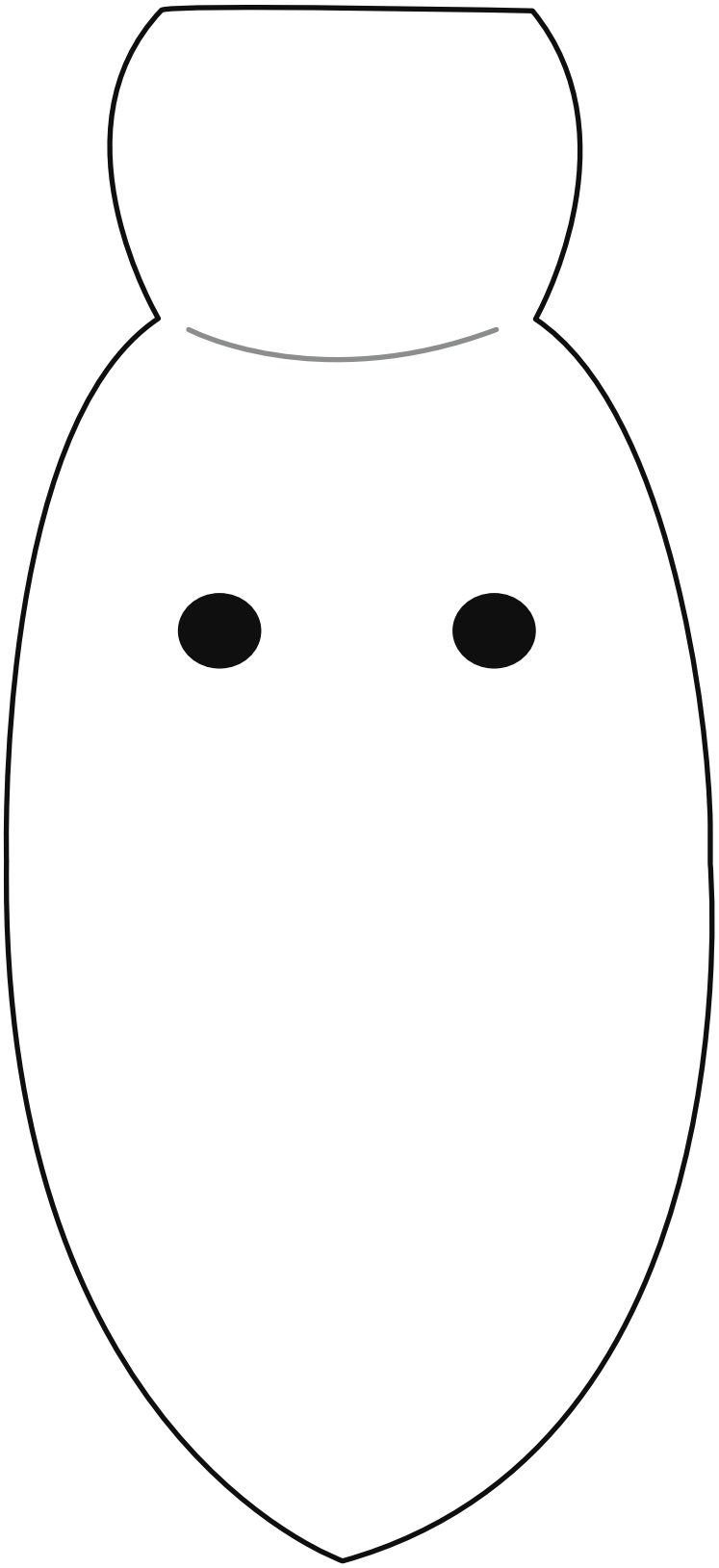
Wearing the wings:
The wings will be worn like a backpack with the child's arm slipped through front side of the strings in each wing set. Once you slip the child's arm through the loop, tie the ends of the strings (holes 1 and 2, and holes 3 and 4) in a knot or bow.

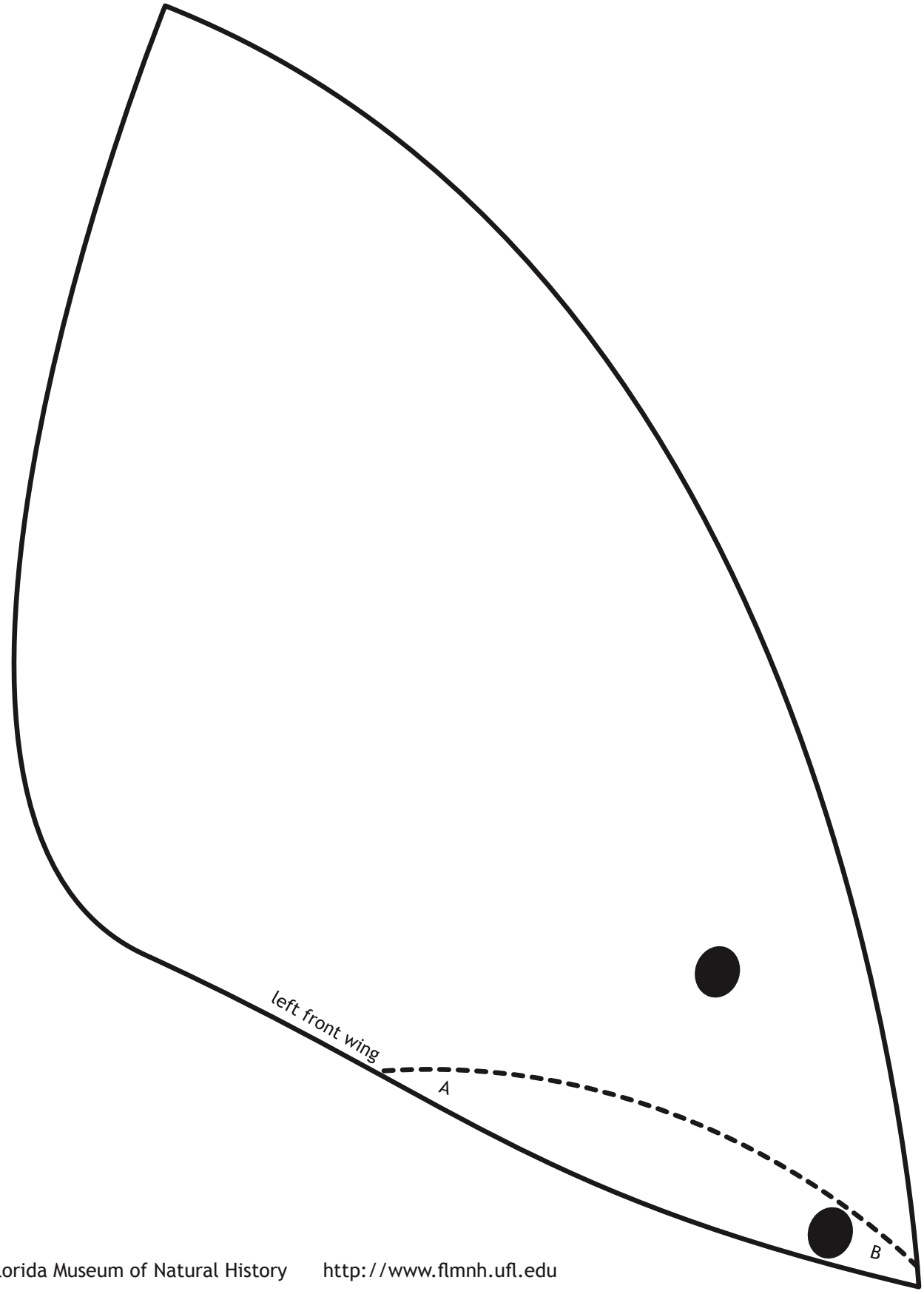


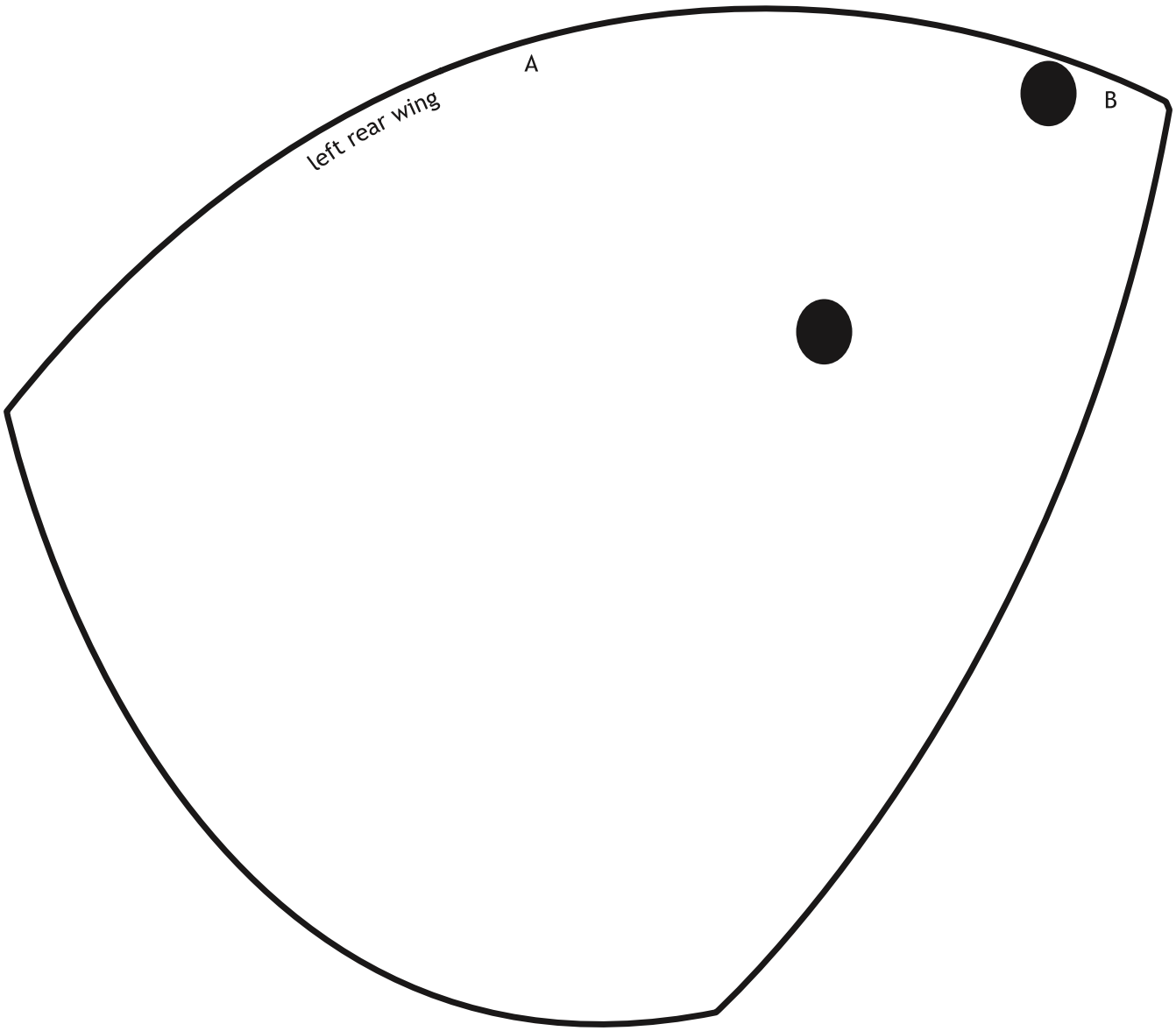
butterfly body

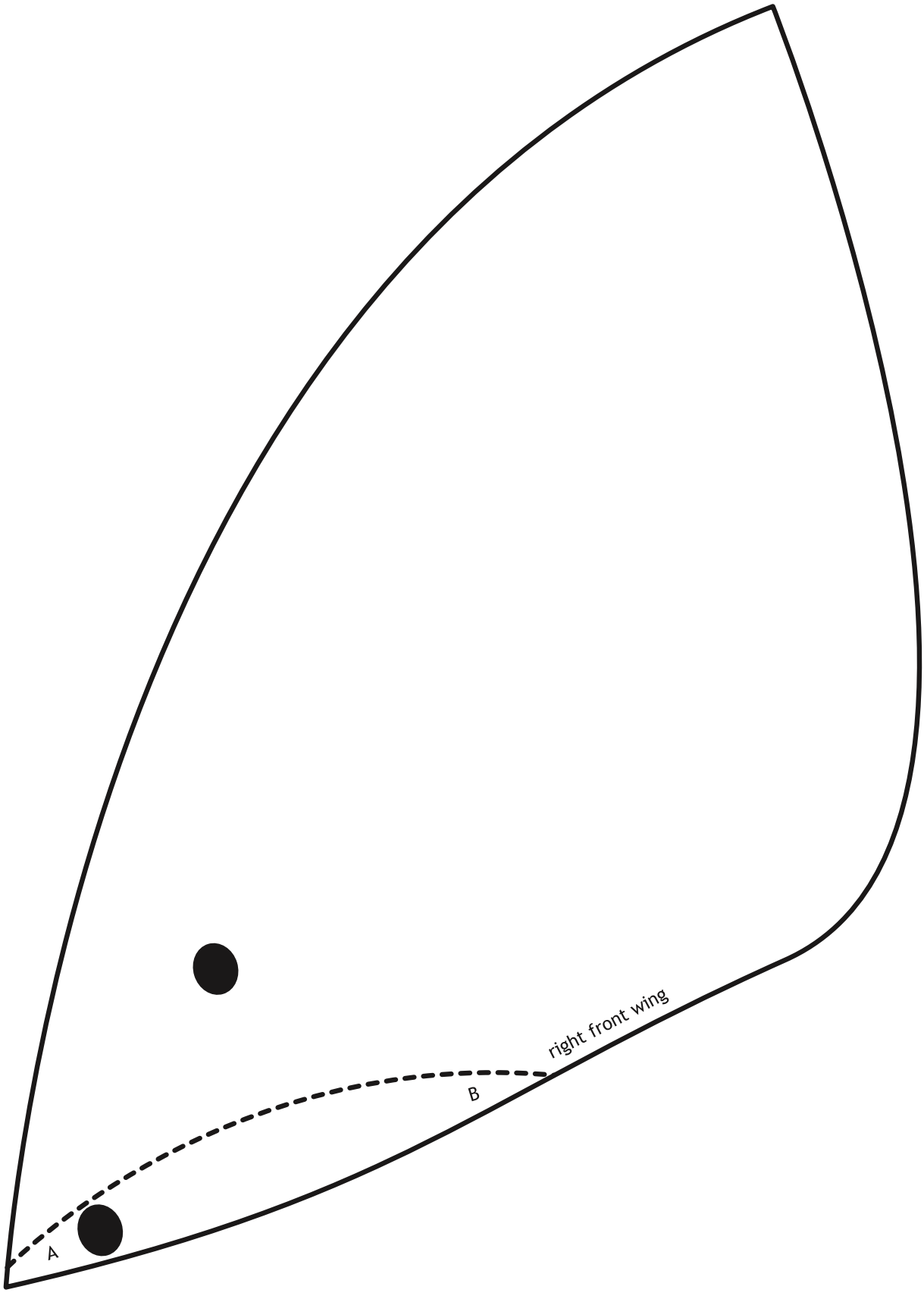


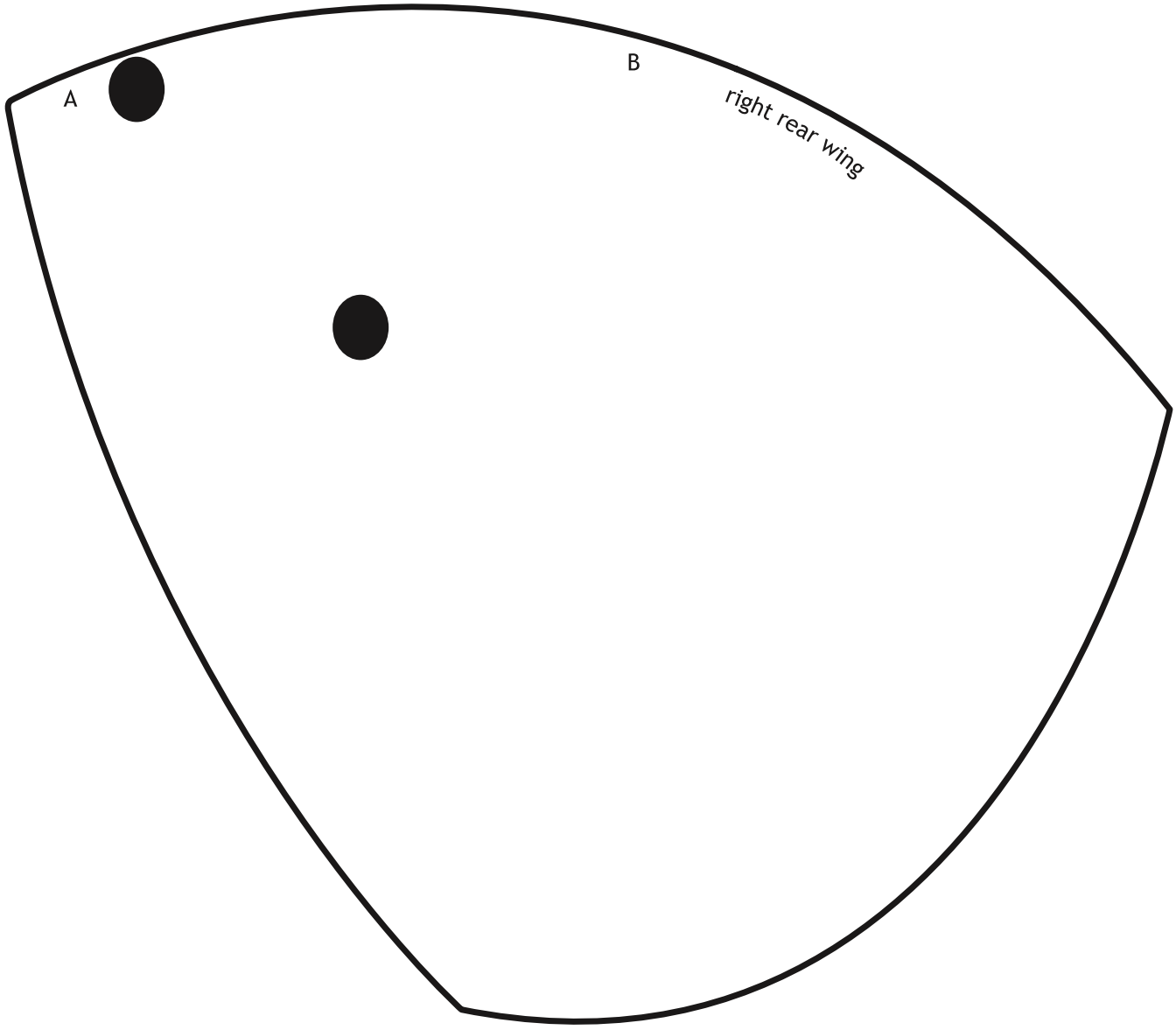
moth body




left front wing
A
B


left rear wing
A
B


right front wing
B
A

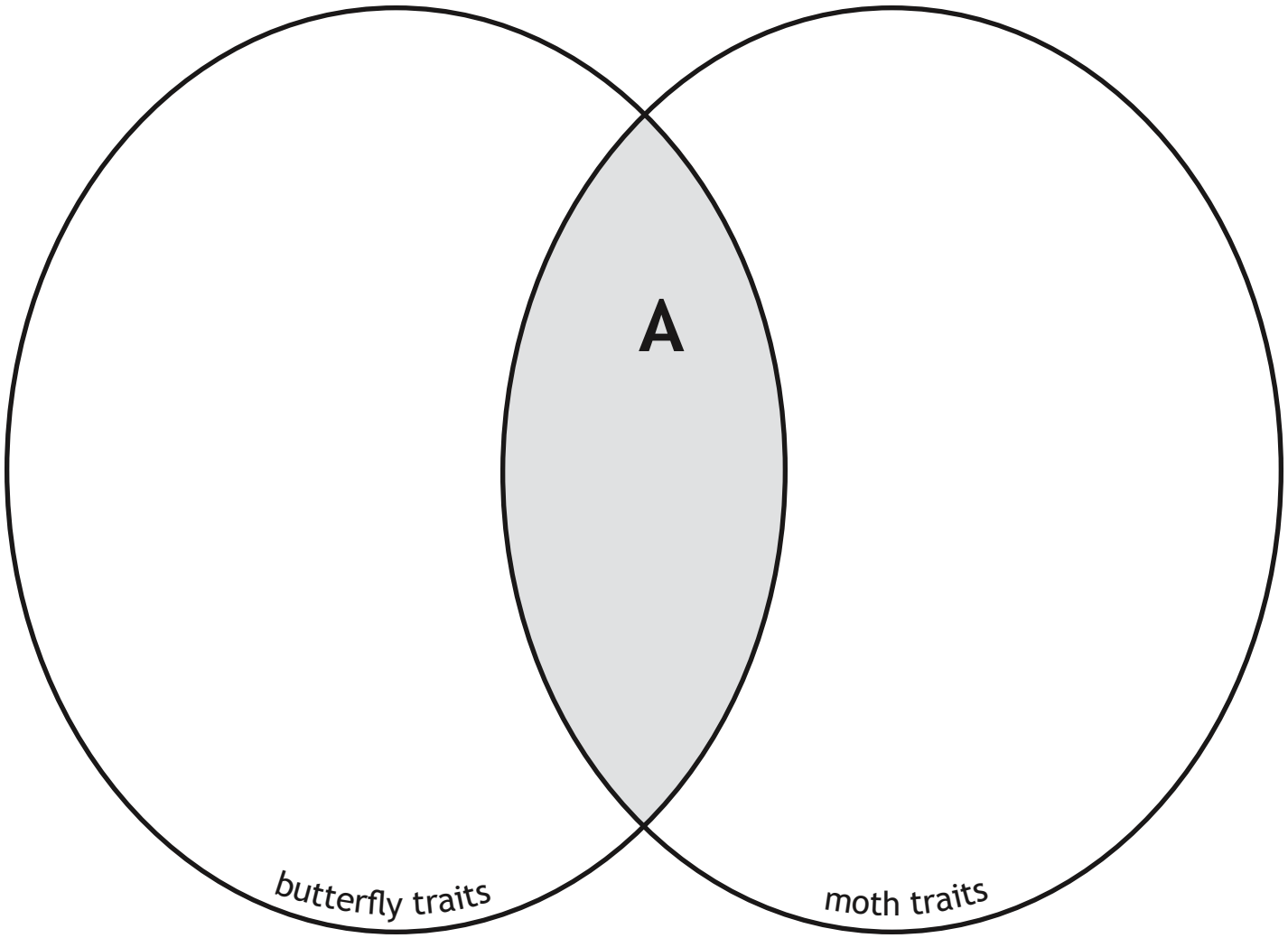

A
B
right rear wing

Butterfly vs. Moth Review

Listed below are some traits of butterflies and some traits of moths. Write the letter corresponding to butterfly traits in the left circle, and write the letter corresponding to moth traits in the right circle. Write the letter of traits they share in the shaded area. The first one has been done for you.

A. six legs
B. compound eyes
C. head, thorax, abdomen
D. two pairs of wings
E. hatches from an egg
F. two antennae
G. usually active at night
H. usually active during the day
I. usually brightly colored
J. usually colored in earth-tones

K. body is thick and looks hairy
J. body is thin and doesn't look hairy
K. makes a cocoon
M. makes a chrysalis
N. mouth is a proboscis
O. is an insect
P. antennae are often thick and feathery
Q. antennae are club-shaped at the end
U. undergoes complete metamorphosis



Life Cycle: Introduction

Lesson Seven
Ages Primary

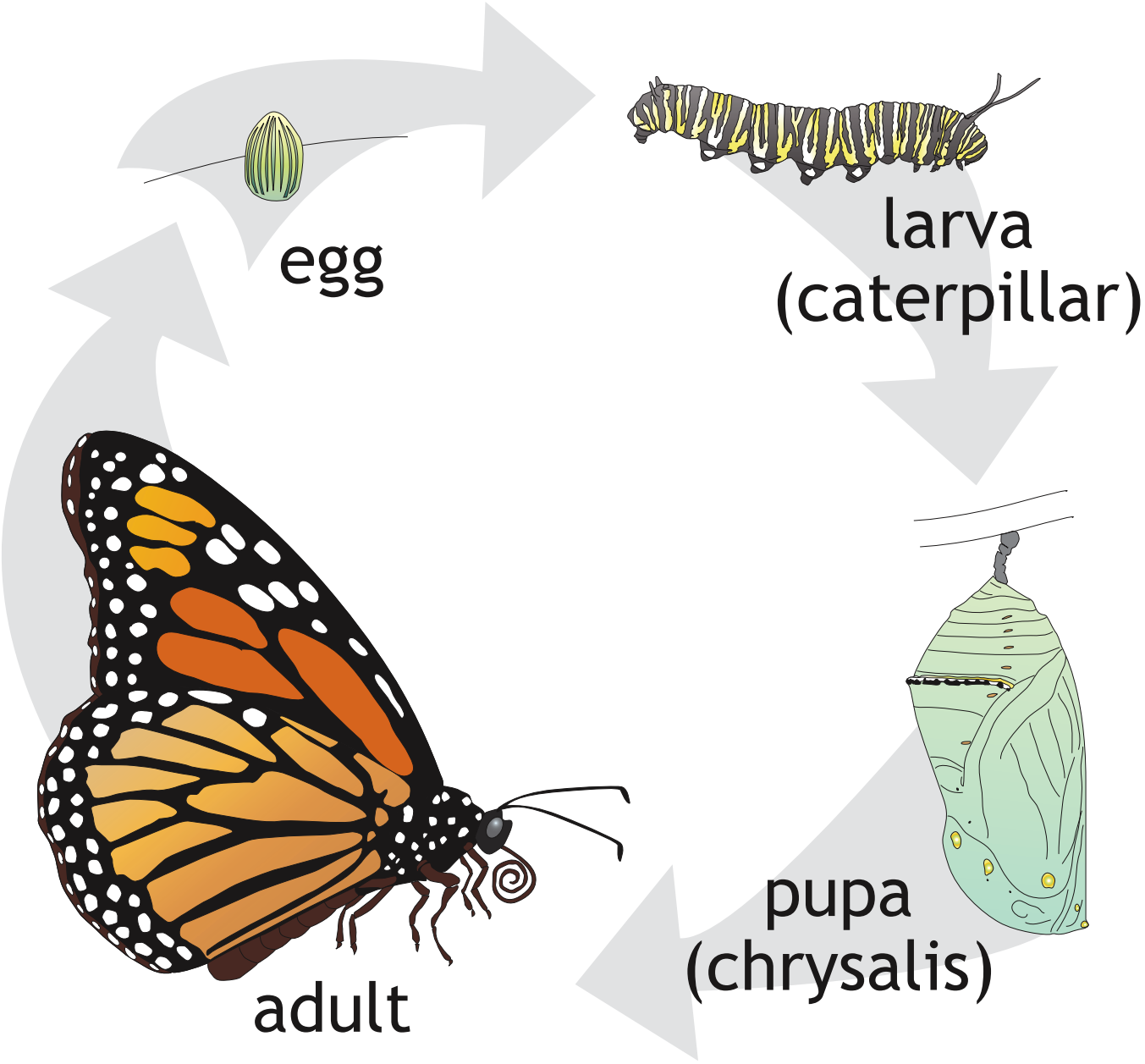
Objective: Students learn the life cycle of a butterfly and a moth.

Materials: Butterfly Life Cycle Figure (Figure 7)

Suggested Approach:
Ask your class "How do butterflies and moths grow? Do they start out as little babies like us or from eggs like snakes, frogs, turtles, and birds?" Using the Figure 7, explain that because butterflies and moths are insects they start as an egg (point to the figure). "When the egg hatches the butterfly or moth is called a larva or caterpillar (point to the figure). Caterpillars spend most of their time feeding on plants and grow very quickly. A caterpillar grows into a pupa (point to the figure). A butterfly pupa is called a chrysalis and a moth pupa is inside a cocoon during this stage of its life." Point to the figure and tell the class that this is a picture of a chrysalis. "What do you think happens to the pupa inside a chrysalis or cocoon? The pupa is turning into a butterfly or a moth. This process of change or transformation from caterpillar to butterfly or moth is called metamorphosis." Have your students repeat the word "metamorphosis."

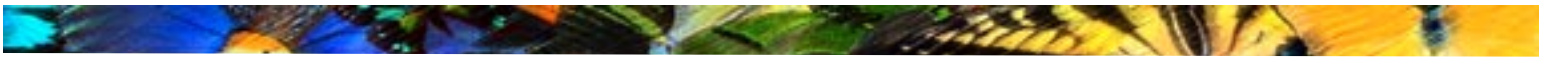
Review the life cycle with hand motions. "What is the first stage in a butterfly's metamorphosis? An egg" (hand clutched tight in a fist). "What is the second stage of a butterfly's metamorphosis? A caterpillar" (index finger extended, scrunched, extended, scrunched). "What is the third stage of a butterfly's metamorphosis? A chrysalis" (index finger wrapped by other hand-like a hotdog). "What is the last stage of a butterfly's metamorphosis? A butterfly" (thumbs interlocked, fingers wiggling and making a flying motion).

Butterfly life cycle



Life Cycle: Metamorphosis Mobile

Lesson Eight
Ages Primary



Objective: Students learn the life cycle of a butterfly.

Materials:

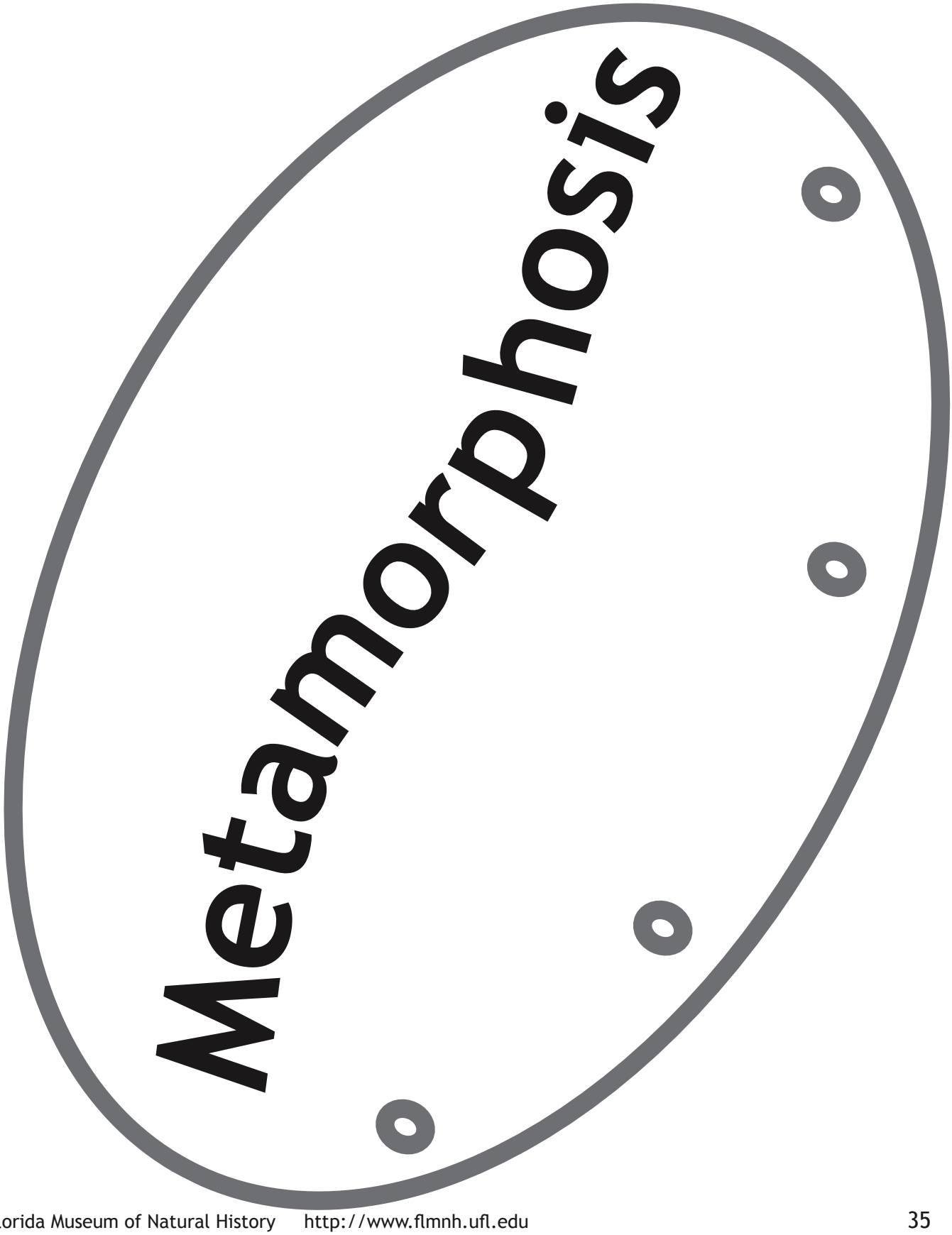
- Tape
- Scissors
- 5 pieces of string, each about 12 inches long
- Crayons or markers
- Enough copies of the Metamorphosis Mobile page for each student (Figures 8.1-8.4)

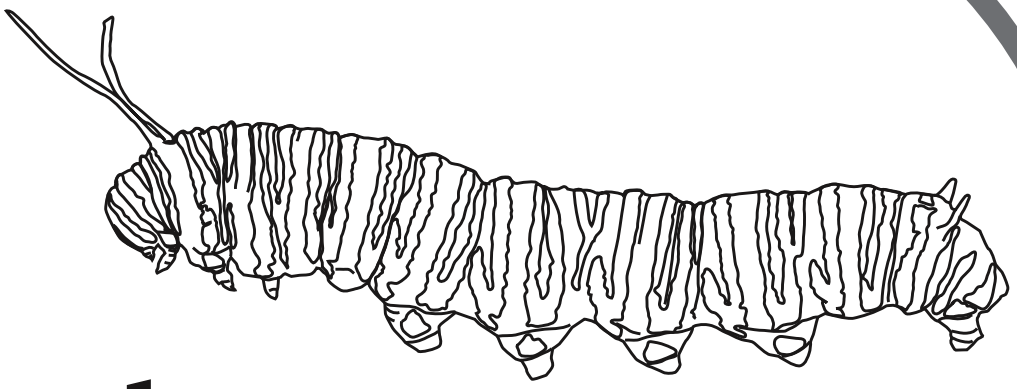
Suggested Approach:
Review the 4 life-cycle stages for all butterflies and moths. What is the first stage? Egg. What is the second stage? Caterpillar. What do caterpillars spend their time doing? Eating plants. What is the third stage for a butterfly? Chrysalis. What is the third stage for a moth? Cocoon. What goes on during the their final stage? The caterpillar changes into a winged adult; a butterfly or a moth. What is the last stage? A butterfly or a moth. What is this kind of life cycle called? This life cycle is called complete metamorphosis.

Metamorphosis Mobile Activity:

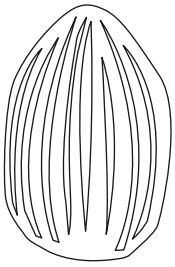
1. Print the images on heavy card stock. Then cut out and color the pictures and text.
2. Tape one string to the top at the back of Figure 8.1. This is the string that the mobile will hang from.
3. Tape one of each of the remaining four strings to the circles at the bottom of Figure 8.1.
4. At the bottom of each of those strings tape the life cycle pictures (Figures 8.2, 8.3, and 8.4).

Hang your mobile and enjoy it!

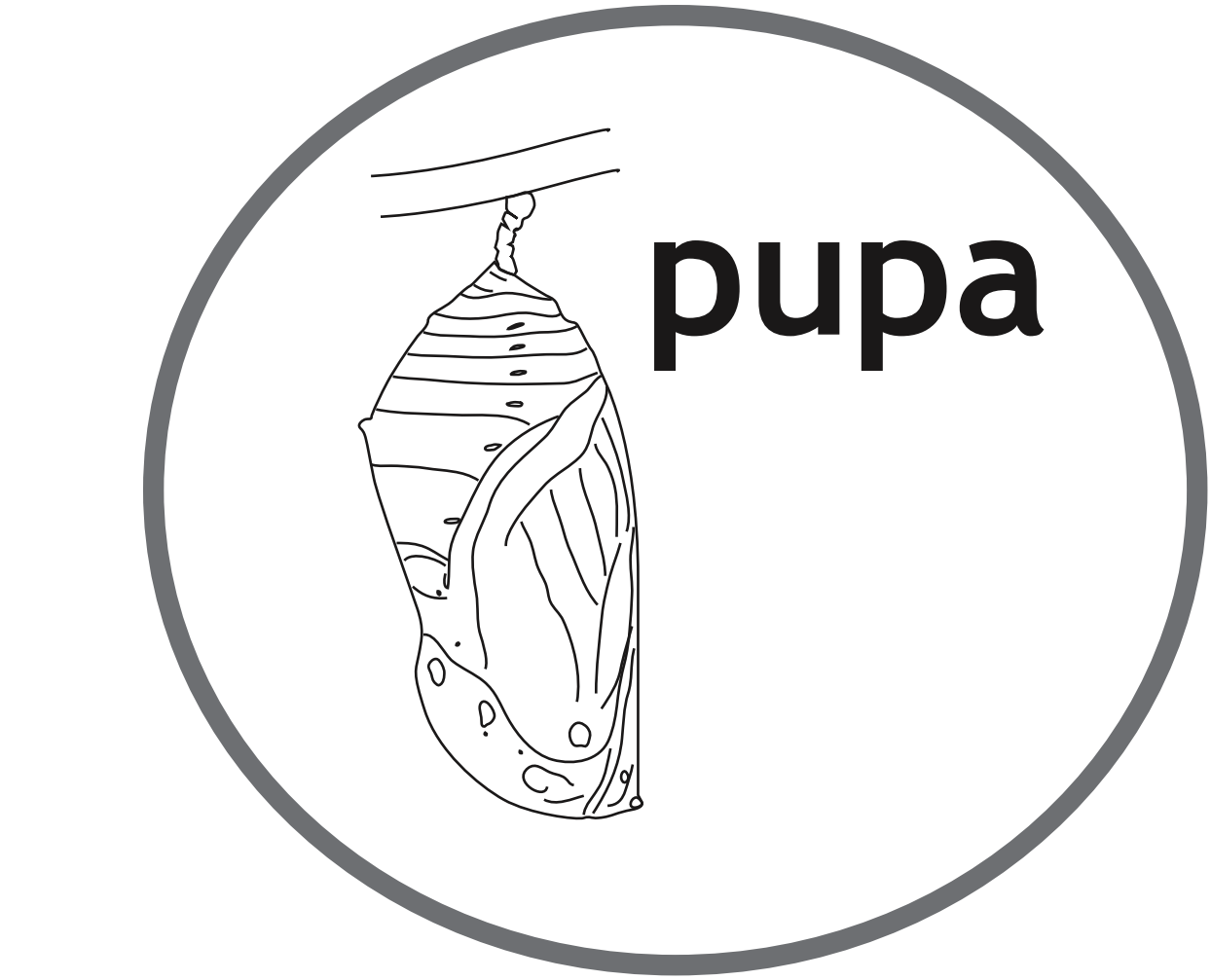

Metamorphosis

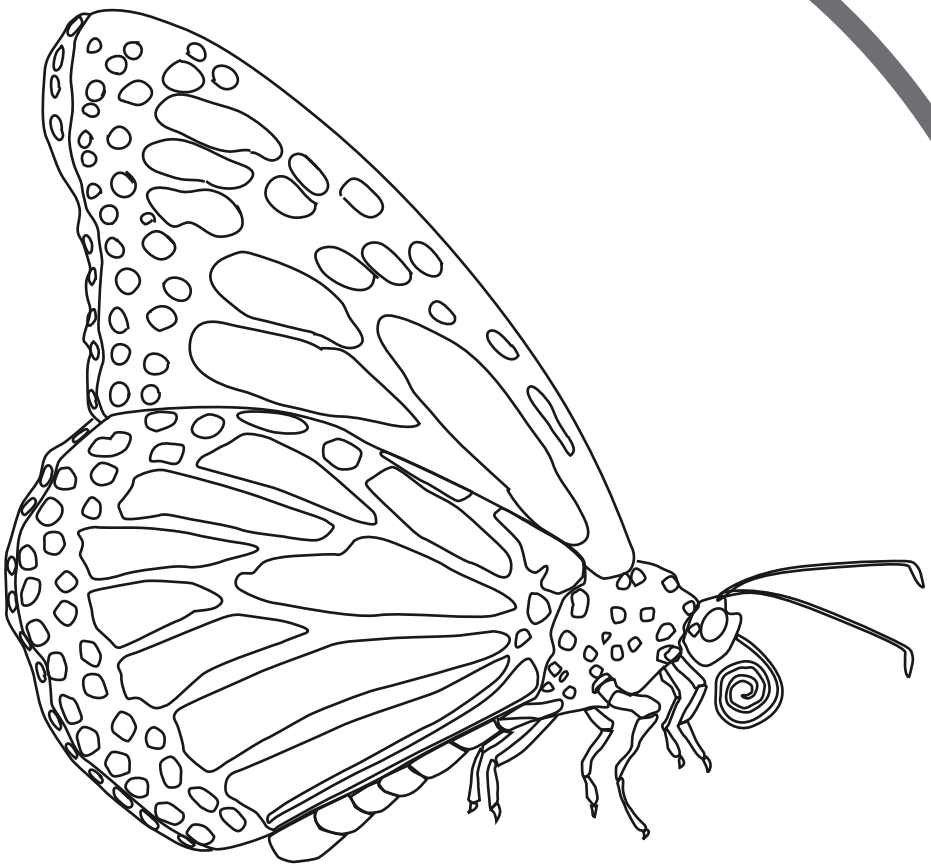


larva



egg


pupa



adult

Life Cycle: Metamorphosis Diagram

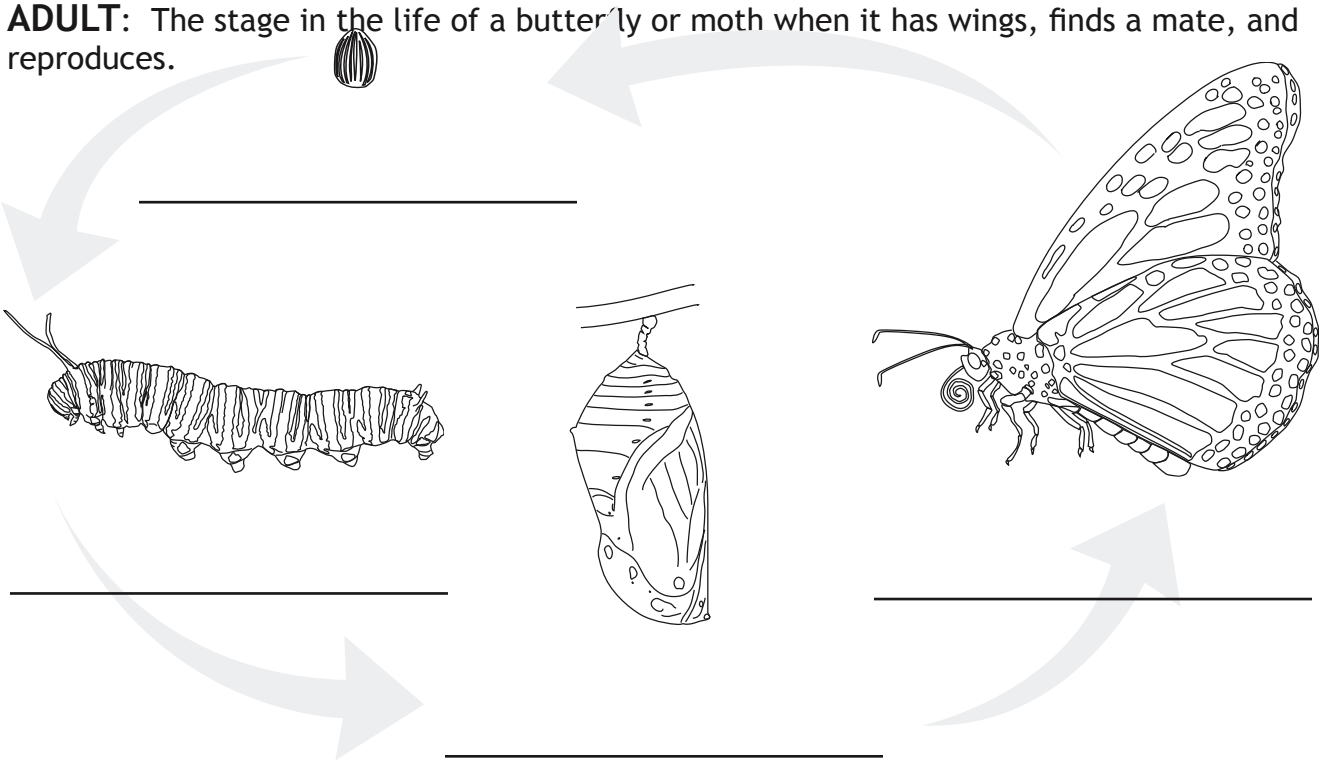
Objective: Follow-up activity on the life cycle of a butterfly

Butterflies, beetles, and ants undergo complete metamorphosis. Insects that undergo complete metamorphosis have a stage in their lives when they transform from larva to adult. This transformation stage is called the pupal stage. Many other insects (grasshoppers and true bugs) undergo incomplete metamorphosis. Insects that undergo incomplete metamorphosis look like a tiny adult when they hatch and grow bigger and bigger through their lives. Those insects do not have a pupal stage.

Butterfly and moth larvae (caterpillars) hatch from an egg. The larva eats, grows, and sheds its exoskeleton (molting) as it increases in size. The larva then begins the stage of life called a pupa. The larva (caterpillar) turns into a chrysalis if it is a butterfly or weaves a cocoon if it is a moth. The pupa then changes into an adult. It grows wings, different legs, a different mouth, antennae, and different eyes. When the adult emerges from this stage it searches for a mate. The adult butterflies and mothsof most species only live a few weeks. Female butterflies and moths lay eggs only on plants that will be the correct food for the larvae when they hatch.

Label the images below as either egg, larva, pupa, or adult.

EGG: The first stage in the life of a butterfly or moth. An egg hatches into a larva.
LARVA: An immature butterfly or moth. The larva is also often called a caterpillar.
PUPA: The stage in the life of a butterfly or moth when it changes from a larva to an adult.
ADULT: The stage in the life of a butterfly or moth when it has wings, finds a mate, and reproduces.



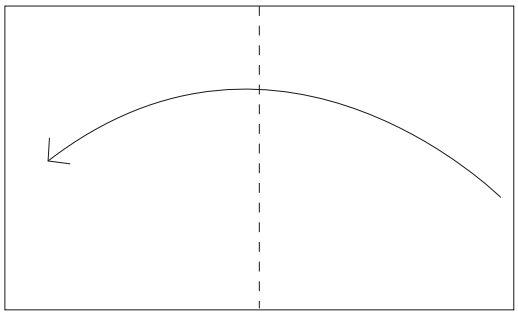
Life Cycle: Metamorphosis Activity

Lesson Nine
Ages: Primary and Intermediate

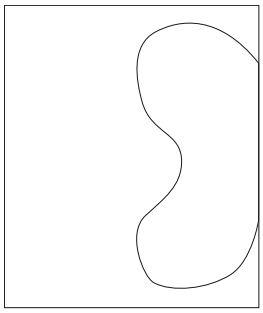
Objective: Students create and understand a butterfly life cycle.

Materials:
Drawing paper
Scissors
Crayons and/or markers

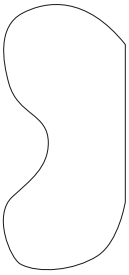
Suggested Approach:
Pass out the materials to each child and explain the following instructions:



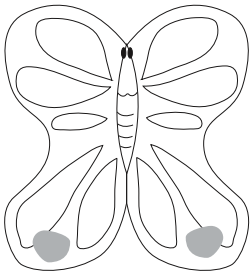
1. Fold a piece of drawing paper in half.



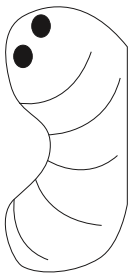
2. Draw a kidney bean shaped figure along the folded edge.



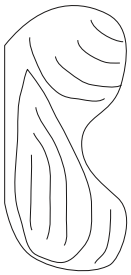
3. Cut out the figure.



4. Unfold the figure, draw, and color a butterfly on one side of the paper.



5. Fold the paper in half again with the blank sides facing out. Draw and color a caterpillar on one side.



6. Flip the folded paper over to the other blank side. Draw and color a pupa on this side.

Food and Finding It

Lesson Ten
Ages Primary

Objective: Students learn how and what butterflies and moths eat.

Materials (for each child):

Straw	Scissors
2 pieces of drawing paper	Tape
Crayons and/or markers	

Suggested Approach:

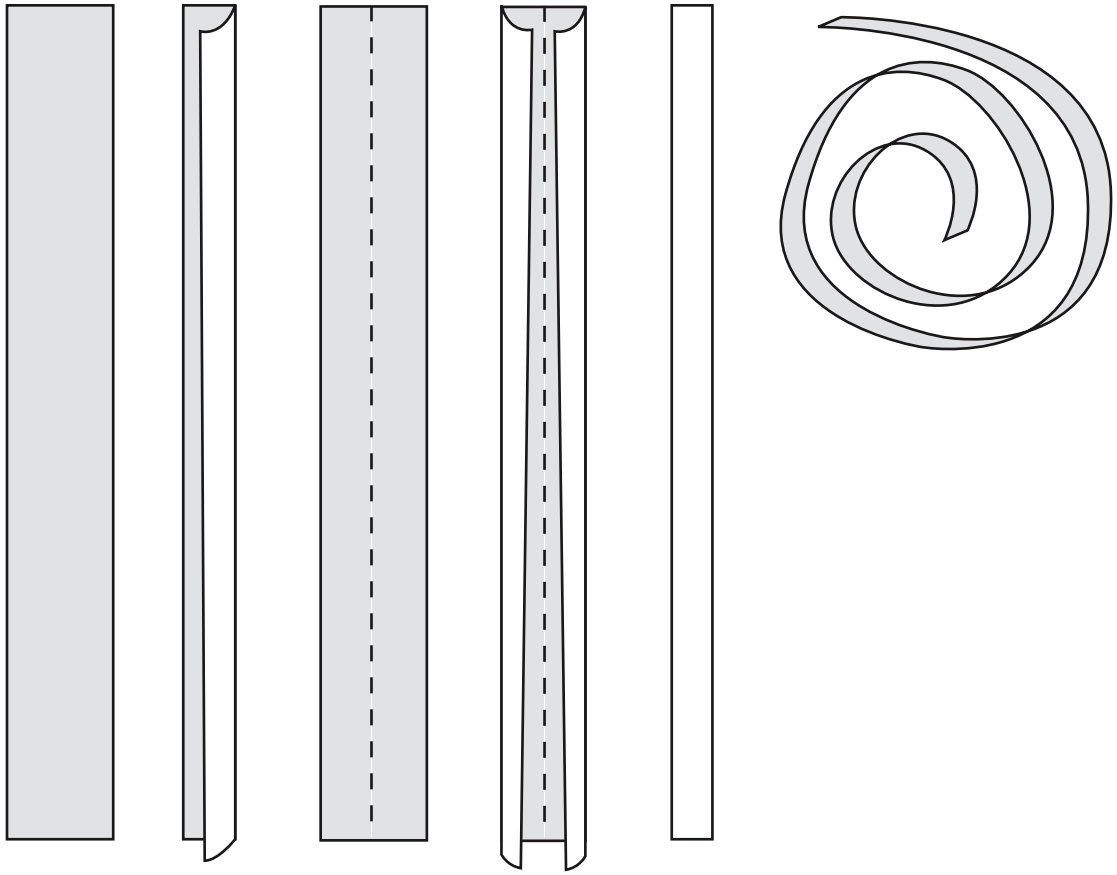
Before going to the butterfly exhibit tell your students that they have to find out how and what butterflies and moths eat. They can do this by observing the butterflies, looking for the information on an interpretive panel, or by asking one of the people working in the exhibit.

After your museum visit, ask your class what they found. Butterflies and moths feed on a wide variety of foods for energy and reproduction. They primarily feed on flower nectar but they also feed on sap and rotten fruit. All butterflies drink water, but male butterflies also drink liquids to obtain minerals that are important for reproduction.
If one male finds a good mineral-rich wet spot to drink, others of the same species follow his example. This is known as "puddling." Females don't puddle but they do drink water to stay hydrated.

Butterflies and moths drink their liquid food through a proboscis. The proboscis is a long straw-like tube that unrolls from the head when the butterfly needs to take either food or water for its liquid diet.

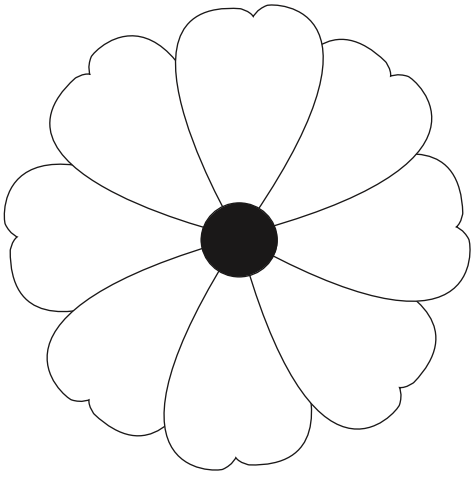
Making a proboscis (see illustration on next page):

1. Cut a 2-inch paper strip.
2. Color both sides.
3. Fold your paper in half lengthwise.
4. Fold the right side in and line it up at the centerfold.
5. Fold the left side of the paper in and line it up with the far right crease, under the paper flap.
6. Fold the right side of the paper down over the left side and crease.
7. Tape the folded right side down to form a flat tube.
8. Roll the paper from the bottom to the top.
9. Place your mouth on the unrolled side and blow. Now you have a proboscis.



Eating Like a Butterfly:

1) Draw a flower on the other piece of paper, similar to the illustration below.
2) Color and cut it out.
3) Poke a straw through the center of your flower.
4) Drink some juice or water through the straw. Now you are eating like a butterfly!



Mating: Following a Scent Trail

Lesson Eleven
Ages Primary and Intermediate

Objective: Students understand how butterflies and moths use pheromones and other senses to find and recognize each other.

Materials:
Cotton balls
5 blindfolds
Some kind of essential oil (mint, orange, sage, etc.)

Suggested Approach:
Ask your students: "How do you think butterflies and moths find mates? Keep in mind that butterflies are active during the day and moths are active during the night." Listen to their responses. Ask them to tell you the main differences between butterflies and moths. We learned that butterflies have club-shaped antennae, are often brightly colored, and active during the day. We also learned that moths have feathery antennae, are often duller in color, and active at night. Many butterflies rely on bright display colors for mating rituals and courtship. Ask your class what body part butterflies and moths use to smell. Ask them how they think moths that fly at night and butterflies that live in dimly lit forests find mates. It is too dark to see colors well so how do you think they find each other? Female moths and some species of butterflies produce large amounts of pheromones, a kind of chemical perfume. Males use their antennae to detect the pheromones of potential mates from great distances. Ask your class if they think it would be hard to find something or someone using only smell. Tell the class that they are going to see if they can follow a "pheromone" trail as well as a moth.

Scent trail activity:
1. Clear a large space in the classroom.
2. Break the class into groups of five.
3. Have the first group form a line at one edge of the clearing.
4. Place a blindfold on each of the children.
5. Tell them that you are going to put down a trail of scented cotton balls and that they will have to follow the scent to the end of the trail.
6. Place the cotton balls down about a foot or two apart in a winding trail to the other side of the room. Make sure to spray each cotton ball with the scented spray.
7. Tell the group of five that they will go one at a time and when they think that they have reached the end of the trail they can take off their blindfold.
8. Begin the game.
9. When the first group of five is done place blindfolds on the second group of five.
10. While the next group is blindfolded rearrange the trail so that the next group will not know what it looks like.
11. Repeat steps 6-10 until all the children have had a turn.

Note: Someone should be available to help guide the child and to make sure they don't run into anything while they are blindfolded.

Mating: Locating a Host Plant

Lesson Twelve
Ages Primary and Intermediate

Objective: Students learn observation skills and demonstrate what features butterflies use (color, odor, taste and appearance) to find a host plant (a larval food plant is called a host plant).

Materials:
6 jams of the same color- These 6 can have different textures as long as they are all the same color or roughly so. Some can even be the same flavor as long as the texture is different and the colors are the same.

2 small paper plates for each child
1 index card for each child
Lots of paper towels

Suggested Approach:

Preparation
1. Set out two small paper plates and an index card for every child in the class.
2. Assign a number to each of the six jams.
3. Write the numbers for each of the six jams on one of the child's plates.
4. Place a small amount of each jam next to its number on the plate.
5. Write the name of one of the jams on the second plate and place a small amount of that jam on it.

In Class
6. Explain that once a butterfly has mated the female will carefully search for the correct food plant for her eggs and future larvae. Butterflies are very picky about where they lay their eggs because each species of butterfly caterpillar is adapted to eat only specific kinds of plants. These plants are called "host plants." The female butterfly instinctively recognizes the leaf shape, color, odor, taste, texture, and appearance of her species' host plant.
7. Write the ways a butterfly recognizes a host plant on the board.
8. Tell the class that the labeled jam on their plate is their "host" jam. Tell them to pretend that they are butterflies and that their baby caterpillars will only be able to eat that jam. Students should find their "host" jam on the second paper plate.
9. Tell them to first observe their "host" jam and to list the observations on their index card.
10. Encourage students to use their senses to determine which mystery jam is their "host" jam.
11. When they think they have figured out which of the 6 mystery jams is their "host" jam they should write down the number of that jam on their index card.
12. When everyone has had enough time to find their "host" jam read out the number and its corresponding jam.

13. For each of the 6 "host" jams go around the room and ask what senses the kids used to determine their host jam and what their observations were about their jam.
14. Explain that this is what a butterfly must go through when trying to find its host plant.

Fun Fact: The criterion for selecting a mate is different from one species to another. Some species of butterflies and moths will perform ritual dances in the air or on leaves. A female may judge a male's strength and vigor by how well he follows her complicated aerial dance.

Predator Avoidance: Camouflage

Lesson Thirteen
Ages Primary and Intermediate

Objective: Students will understand how camouflage works.

Materials:
Tape
Crayons and/or Markers
Scissors
Drawing paper

Suggested Approach:

1. Review camouflage briefly with the class.

Some animals (for example, birds, bats, spiders, dragonflies, and mice) rely heavily on Lepidoptera for food. Butterflies and moths have evolved several strategies to keep from being eaten. These include:

Warning coloration- a bold pattern and bright contrasting colors. Bright warning coloration, especially yellow-and-black, orange, or red, warn birds and other predators that such insects may bite, sting, or taste bad.

Camouflage- Moths and many butterflies, particularly females, have earth-tone colors or patterns that resemble tree bark, lichens, or leaves. This "cryptic coloration" allows them to avoid predators by blending into their surroundings.

Mimicry- Some butterflies and moths deter predators by mimicking the color pattern of other less edible species or other insects, plants, and animals.

Two types of mimicry:

1) Batesian Mimicry
Some harmless Lepidoptera species mimic the appearance of other species that are poisonous or distasteful. They "pretend" to be poisonous and predators avoid them.

2) Mullerian Mimicry
Sometimes two species look alike and both are poisonous or distasteful. When a predator attacks one of the two, it remembers the color pattern and is unlikely to attack either, avoiding insects with that color pattern.

Defense patterns- Alarm Patterns: Eyespots on wings intimidate predators, especially small birds, who think they see the eye of a larger bird that might harm them.

Predator Avoidance: Camouflage

Lesson Thirteen
Ages Primary and Intermediate

1. Tell the class that they are going to play a camouflage game.

2. Pass out a couple of pieces of drawing paper, scissors, and some crayons and/or markers to each child.

3. Ask each child to make a butterfly that would be camouflaged in some part of the classroom.

4. Have them color their butterflies and cut them out.

5. When everyone is finished with their butterfly break the class into groups of 5-8.

6. While the rest of the class has their eyes closed put a folded piece of tape on the back of the first group's butterflies. Have the children hide their butterflies around the room in places where their butterflies would be difficult to see.

7. When the first group is done have the rest of the class get up and try to find the camouflaged butterflies.

8. When all of them have been found, let the next group hide their butterflies.

9. Continue this process until all the children have had a chance to hide their butterflies.

Additional Resources

BUTTERFLY BOOKLIST - Adult

The Audubon Society Handbook for Butterfly Watchers
Pyle, Robert Michael
This rare combination of scientific observation merged with poetic appreciation hearkens back to the writings of William Bartram.

Butterflies [video recording]
As you get to know these wonderful insects you will be continually amazed by their beauty and their incredible lives; a video especially designed for families, students and teachers.

Butterflies and Moths
Carter, David J.
Carter who is an entomologist at the Natural History Museum, London, has created a concise and comprehensive pocket guide to butterflies and moths of the world.

Butterflies of North America
Brock, James P.
From its durable, flexible cover to its color-coordinated index, this field guide will serve as an excellent identification resource for experienced and novice lepidopterists.

Butterflies of North America
Howe, William H.
With 97 color plates and 633 pages, this massive volume includes descriptions of North American, Alaskan and Hawaiian butterflies.

The Butterflies of North America: a Natural History and Field Guide [interactive multimedia software]
Scott, James A.
A comprehensive field guide to all the butterfly species of North America, including field maps, full-color pictures, and discussion of anatomy and behavior.

Butterflies of the World
Sbordoni, Valerio
With its concise text, more than 200 illustrations and 125 color plates this is the most comprehensive volume on the subject.

Butterfly Gardening for the South
Ajilvsgi, Geyata
With more than 200 breathtaking color photographs as well as landscape plans, detailed butterfly description, comprehensive seed and plant sources, and a special section on how to photograph butterflies.

Butterfly World [video recording]
Dominque, Charles
Filmed all over the planet, this exceptional video presents some of the most varied and exotic butterflies that nature has to offer.

Additional Resources

Chasing Monarchs
Pyle, Robert Michael
The author, to discover the secret of monarch migration, set out to find individual butterflies at their northernmost habitat, follow them as far as possible, and repeated the process with other individual butterflies along the southward route.

The Encyclopedia of Butterflies
Feltwell, John
A comprehensive resource of more than 1,000 of the world's most common butterflies, all of which are covered in detail; including taxonomy, structure, life cycle, and migration.

A Field Guide to Eastern Butterflies.
Opler, Paul
This guide features 524 species of butterflies, 100 color photographs, 348 color range maps accompany the species descriptions. Introductory chapters include information on butterfly gardening, habitats, and conservation.

Florida Butterflies
Gerberg, Eugene J.
Handy guide for the initiated naturalist who desires a complete record of Florida butterflies.

Florida Butterfly Gardening: a complete guide to attracting, identifying, and enjoying butterflies of the lower South
Minno, Marc C. and Maria
400+ color photos taken by the authors, showing every butterfly in adult, larva, and pupa stages, with practical information on garden plants, installation, and maintenance, as well as inquiry-based science activities and a Florida butterfly checklist.

Florida's Fabulous Butterflies
Emmel, Thomas C.
Award-winning photographer Brian Kenney contributes some of the finest photographs ever taken of Florida's butterflies, in this information-filled guide by UF Emeritus Professor Emmel.

Four Wings and a Prayer
Halpern, Sue
This lively, lyrical account of monarch life and migration will delight armchair and active naturalists and anyone interested in science.

Gardening for Florida's butterflies
Traas, Pamela F.
Entice butterflies to visit your Florida garden by growing the plants that feed them throughout their life stages.

Identifying Butterflies: the New Compact Study Guide and Identifier
Preston-Mafham, Ken
Over 100 species are explored in depth, from the butterflies seen in the backyard to more exotic and unusual varieties.

Additional Resources

Nabokov's Blues: the Scientific Odyssey of a Literary Genius
Johnson, Kurt
Nabokov gained world fame with Lolita and captivated sophisticated readers with his fiction writing, but he took equal pride in his studies of butterflies.

An Obsession with Butterflies: Our Long Love Affair with a Singular Insect
Russell, Sharman
An acclaimed nature writer takes a delightful look at the science of butterflies--and our obsession with them.

Seguy's Decorative Butterflies & Insects in Full Color
Séguy, E. A
This book reproduces, in full color, all 40 of the extraordinary plates from Papillons and Insectes by Seguy, one of the foremost French designers of decorative art during the first third of the twentieth century.

Your Florida Guide to Butterfly Gardening: a Guide for the Deep South
Daniels, Jaret C.
This book offers a thorough look a Florida's most important butterflies and the plants they prefer for food, shelter and egg laying.

Butterflies of the Florida Keys
Minno, Marc C. and Thomas C. Emmel
Scientific Publishers, 1993

Butterflies East of the Great Plains
Opler, Paul A. and George O. Krizek
John's Hopkins University Press, 1984

Butterflies of Florida: Field Guide
Daniels, Jaret C.
Adventure Publications, 2003

The Butterflies of West Virginia and Their Caterpillars
Allen. Thomas J.
University of Pittsburgh Press, 1997

Websites

The following web site offers lesson plans and has served as a signigicant reference for this guide:
Enchanted Learning
www.enchantedlearning.com/subjects/butterfly

Additional Resources

United States Geological Survey Learning Lab http://www.usgs.gov/education

Monarch Watch http://www.monarchwatch.org

Butterfly and Moth World http://members.aol.com/YESbutrfly/home.html

Discover Life http://www.discoverlife.org

Magical World of Butterflies
http://www.shuntington.k12.ny.us/curr_resources/butterflies/butterflysites.html

Entomology web sties about butterflies
http://www.isis.vt.edu/~fanjun/text/Link_specb04.html

Places to visit

Butterfly Rainforest
Florida Museum of Natural History
Powell Hall
Hull Road and 34 Street
Gainesville, Fl 32611
http://www.flmnh.ufl.edu

The Butterfly House
15193 Olive Blvd.
Chesterfield, MO 63017
(636) 530-0076
www.butterflyhouse.org

Butterfly Pavilion
6252 W 104 Avenue
Westminster, CO 80022
www.butterflies.org

Houston Museum of Natural History
Cockrell Butterfly Center
One Hermann Circle Drive
Houston, TX 77030
(713) 639-4629
www.hmns.org

Butterfly World
Tradewinds Park
3600 W. Sample Road
Coconut Creek, FL 33073
(954) 977-4400
www.butterflyworld.com