As the Indian Legend Goes

If anyone desires a wish to come true they must first capture a butterfly and whisper that wish to it.

Since a butterfly can make no sound, The butterfly cannot reveal the wish to anyone but the Great Spirit, who hears all and sees all.

In gratitude for giving the beautiful butterfly its Freedom, the Great Spirit always grants the wish.

So, according to legend, by making a wish and giving The butterfly its freedom the wish will be taken to the Heavens and be granted.
# TABLE OF CONTENTS

## PROGRAM INFORMATION

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>About Pan’s Garden</td>
<td>5</td>
</tr>
<tr>
<td>Directions to Pan’s Garden</td>
<td>6</td>
</tr>
<tr>
<td>Teacher Information</td>
<td>7</td>
</tr>
<tr>
<td>Your Visit to Pan’s Garden</td>
<td>8</td>
</tr>
<tr>
<td>What Will Students Experience?</td>
<td>9</td>
</tr>
<tr>
<td>Preparation for This Program</td>
<td>10</td>
</tr>
<tr>
<td>Monarch and Other Butterfly Fun Facts</td>
<td>11</td>
</tr>
<tr>
<td>Butterfly Language</td>
<td>12</td>
</tr>
</tbody>
</table>

## BACKGROUND INFORMATION

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monarch Butterflies</td>
<td>13</td>
</tr>
<tr>
<td>Life as an Egg</td>
<td>13</td>
</tr>
<tr>
<td>Life as a Caterpillar</td>
<td>14</td>
</tr>
<tr>
<td>Life as a Chrysalis</td>
<td>15</td>
</tr>
<tr>
<td>Life as an Adult Monarch</td>
<td>16</td>
</tr>
<tr>
<td>Caterpillar Anatomy</td>
<td>16</td>
</tr>
<tr>
<td>Butterfly Anatomy</td>
<td>18</td>
</tr>
<tr>
<td>Butterfly Senses</td>
<td>21</td>
</tr>
<tr>
<td>Butterfly Defenses</td>
<td>22</td>
</tr>
<tr>
<td>Butterfly Behaviors</td>
<td>27</td>
</tr>
<tr>
<td>Factors That Limit Population</td>
<td>28</td>
</tr>
<tr>
<td>Milkweed</td>
<td>29</td>
</tr>
<tr>
<td>Milkweed is a Host Plant</td>
<td>29</td>
</tr>
<tr>
<td>The Interrelationship Between Monarchs and Milkweed</td>
<td>30</td>
</tr>
<tr>
<td>Loss of Habitat</td>
<td>30</td>
</tr>
<tr>
<td>Milkweed Adaptations</td>
<td>31</td>
</tr>
<tr>
<td>Milkweed History and Uses</td>
<td>31</td>
</tr>
<tr>
<td>Growing Milkweed Plants</td>
<td>32</td>
</tr>
<tr>
<td>Milkweed Bugs</td>
<td>33</td>
</tr>
<tr>
<td>Biomonitoring</td>
<td>34</td>
</tr>
<tr>
<td>Ozone</td>
<td>36</td>
</tr>
<tr>
<td>Monarch Migration</td>
<td>38</td>
</tr>
<tr>
<td>Why Butterflies Are Important</td>
<td>39</td>
</tr>
<tr>
<td>The Importance of Butterfly Gardens</td>
<td>40</td>
</tr>
<tr>
<td>The Importance of Native Plants in Butterfly Gardens</td>
<td>40</td>
</tr>
</tbody>
</table>

## MONARCH ACTIVITIES

<table>
<thead>
<tr>
<th>Activity</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffee Filter Butterflies</td>
<td>41</td>
</tr>
<tr>
<td>Monarch Life Cycle</td>
<td>42</td>
</tr>
<tr>
<td>Butterfly Life Cycle Pasta Activity</td>
<td>43</td>
</tr>
<tr>
<td>Scent Game</td>
<td>44</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS (continued)

- Write a Monarch Story 47
- Butterfly Charades 48
- Label the Caterpillar 49
- Design Your Own Caterpillar 52
- Butterfly Anatomy Activity 53
- Butterfly versus Moth 55
- Build a Bug Activity 58
- Camouflage Activity 60
- Now You See Me, Now You Don’t Camouflage Activity 62
- Beneficial Insects 65
- Friend or Foe? 70
- What’s Buggin’ You? 73
- Milkweed Bug Investigation 75
- Insect Observation 76
- Finding Host Plants 79
- A Lesson in Mimicry 80
- The Secret Likes of Butterflies 81
- Monarchs Chrysalides Investigation 83
- How High Do they Fly? 85
- Monarch Migration Activity 86
- Suggestions for Long Term Butterfly Studies 87
- Milkweed Plant Study 88
- Old or New? 89
- Air Quality and Plants Activity 90
- You Can Help Conserve Monarchs 93
- Why Plant a Butterfly Garden at School? 94
- How to Begin 94
- Important Management Considerations 95
- Tips for Planning and Planting 95
- Plants for Butterflies 95
- Build a Butterfly Cage 96
- Releasing Butterflies 97

**VOCABULARY** 98

**RESOURCES** 105

**STATE CURRICULAR STANDARDS** 106
ABOUT PAN’S GARDEN

Pan’s Garden is a botanical garden devoted to Florida’s native plants opened in 1994, and is a project of the Preservation Foundation of Palm Beach. The Garden takes its name from the bronze statue of Pan of Rohallion, designed by Frederick MacMonnies in 1890. In Greek mythology, Pan was the God of Shepherds, whose job was to protect and guard the flocks. The statue graces the Garden’s entrance pool and is depicted in idealized human form playing an enchanted flute, called a syrinx, which is an ancient Greek instrument of shepherds.

Pan’s Garden’s heavily planted area of more than one-half acre showcases more than 300 species of Florida native plants, many of which are endangered. The Garden incorporates upland, hammock and wetland areas designed to display indigenous trees, shrubs, grasses and wild flowers in naturally occurring relationships to each other. Varieties of native species are planted in seasonal display areas to highlight possible choices for home and school landscaping. Pan’s Garden has also become home to a wide array of birds, butterflies and other creatures which await discovery at every turn.

Statue of Pan of Rohallion
DIRECTIONS TO PAN'S GARDEN

Please make copies of these directions for every driver.

Pan’s Garden is located in Palm Beach, at **386 Hibiscus Avenue**, between Chilean and Peruvian Avenues; one block north of Worth Avenue (see map).

From I-95, take the Okeechobee Blvd East Exit and drive east through West Palm Beach. Cross the Intracoastal Waterway via the Royal Park Bridge (middle bridge); the road name becomes Royal Palm Way once on Palm Beach.

Continue to travel east on Royal Palm Way to Hibiscus Avenue. Turn right (south) onto Hibiscus Avenue and proceed three blocks. The main gate of Pan’s Garden is located on Hibiscus Avenue, just past the Chilean Avenue intersection. The Garden is surrounded by a coral colored wall.

Parking is extremely limited. There is adequate space for one school bus or five vehicles, which may remain parked at the Main Entrance, **directly in front of the Garden**, for the duration of the visit. Additional metered one-hour parking is available on the side streets.

DEPARTURE INSTRUCTIONS

Proceed south to the intersection of Hibiscus and Peruvian Avenues. Turn left onto Peruvian Avenue and travel east one block to South County Road. Turn left (north) onto South County Road and travel to the Royal Palm Way intersection. Turn left onto Royal Palm Way and proceed west to West Palm Beach.
TEACHER INFORMATION

SCHEDULING:
Reservations are limited and booked months in advance. Please contact the Education Department of the Preservation Foundation of Palm Beach at (561) 832-0731.

GROUP SIZE:
Pan’s Garden programs are limited to one class from one school per day and can accommodate a maximum of 30 students, one teacher and one chaperone. Kindly give advance notice of special needs student accommodations.

TIME OF ARRIVAL:
The program runs from 10:00 a.m. until 12:00 noon. Please be prompt, as late arrival will shorten your program. If you are running late, please contact the Preservation Foundation at (561) 832-0731.

WEATHER:
To ensure everyone’s safety and comfort, educational programs will not be held during periods of heavy rain or thunderstorms. If these conditions arise the morning of your visit, please contact us to determine if we will continue as scheduled. If inclement weather causes a cancellation, every effort will be made to reschedule your group.

COST:
Pan’s Garden educational programs are free of charge. The only contribution that we ask is that your class arrives fully prepared and enthusiastic!

TRANSPORTATION:
Transportation must be provided by the school. Limited parking is available for one school bus or five vehicles directly in front of the Garden’s main gate at 386 Hibiscus Avenue (see map). Please make a copy of directions and map for each driver.

DRESS:
All educational sessions at Pan’s Garden are outdoors. Students should wear closed-toe walking shoes and clothes appropriate for the weather (including light rain).

NAME TAGS:
For identification purposes and to personalize the experience, please have students wear name tags.

RESTROOMS:
Restrooms are available. Teacher/chaperone must monitor students’ use.

LUNCH:
We invite you to bring a picnic lunch and enjoy your meal in the Garden after the program; lunch is on your own time. There are no vending machines. Please leave lunches/coolers on the bus or in vehicles during the program, as there is no refrigeration available and we have lots of hungry ants!

DISCIPLINE:
Teachers are responsible for student behavior; remain with your students at all times. Please inform students that, unless instructed by our staff, they will not be allowed to touch, take, or eat any plant material. It is not unusual for a plant listed as food to also possess poisonous or medicinal properties! Students must walk and stay on paths at all times. For safety reasons, students who do not adhere to these rules will not be allowed to continue participation in the program.

FURTHER INFORMATION:
If you have any questions regarding scheduling or course content, please contact the Education Department of the Preservation Foundation of Palm Beach at (561) 832-0731.
“Monarchs and Milkweed” is a hands-on discovery program developed to focus on environmental awareness, interrelationships, adaptations and protection of species. Monarch butterflies, milkweed plants and hands-on investigations and activities are employed to demonstrate these important issues. Monarch butterflies are fascinating and fun to watch. Students observe Monarchs during various stages of development in the Garden and learn firsthand about adaptations that assist in their survival. Interacting with beautiful butterflies while learning important environmental issues is an event students won’t soon forget.

This manual is intended to help you familiarize your students with what they will encounter at Pan’s Garden. It includes many pre- and post-visit activities for varying grade/ability levels. You may wish to use the Background Information section to strengthen your own knowledge or copy and use it as informational text for older students.

The “Monarchs and Milkweed” program for younger students concentrates heavily on life cycles, adaptations and making good observations. Older students learn the physical science of ozone, conduct in-depth investigations in biomonitoring and learn about loss of habitat and more adaptations that assist butterfly survival.

There is no charge for either the Garden visit or the manual, but we do ask that you prepare your classes with at least a preliminary understanding of the session’s content which will greatly enhance students’ experience and knowledge. We look forward to your students’ visit to Pan’s Garden.
WHAT WILL STUDENTS EXPERIENCE?

Younger students will...

- Discover an award-winning native plant garden and interact with beautiful butterflies
- Examine Monarchs in all life stages
- Learn how to make observations using hand lenses
- Understand the importance of adaptations and interrelationships
- Learn what makes up a butterfly habitat
- Learn why butterflies are important to our environment

Older students will do the entire above plus they will...

- Realize the need to preserve and protect our native plants and butterflies
- Learn the chemical components of ozone and milkweed ”sap”
- Observe how ozone negatively affect plants and our surroundings
- Observe, measure, record and share scientific data
- Understand consequences of loss of habitat

HOW WILL STUDENTS ACCOMPLISH THIS?

Younger students will…

- Observe host plants and butterflies in all life stages
- Discuss the interrelationship between host plants and butterflies
- Role-play as butterflies to learn how limiting factors impact butterfly populations

Older students will do the entire above plus they will…

- Perform biomonitoring experiments on Milkweed plants
- Utilize a variety of tools and activities to demonstrate the function and importance of specific adaptations
- Discuss stewardship of our environment
PREPARATION FOR THIS PROGRAM

Please prepare your students for the Monarchs and Milkweed experience at Pan’s Garden.

This Teacher’s Manual has been provided for you and your students to prepare for this unique field experience. It is important the students gain a foundation of background knowledge to enhance their Pan’s Garden educational experience and to arrive knowing what to expect and what is expected of them.

Included are guidelines for the visit, valuable background information regarding the life cycle, adaptations and anatomy of butterflies; the interdependence between Monarchs and Milkweed plants; an explanation of biomonitoring; pre-and post-visit activities for a variety of grade levels and much more. The Monarchs and Milkweed program was developed utilizing the Florida Next Generation Sunshine State Standards for Science as reference.

Review *the life cycle* of butterflies

- Egg
- Caterpillar (larva)
- Chrysalis (also known as pupa but not cocoon!!)
- Butterfly (adult)

Review basic *insect anatomy*

- Head
- Thorax
- Abdomen

- Younger students should understand the *five senses* and *camouflage*
- Reinforce the term *adaptations* and how they are important for survival

- Older students should be familiar with the negative effects of *air pollution*
- Discuss the term *loss of habitat* and its potential consequences for butterflies
MONARCH AND OTHER BUTTERFLY FUN FACTS

- Butterflies and moths belong to classification of insects called Lepidoptera. In the Greek language Lepidos means “scales” and ptera means “wings”- or scaly wings. Butterfly wings are covered with thousands of loosely attached scales that are arranged like shingles on a roof.

- There are about 17,000 species of butterflies in the world and about 700 species in North America; there are about 160 species of butterflies in Florida.

- Butterflies are important pollinators of flowers.

- All butterflies go through a complete metamorphosis: egg, larva (caterpillar), pupa (chrysalis- NOT cocoon) and adult.

- Butterflies are cold-blooded and rely on the heat of the sun to raise their body temperature in order to fly. An activity called basking allows the wings to catch sunrays and warm up and circulate an internal fluid called hemolymph. In cold weather hemolymph becomes very dense and makes it impossible for the butterfly to fly. Some butterflies bask with their wings open and other with their wings shut; on really cold days butterflies may not fly at all.

- Many species of butterflies survive winters by becoming dormant at different life stages: some as eggs that are laid late in the summer and do not hatch until spring; some as caterpillars (larvae) that burrow underground or roll up in leaves, underneath tree bark or in piles of logs and come out in the spring to eat, grow and continue their life cycle; some as chrysalides (pupas) that hang on branches or twigs to emerge as butterflies in the spring.

- Some butterflies are territorial and chase weaker, slower butterflies away.

- When completely unrolled, some butterflies proboscis can be three times longer than their bodies.

- All butterflies rely on healthy environmental conditions to survive and thrive. Polluted air, water or ground causes their population to quickly become smaller or totally die off. For that reason Monarch butterflies and their host plant Milkweed are known to scientists as indicators for biomonitring the health of an entire ecosystem.

- An adult Monarch butterfly’s lifespan is about two weeks, but some can live as long as one year.

- Adult Monarch butterflies born late in the year migrate to warmer climates (except those living in Florida) where they roost for the winter and in spring begin to travel northward again where they reproduce and die.
BUTTERFLY LANGUAGE

Listed below is the word “butterfly” in other languages

Spanish: Mariposa
French: Papillon
Portuguese: Borboleta
German: Schmetterling
Italian: Farfalla
Arabic: Farrash
Hebrew: Parpar
Nigerian: Laba-laba
BACKGROUND INFORMATION

**Monarch Butterflies**

**Monarchs** are one of the best known and loved species of butterflies. They are easy to identify by their large bright orange wings with lines of black and sprinkled with white dots. Monarchs belong to a family known as Milkweed Butterflies because they rely on the Milkweed plants for survival.

Monarch butterflies change form as they grow in a process known as **complete metamorphosis**. Chemicals called **hormones** inside the butterflies’ bodies control the timing of each change or stage. There are four stages in butterflies’ metamorphosis: egg, larva (caterpillar), pupa (chrysalis) and adult. It takes about one month for a butterfly to grow from an egg into an adult. In warm weather adult Monarchs live anywhere from two to six weeks.

![Egg > Larva (caterpillar) > Chrysalis > Adult]

**Life as an Egg**

Female Monarchs butterflies lay their eggs only on Milkweed plants. Each egg is tiny, white and oval-shaped and looks like part of the leaf or milky sap of the Milkweed leaves. This **camouflage** protects the egg from hungry **predators** such as wasps and ants.

![This Monarch egg (left) looks a lot like the drop of milky sap from the Milkweed leaf (right)]

Female Monarchs lay their eggs on the underside of Milkweed leaves to protect them from harm such as the hot, drying effects of direct sunlight, heavy rain, hail, strong winds or falling tree branches. A special glue-like fluid surrounds each egg that attaches it securely to the leaves. The egg has a waxy, thin, tough shell with raised ribs or pits (see picture) that allow air and small amounts of water to enter. Inside each egg is a **yolk** that feeds the caterpillar developing inside.

Some butterfly species lay many eggs in groups or clusters; some even spread their eggs while flying over grasses! But Monarchs lay one egg at a time and on widely scattered plants. A female Monarch in the wild lays up to 700 eggs in her lifetime, but only about 1% (seven) survives to become healthy adult butterflies! The others die sometime during their life cycle; killed by diseases, predators, accidents, chemicals or bad weather conditions.
Life as a Caterpillar

In 3-6 days caterpillars also called larvae hatch from their eggs. Each begins the hatching process by chewing through the shell of its egg. Then it eats the entire egg as a first meal and quickly moves on to eat Milkweed leaves.

Milkweed leaves have milky white sap inside called glycoside. Glycoside tastes terrible to many animals when eaten and it is poisonous to some. But a Monarch caterpillar can eat the milky sap without harm. The awful tasting glycoside remains inside a Monarch caterpillar’s body for the rest of its life. This helps protect it from predators such as birds or lizards but does not defend them from many insects or spiders which don’t seem to mind the taste.

For the next 12-14 days a Monarch caterpillar spends all of its time eating only Milkweed leaves and rarely rests or sleeps. During that time the larva is an “eating machine” - one Monarch caterpillar can eat an entire milkweed leaf in four minutes and every day they consume twice its body weight in food! In the short time between hatching from its egg until it forms a chrysalis, a caterpillar grows 2000 times in body weight and size. This is the only time during their life cycle that it actually grows in size.

When a tiny larva hatches from its egg it is about the size of the head of a pin and it begins growing immediately. If a 7 pound human baby were to grow at the same rate as a Monarch caterpillar, in just one month that baby would equal the size of a double-decker school bus and weigh many tons!!! A Monarch caterpillar grows very fast which causes its skin, called an exoskeleton, to quickly become too tight. So to continue growing a caterpillar must shed the tight skin. This is called molting. Molting causes the old skin to split beginning at the head and peel back off the caterpillar’s body. When the molt is complete the larva eats the old skin which gives it valuable nutrition. Then the caterpillar continues eating Milkweed leaves. The molting process occurs five times during the larval stage.

Instars are the periods of time between molts and when a caterpillar body grows. A Monarch caterpillar goes through five instars- the last instar ends when it forms its chrysalis.

When the larva reaches full size hormones inside signals the caterpillar that it is time to pupate (change into chrysalides). It stops eating, empties its stomach and leaves the safety of the Milkweed plants to hunt for a place to change into a chrysalis, usually on a branch or twig. This is the most dangerous time for a caterpillar. Predators such as wasps and birds can track a caterpillar using scent trails and this makes it an easy target as food. After the caterpillar finds the perfect spot it spins anchors or pads from organs found behind its heads called spinnerets. These pads, called silk buttons are how a larva attaches its body to the twig. Then the caterpillar hangs upside down in the shape of a “J”.


Once upside down and secure the caterpillar twists around and attaches hook-like stems called cremasters firmly into the silk pad. The larva continues to wriggle until its exoskeleton splits lengthwise and it molts for the very last time. Under the old skin is a new soft protective bright green covering which soon hardens into a protective case. The Monarch larva is now a chrysalis. As if that’s not cool enough, over the following 10-14 days an amazing metamorphosis takes place inside the chrysalis.

### Life as a Chrysalis (Pupa)

A butterfly’s body goes through many changes in its life cycle- especially while inside its chrysalis. When the chrysalis (pupa) forms it is about half the length and about twice as wide as it was as a caterpillar. A pupa does not eat during this stage. During the time as a caterpillar invisible but important changes occurred: wings and other adult organs began to form. Now during the pupal stage these changes finally become complete. The chrysalis is helpless during the two week-long pupal stage; it cannot fly, sting, bite or run away from predators. Therefore most are well-camouflaged in colors of brown, green or gray for protection.

Just hours before it ecloses (come out of the pupal stage) the chrysalis becomes almost transparent and the adult butterfly inside can be seen. Then the protective case splits wide open and the adult butterfly emerges (comes out).
**Life as an Adult Monarch**

A newly emerged butterfly pushes out of its chrysalis but cannot fly yet because its wings are wet, wrinkled and weak. This makes it an easy meal for hungry predators. A butterfly has to expand and dry its wings as soon as it emerges from the chrysalis. For several hours the butterfly flaps its wings to dry them more quickly. The flapping also pumps and forces fluid called hemolymph throughout a series of tube-like veins in a butterfly’s body. It's a little like inflating a balloon -- as the veins fill with fluid, they slowly stretch the surface of the wings. Hemolymph is a yellow or green liquid that flows through the bodies of many insects and other invertebrates. Its job is much like the blood in vertebrates. Once hemolymph is freely flowing and the butterfly’s wings are strong and dry it is able to fly away and begin looking for food.

**Caterpillar Anatomy**

During the larval (caterpillar) and adult stages, a Monarch’s body is called an exoskeleton and is divided into three parts; head, thorax and abdomen.

**The Head**

The head is made up of body parts that perform some of the most important jobs for a caterpillar to live and is the only part of their bodies that never grows. It is easy to tell which instar a caterpillar is in by the relative size of the head to the body. The head has organs that allow the senses of touch, taste, smell and sight to take place and also includes the mouth for eating.

A Monarch larva has twelve (six pairs) simple eyes called ocelli. Even with all of these eyes, it can only see differences between large and small and light from dark.
A caterpillar has many tiny hairs called setae that cover its head. Setae give the sense of touch. On top of a caterpillar’s head are two tentacles that also give a larva the sense of touch. Since it not see very well its tentacles keep it from losing balance falling. Most people think the spiky “feelers” sticking out from a caterpillar’s head are antennae. But they are not...they are tentacles. Tentacles help find food and guide it into the mouth and help a caterpillar move around safely.

Antennae are very short sensory organs found close to a caterpillar’s mouth. Antennae are responsible for the sense of smell. Since a caterpillar cannot see very well it relies heavily on the sense of smell to find food. A caterpillar’s mouth has an upper and lower lip, two and two mandibles or jaws. These organs help a larva eat large amounts of food quickly which is one reason they grow so fast. Maxillary palps are on each side of the upper part of the mouth. Because a caterpillar has such poor eyesight palps are useful in guiding food into its mouth.

Attached to the jaws (mandibles) are ten very small teeth (five each side) which a caterpillar uses to chomp leaves by tearing side-to-side movements.

At the bottom of the head near the mouth and below the palps is the spinneret. This organ has no function throughout most of the caterpillar's life until it is time to pupate when it has a very important job. The spinneret spins sticky silk thread used that makes a mat called a silk button. Silk buttons attach caterpillars to branches or twigs where they change into chrysalides.

The Thorax

All caterpillars have three pairs of true legs which are the legs found closest to head on the thorax. One pair is attached under each of the three segments of thorax. The true legs have joints like our knees and ankles with a little claw on ends.

The rest of the legs are "false" legs called prolegs that grow from the caterpillar's abdomen, and differ in number from species to species. Monarch caterpillars have five pairs.
The Abdomen

The abdomen is made up of eleven segments. Monarchs, like most caterpillars, have up to five pairs of false legs called prolegs. Prolegs do not have segments or joints, but are cylinder-shaped (see diagram and picture above). They have tiny hooks on the base called crochets that help a larva walk and hold on to leaves without falling. Crochets also securely attach a larva to the silk mats and buttons where it hangs upside down in a “J” shape and transforms from a caterpillar into a chrysalis. The true legs on a caterpillar are the same legs that you see on butterflies—all prolegs disappear during metamorphosis.

A caterpillar needs oxygen just as humans or other animals but it does not have a nose or mouth. Instead it breathes through holes along the sides of the bodies called spiracles. These rows of small openings have flaps that stay closed until air is needed. As the caterpillar takes a breath the spiracle valves open to let in air which is then carried throughout the body. Carbon dioxide is released following the same path back to the spiracles and out of the body. There is one pair of spiracles located on the first thorax segment and there are other 8 pairs are on the first 8 abdominal segments.

Spiracles along a caterpillar’s side

The same tiny hairs called setae that cover a caterpillar’s head also are found on the rest of the body. A caterpillar also has tentacles on its front and back ends and several more pairs along its body that look like the ones on its head. Setae and tentacles work together to give the caterpillar’s entire body the sense of feeling. Since there are tentacles in several places along the caterpillar’s body, predators are not sure where the caterpillars’ head is located and become confused about where to strike.

In the abdomen the caterpillar's digestive system breaks down the food and stores it in a layer of fat. A caterpillar's body is basically a long tube for processing and storing food. A set of mouth parts lets the caterpillar chew its food -- leaves and other plant parts. The mouth empties into a very long intestine where it is digested and passes out of the caterpillar’s body as waste material called frass.

Butterfly Anatomy

The Head

The largest sensory organs on a butterfly’s head are the two compound eyes. Compound eyes allow a butterfly to see movement in all directions. This allows a butterfly to look at the flower it is probing with its proboscis and see a predator approaching from behind at the same time. But whatever it sees is blurry when compared to human sight.

Butterflies can see more colors than humans and different species of butterflies see different colors. Some species cannot see a difference between the colors of red and green. One butterfly may have an easy time
seeing a particular color of flower while another species may not. A butterfly’s eyes can also help it find the direction of the sun, even on cloudy days, which is very important for a Monarch during migration.

Like all other insects butterflies have a pair of feelers on their heads called antennae. They are thin with knobs at the ends and are used to help butterflies smell and touch. The antennae sense odors in the air, wind direction and the smell of nectar. These functions are very important when butterflies fly around in search of food. Though butterflies can see flowers with their eyes, they find them first by smelling them. Antennae also allow butterflies to smell other butterflies so they can group together to fly, puddle (drink water) and find mates to reproduce.

Also located on the head is the proboscis. The proboscis is actually two narrow tubes joined together and used like a straw to drink nectar from flowers. Butterflies usually keep their proboscis coiled up under their head until they drink, then they uncoil it. Adult butterflies do not eat solid food—they can only drink liquids.

On either side of the proboscis are labial palps which help butterflies smell to decide what is and isn’t food. They also help protect the proboscis and the eyes from dust and dirt.

The Thorax

The thorax is made up of three segments and is located between the head and the abdomen. Each segment has a pair of legs attached to it, and the second and third segments each have a pair of wings attached, as well. The five or six pairs of false legs or prolegs that were attached to the caterpillar’s thorax disappear in the adult stage.

Butterflies have six legs attached to the thorax. They are the six true legs on the thorax in the caterpillar stage kept through pupation to become the legs of the adult. Many times it looks like adult butterflies have only four legs because the two front ones are very tiny and curl up next to the thorax.

Adult butterfly legs have important sensory organs that can detect vibrations, sound and smell. The front pair of legs (forelegs) is short and the butterfly uses them to clean its antennae.

The middle and hind legs are for walking and holding on to things. The adult butterfly’s legs have pores, scales and hairs that are used as specialized sense organs. These organs detect sound vibrations, but butterflies don’t have ears and don’t really hear—instead they feel the sound waves. These organs also allow a butterfly to smell and taste. The smell and taste sensory organs are on a butterfly’s feet so when it lands on a flower the feet check it out. They work together with the antennae to learn if it landed on a flower that will give it food. This is very important to a butterfly hunting for a meal, since its eyesight is very blurry. On the end of each leg is a
tarsus (tarsi, plural) which helps a butterfly grip flowers or whatever it lands on. The organs that actually taste sweet liquids like nectar are on the back of the tarsi.

One of the most important body parts for a butterfly is also easiest to see…wings! Wings allow adult butterflies to fly and find food or escape from danger. A butterfly has four wings (two hindwings and two forewings) are attached to the thorax. Each species of butterfly has differently shaped wings. The hindwings are small, shaped like fans and closer to the tail. The forewings are shaped like triangles, covered with tiny scales and closer to the butterfly's head.

Butterflies’ wings are made of very thin, almost transparent material called chitin that is stretched over a series of vein-like structures. Butterflies’ coolest feature is its wings which have pretty colors and patterns made by layers of tiny scales. But these scales are not like fish scales. Instead they are actually more like short, tiny hairs that protect the wings and help a butterfly fly easily. Usually the scales on the top of butterflies’ wings are brightly colored and the scales on the underside have a dull color for better camouflage.

The Abdomen

The third part or segment of the butterfly’s body is called the abdomen. It is usually narrow and divided into eleven segments. Most important organs such as the flexible, tube-like heart, reproductive organs, many spiracles (breathing pores), and most of the digestive system are located in a butterfly’s abdomen. An adult butterfly does not have a large stomach because it only drinks a very small amount of nectar at one time.
The abdomen is much softer than the head and the thorax. Waste material passes through the hemolymph and out of the butterfly as a clear liquid.

**Butterfly Senses**

**Touch**

Tiny hairs called setae give a butterfly a sense of touch in both larval and adult stages and are very important to each in different ways. Setae are spread evenly over the entire caterpillar’s body and can be seen by using hand lenses. A larva instinctively rolls up into a ball when touched to protect itself from possible harm. Setae cover almost all of an adult butterfly’s body parts. The tiny hairs sense wind, gravity and body position which greatly help a butterfly in flight. The adult butterfly’s antennae sense both touch and smell.

**Hearing**

In larval and adult stages, butterflies have a poor sense of hearing because they do not have ears. They “hear” sound by feeling vibrations that move their setae but rarely react to anything but the loudest of noises. An adult butterfly can also sense sound through the veins in its wings. Scientists think butterflies make sounds humans cannot hear to scare off predators or possibly to find a mate. Scientists do know caterpillars and adults can communicate very simple messages by giving off chemicals.

**Sight**

A caterpillar does not see well at all. Even with twelve (six pairs) simple eyes called ocelli it can only see differences in size and brightness. An adult butterfly has compound eyes which give it excellent information about color and movement but objects are blurry and they cannot judge distance very well. Thousands of ommatidia, units of two-part lenses that sense and gather light, make up compound eyes and also allow a butterfly to see in all directions at the same time.

**Taste and Smell**

Chemoreceptors cover the bodies of caterpillars and adult butterflies and sense different chemicals in the environment. Body parts such as the tarsi on an adult’s feet have many chemoreceptors that taste nectar/sugar. When a butterfly lands on a flower chemoreceptors in the feet send a message to its brain to uncoil its proboscis to drink the nectar.

An adult’s antennae, especially the club-shaped parts are covered with chemoreceptors which gives the
sense of smell. The antennae sense odors in the air, wind direction and the smell of nectar. These functions are very important when butterflies fly around in search of food. Though butterflies can see flowers with their eyes, they find them first by smelling them. Antennae also allow butterflies to smell other butterflies so they can group together to fly, puddle (drink water) and find mates to reproduce.

**Butterfly Defenses**

Butterflies face many dangers during all stages of their lives and therefore have adaptations that protect them from predators and increase their chances for survival. A butterfly is food or prey for almost any creature larger than itself. Ants, spiders, wasps, flies, birds, rats, toads, lizards, praying mantis and snakes are just a few that would love to eat a butterfly in one or another of its life stages. Coloration and behaviors are important defenses in every stage of life and are used many different ways in Nature.

**Camouflage**

Camouflage allows a butterfly in any life stage to blend into its surroundings to make it harder for predators to see it. It is one of the most important defenses for butterflies in all life stages. The eggs of many different species of butterfly are the same color as the underside of the leaf they are laid upon. The caterpillar shown below blends in very well with the leaf it eats because they share the same color. Many adult butterflies also blend in well with the plants around them.

**Warning coloration**

In Nature bright colors serve to predators that this animal or insect is bad-tasting. This is called **warning coloration**. For insects like butterflies warnings colors are orange, red, white and yellow. A Monarch’s bad taste comes from the leaves it eats. Glycoside, the bad-tasting white sap inside Milkweed plants, stays in the Monarchs’ body for life. A Monarch’s warning coloration send the message to predators “I taste bad or I am poisonous, don’t eat me!” Any predator that forgets that warning becomes very sick from eating a Monarch. If the predator survives it quickly learns not to make that mistake again!

**Mimicry**

Looking or acting like something else in Nature is a very important and often used form of protection. This copying or pretending is called **mimicry**. Butterflies use mimicry to look like the leaf or berries of a plant, a twig or even bird droppings!
Mimicking another butterfly

Some species that use warning coloration are not poisonous at all. The Monarch butterfly has orange and white colors to warn predators that it is poisonous to eat. The Viceroy and Queen butterflies share the same colors as the Monarch but are not poisonous. They use mimicry to fool predators into believing they are.

Mimicking something else found in Nature

Sometimes butterflies use more than one kind of mimicry. For example, the color and shape of the Giant Swallowtail caterpillar below make it look like bird poop! The caterpillar in the center looks like part of a tree branch and the caterpillar at the right looks like a tree’s berries.

Mimicking Horns

When it senses danger a Y-shaped gland on the neck of the Giant Swallowtail caterpillar swells up and mimics fierce horns. This gland is called an osmeterium and is the warning color of orange. And if that doesn’t scare off a predator, the osmeterium then gives off a very bad smell. No predator would want to eat that! Many other caterpillars have osmeterium that mimics horns too.
Mimicking Its Host Plant

A Monarch egg mimics a drop of poisonous glycoside sap from a Milkweed leaf. Most predators would not bite at the egg and take the chance of getting a mouthful awful-tasting sap. The caterpillar at the right is not only well camouflaged, but its body looks like the stem and veins of a leaf of its host plant.

Spike

Some larvae are covered with what look like painful spikes or hooks to protect them from predators. Often times those spikes are actually soft hairs that mimic sharp-looking stickers. But the spikes of a few caterpillars really do give a very painful sting! Most predators don’t want to take the chance of being stung in the mouth.

Eyespots

Some species of larval and adult butterflies have spots that look like eyes that make them look much larger and more dangerous. Some caterpillars’ eyespots mimic some other animal like a lizard or snake. This can confuse a predator or scare it away.

Eyespots are usually on a caterpillar’s rear end and on the adult’s lower wings. The spots make a predator think it is biting the prey’s head, but instead it is actually biting the rear end or hindwing. A caterpillar may be able to survive a bite to its rear end, but not to its head. An adult butterfly can survive bites taken from wings and still fly. But a bite to the head by a predator would likely kill it.
More Eyespots

Leaf Rolling or Just Rolling Up

Other caterpillars defend themselves by rolling their bodies up in leaves to hide during the day and feed only at night. Some caterpillars roll into a ball to hide or protect themselves from a bite to the head.

Tails

Many adult butterflies’ wings appear to have “tails” that mimic antennae and make false targets that also direct a predator’s attacks away from the head.
Scales

If a butterfly becomes caught in a web or held in the grasp of a predator, it flutters vigorously to help scales that cover its wings detach and allow the butterfly escape unharmed. If you touch a butterfly’s wing and scales rub off it can still fly.

Flash Coloration

Some adult butterflies use flash coloration to mimic a bigger animal and surprise a predator. A butterfly at rest usually folds its wings above its body. The underside of many butterfly’s wings are dull colored and blend into the surroundings. The sudden opening of colorful wings make the butterfly look much larger and the quick movement can scare a predator away.

Flying

Flying is a major butterfly defense. Most butterflies have large wings that are made for slow-flying and gliding. This could make them easy targets for many predators. However, speed is not the only way to escape danger. When in flight butterflies are able to quickly change directions and speed or move in ways that make it very difficult for predators to catch them. Different species of butterflies fly at differing speeds; the poisonous fly slower than the non-poisonous varieties. Butterflies called Skippers can fly as fast as 30 miles per hour; the slower fliers have a much slower speed of about 5 miles per hour.
Laying Eggs

Different species of butterflies lay their eggs differently. Some, like the Monarch, lay one egg at a time on many different Milkweed leaves. Other species lay a large cluster of eggs on one leaf. Females must lay large numbers of eggs to insure survival of only a few offspring.

![a single Monarch egg](image1) ![a large cluster of butterfly eggs](image2) ![a line of eggs nestled in a stem](image3)

Butterfly Behaviors

Basking

A butterfly, like all cold-blooded animals, uses energy from the sun to keep its body warm. In temperatures less than 60 degrees its body cools down causing hemolymph to become heavy and dense. When this happens the butterfly cannot fly. This puts it in great danger from hungry predators. So after a cold night a butterfly must perch in the sunlight with outstretched wings to absorb heat. This behavior is known as basking. Many butterflies’ bodies are darkly colored which helps to absorb heat more quickly as they bask.

![butterfly basking](image4)

Nectaring

Nectaring is the term for an adult butterfly’s eating process. A butterfly eats by unrolling its proboscis and using it like drinking straw to suck up sweet nectar from flowers. Since they do not have any chewing mouthparts they can only sip liquids like water and nectar.

![butterflies nectaring](image5)

Puddling

Butterflies can often be seen gathered around the moist edges of water or mud puddles drinking up the water through their proboscis. These puddles have nutritious minerals soaked up from the surrounding soil that butterflies need for good health.
Factors That Limit Population

A Monarch butterfly usually completes its life cycle in about one month. During that time a female can lay hundreds of eggs. If all of her eggs survived one Monarch could produce a billion butterflies in only 4 generations (each generation is one complete life cycle). But there are many limiting factors that keep us from having billions and billions of butterflies swarming the world. Predators, accidents and environmental conditions all help limit the butterfly population.

Predation

Monarchs are protected somewhat by glycoside that tells predators “I’m poisonous don’t eat me!!” but there are still a number of birds, mice, spiders, ants and wasps that eat Monarch eggs and larvae and aren’t bothered by the awful taste.

Adult Monarchs are often easy prey while roosting at their winter migratory places. Mice and birds such as the Black Headed Grosbeak, and the Black Backed Oriole are the biggest threat to the Monarch Butterfly. These predators can eat over ten percent of the monarch population while the butterflies are in their semi-dormant state of torpor at the over-wintering sites. Raiding a large population of roosting Monarchs is an "all you can eat" buffet for predators.

Diseases

Just as humans fall ill from diseases, so do Monarch butterflies and they can happen at any life stage. Most diseases are deadly but necessary in Nature to keep population growth in check.

Accidents

Many different types of accidents can happen to Monarchs in all life stages. Eggs, caterpillars and chrysalides can all be crushed by falling tree branches or under animals’ feet. Caterpillars and flying adults can be hit and squished by cars. Some are collected by humans who catch, kill, mount and display beautiful butterflies for biology classes or as a painting on the wall.

Environmental conditions

There are many naturally occurring hazards that kill Monarchs in all stages of life. Dangerous weather conditions such as tornadoes, hurricanes, hail storms, unseasonable cold spells and drought and destructive environmental events like floods and forest fires can be deadly. Limited food can cause starvation and chemicals that kill insects or weeds also kill host and nectar plants and limit Monarch populations.
There are many species of Milkweed (of the genus *Asclepias*) that grow throughout the United States and 24 are native to Florida. This **perennial** plant usually has single stems about 2 to 6 feet tall, with oval leaves that are smooth on top and hairy underneath. Flower colors can be purple, orange, red, yellow and white, depending on species.

Milkweed seeds grow in thin pods usually at the top of the plant. When the seeds are ripe the pods split open. Inside are fuzzy, white fluffy parachutes that carry their seeds into the wind that will land in many places to produce new Milkweed plants.

Native Americans used ground up Milkweed seeds as medicine to heal sores, remove warts and beestings and to draw out poisonous venom from rattlesnake bites. The thick, tough stems were twisted and woven to make rope and strong, coarse cloth and the white fuzzy silk that holds the seed was used to stuff sleeping mats and to insulate moccasins.

**How Milkweed Got Its Name**

Milkweed gets its name from the thick, milky white **toxic** sap that bleeds out when a stem or leaf is broken. The amount of poison called **glycoside** is not the same in every Milkweed species. Some northern plants contain very small amounts of poisons, while a species here in Florida has some of the highest amounts of glycosides.

**Milkweed Is a Host Plant**

Monarchs lay their eggs **only** on Milkweed leaves. Monarch caterpillars only eat Milkweed leaves. Milkweed is the **host plant** for Monarchs. When a caterpillar hatches from its egg it begins eating right away. As it eats the Milkweed’s leaves the caterpillar also eats the milky white sap poisonous called
glycoside inside the leaves. The glycoside is harmless to a caterpillar and it remains inside a Monarch’s body for the rest of its life. The poison makes the Monarch taste awful to predators and provides outstanding protection from many, but not all, predators.

**The Interrelationship Between Monarchs and Milkweed**

Monarch butterflies and Milkweed plants rely on each other for survival. This is called **interdependence** or **interrelationship**. Monarchs need Milkweed plants as host plants on which to lay their eggs and provide the caterpillars with food and protective poisons called **cardiac glycosides**.

Milkweed plants depend on Monarch butterflies to pollinate them to produce new plants. **Loss of habitat** has caused the Milkweed population to become so scarce making pollination difficult. However, Monarchs, unlike many butterflies, fly long distances as they feed, mate and search for the host plant on which to lay their eggs. This wide range of travel insures the Milkweed is pollinated to produce new crops of host plants. The interrelationship helps both species survive.

**Loss of Habitat**

Monarch butterflies are rapidly disappearing and so are the open fields and wetlands where Milkweed grows. This is called **loss of habitat**. Monarchs depend on Milkweed as a host plant - a birthplace and food for their **offspring**. The cypress and fir forests in California and Mexico where Monarchs migrate are also being destroyed by logging and road building.

Here in Florida what was once natural open land is being destroyed so that new homes, shopping malls, roads and businesses can be built. Farmers use chemicals called insecticides to kill insects that eat their crops. These chemicals also kill butterflies. Fungicides (chemicals that cure plant diseases) and herbicides (chemicals that kill weeds) also kill Monarchs and Milkweed plants. Monarchs are adapted to protect themselves from many natural dangers but they cannot adapt to chemicals or lack of Milkweed.
Milkweed Adaptations

Just as butterflies have defenses that help them survive so do plants. Examples of adaptations that protect plants are sharp-edged leaves, spines, stinging spikes and chemicals that repel or even poison predators.

The Milkweed plant’s milky sap contains quantities of glycoside which makes the leaves, stems and seed pods taste bad. Milkweed can even be toxic for to most predators—even large mammals and humans; though a large amount would need to be eaten. The toxicity and bad taste are adaptations that help defend the plant from most hungry predators. Birds will vomit if they ingest Monarchs full of the Milkweed’s milky sap.

Monarch larvae are the most well-known insect adapted to feed on the toxic Milkweed plant. It is difficult to think of Monarch caterpillars as predators but to the Milkweed plants that is exactly what they are. They are eating machines and can easily strip entire Milkweed plants of their leaves in a short period of time. The plants could easily be eaten into extinction if every Monarch egg hatched and every caterpillar survived. Several other species of insects are also Milkweed eaters; the larvae of the Milkweed Tussle Moth, Milkweed Beetles and Milkweed Aphids. All of these insects are immune to the toxic glycosides; this adaptation is called host-plant specialization.

Unfortunately neither Milkweed nor Monarch butterflies have been able to adapt to the devastating loss of habitat that land development is causing. Fewer Monarch butterflies means fewer Milkweed plants. And for Monarchs, who rely upon the Milkweed as their host plant, fewer plants mean fewer butterflies.

Milkweed History and Uses

Milkweed plants have a long history for use by Native American tribes to treat illnesses, conditions and diseases. Parts of the Milkweed plant became powerful medicines used to produce vomiting and as tonic for invigorating and strengthening the body; to treat asthma, stomach troubles, indigestion, and arthritis; and to produce perspiration and cure warts. The cardiac glycosides were and still are, used to treat heart problems. The roots acted as a counter-poison for other poisons. The milky sap made an instant bandage by forming a sticky layer on the skin that stopped bleeding and protected wounds.

Surprisingly, Native Americans used the poisonous Milkweed as food. But before it could be eaten Milkweed had to be harvested, prepared and cooked at the proper time and the correct recipe had to be followed to remove harmful toxins.
Milkweed nectar has high sugar content and Native Americans boiled the flower heads to use as a sweetener. Chewing gum was made from the boiled sap. Some tribes stewed the flowers and ate them like jam. Tender shoots of Milkweed plants were eaten like asparagus and young seed pods tasted like okra when they were boiled.

The silky hairs from the pods were used to stuff pillows and mattresses. Stringy Milkweed fiber is very strong and was used the fiber from the stems made strong ropes and excellent fishing nets. The milky substance was also used to produce poison arrows.

**Growing Milkweed Plants**

Milkweed seeds and plants can be purchased at area Garden Centers. But most Milkweed plants are sprayed with chemicals to stop predators from eating the leaves, which make the plants pretty ugly. Plants that have been sprayed will not immediately provide shelter or food for Monarch eggs or larvae. However, after a few rainfalls and/or waterings (and provided they are not sprayed with additional chemicals) these Milkweed plants will become safe for Monarchs’ use. If you look carefully you may find eggs or caterpillars already on the leaves. If so, the plants have not been sprayed recently and are immediately fine for raising butterflies.

Milkweed plants grow in full sun to light shade. They need well-drained soil and many times re-seed themselves. To increase the number of plants, collect seeds after the pods have ripened but before they spilt open. Seeds should be placed in a paper bag and stored in cool conditions for about 3 months and then can be planted directly into the ground.

Be forewarned!!! Monarch larvae devour Milkweed plants very quickly, so be certain to have plenty of plants (that have NOT been exposed to chemicals) available. Beautiful Milkweed plants become ugly and scraggily green stalks when caterpillars feed on them. Once caterpillars have pupated, carefully check the plants for chrysalides and then cut the bare stems back to at least half the original size. Soon new leaves will grow for another generation of Monarch caterpillars.
Milkweed Bugs

The adult Milkweed bug like all other insects has six legs, three body parts (head, thorax, and abdomen), and two antennae. It is a true bug (order Hemiptera) which means it does not have a mouth for biting or chewing food—instead it has a tube-like beak for sucking fluids called a proboscis.

The Milkweed bug goes through a simple or incomplete metamorphosis. It hatches from a lemon-colored egg looking like a tiny adult with small wings that cannot yet fly. At this stage it is called a nymph. A newly hatched nymph’s only job is to eat and grow. Like all other insects, in order to grow a nymph must molt periodically. A Milkweed bug nymph has five instars before it reaches adulthood. Black wing pads appear early in development. Each molt lasts five to six days.

The Milkweed bug is dark gray to black in color with a wide orange or red band on forewing that forms an "X" shape across its back. Its head is black with a dull red spot on top, sometimes extending down onto face. An adult will live for about one month. The insect overwinters as an adult.

The Milkweed bug can be found in all stages of growth in small groups on Milkweed stems, leaves and seed pods in mid to late summer. It feeds mostly on the seeds of Milkweed plants by stabbing and sucking out the sap with its proboscis. Even though it feeds on the seeds by piercing the Milkweed seed pod it does not damage the plant. Just like a Monarch caterpillar the Milkweed bug is poisonous because it eats the glycoside from inside the Milkweed plant seeds.

Fun Facts about Milkweed Bugs

Milkweed bugs in nature suck nutrients from milkweed seeds, but those raised in the classroom have been bred to feed exclusively on sunflower seeds.

Milkweed bugs grow faster in warmer temperatures.

Just after molting the bug is creamy yellow with bright red legs and antennae. Within a few hours the body turns dark orange, and the legs and antennae resume their usual black color.

Milkweed bugs have few predators because they concentrate in their bodies bad tasting compounds found in the sap of milkweed plants. The bugs use their bright colors to advertise their bad taste. Inexperienced birds that taste their first milkweed bug are unlikely to try to eat another orange and black insect such as a Monarch or Viceroy butterfly.
Biomonitoring

Watching plants, animals or an entire ecosystem over time can tell us important information about the health of those plants, animals or environment. That kind of observation can also warn us about unhealthy air, land or water pollution well before humans know something is wrong. This is called biomonitoring. Scientists have used it for many years—well before computers, weather instruments or other high-tech tools—to learn important information about the health of the environment.

A good example of biomonitoring is coal miners’ use of canaries to warn them of dangerous gases in the air. At that time most mining accidents were not cave-ins but large amounts of deadly gases that seeped through cracks in the rock as miners chipped away to get at the coal. The deeper the miners dug the greater the risk of releasing carbon monoxide and methane into the mine shaft that could quickly kill the miners or cause huge explosions. The miners could not see or smell the gases and had no way to measure the poisons in the air to know if they were in danger.

Birds are very sensitive to air pollution that humans cannot see or smell. So miners took birds called canaries down into the mines with them to monitor the air. The canaries happily chirped and sang as long as the air was healthy. But if carbon monoxide or methane gas leaked into the mine the canaries stopped singing and became very still. This warned miners that deadly gases were in the air and they quickly left the mines before they were poisoned. The canaries biomonitored the air in the mines.

Farmers and biologists sometimes use plants to biomonitor pastures, ponds and forests to learn if the area is healthy. Some plants such as Milkweed are very sensitive to air pollution. Milkweed leaves quickly show signs of damage from ozone, a dangerous form of air pollution that makes. Ozone pollution causes dark purple or brown polka dots on Milkweed leaves and stems. It can also cause the plants to be weak, small and unhealthy because they cannot make their own food in their leaves—a process called photosynthesis. Each of these signs is called a bioindicator and is an early warning of poor air quality in the surrounding environment.
**Plants as Biomonitor**

Milkweed is only one of many plants that are very sensitive to ozone and can be used as a biomonitor to measure air quality and give early warning of an unhealthy environment.

Maple and pine leaves affected by ozone pollution

Ozone damaged cherry leaves

Ozone damage on a bean leaf

Healthy Milkweed leaf

Ozone damaged Milkweed leaf
Ozone

What is Ozone?

The oxygen we breathe is made up of two atoms. Ozone is a gas made up of three oxygen atoms. The extra oxygen atom is what makes ozone harmful to humans, animals and plants. Ozone is found in two areas of the Earth’s atmosphere – at ground level and in the upper regions of the atmosphere. Both kinds of ozone are the same chemical make-up (O3). Ozone in the Earth’s upper atmosphere (the stratosphere) shields the Earth from the sun’s ultraviolet rays. However, ozone found close to the Earth’s surface is called ground level ozone or smog and is harmful air pollution. Why should we care about ozone?

Ground level ozone is made by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOC). Fumes from factories, power plants, paint, and chemical cleaners and exhaust from gasoline motors, are some of the major causes of NOx and VOC.
Ozone forms on humid, hot sunny days in cities where there are higher amounts of car exhaust and other fumes. Ozone can also be carried long distances by wind so even areas far away from big cities can have high ozone levels. Ground level ozone, which is what we breathe, can harm our health even at low amounts. Ozone can cause coughing, sore throat and shortness of breath and can be dangerous for anyone who spends a lot of time outdoors, has allergies, asthma or other lung conditions.

Ozone also harms trees and plants during the growing season. The damage shows up as black, dark purple or brown spots on the leaves and hurts a plant’s ability to perform photosynthesis. A plant that cannot make enough food for itself grows much smaller and is not able to produce normal amounts of fruits or vegetables for us to eat.
Monarch Migration

During the summer months as many as four generations of butterflies hatch, live, mate and die. Most species live for just 2 to 6 weeks. Some butterfly species can survive winters as dormant eggs, others burrow underground in their larval stage and some spend winters as chrysalides. Monarch butterflies cannot survive freezing temperatures by hibernating as some species do. In order to survive the winter Monarchs born late in the season must migrate south to warmer areas. A few other species migrate, but Monarchs are by far the most famous travelers.

Every autumn when days become shorter, nights are cooler and flowers go to seed, millions of late-season Monarch butterflies from all over North America gather together in large groups to begin their incredible migration journey. As these late-season Monarchs migrate they find food along the way but do not mate and lay eggs-this is known as diapause. Instead they travel long distances to thousands of wintering sites they have never seen.

Scientists who study insects called entomologists divide the migrating Monarch populations into two groups- the Eastern group; those living east of the Rocky Mountains and the Western group; those living west of the Rocky Mountains. The eastern group migrates to central Mexico or Cuba. There they rest in the cool, humid fir forests at an altitude of 9,000 to 11,000 feet (nearly 2 miles above sea level) and wait for the winter pass. The western group migrates to wintering sites in central and southern California, where they quietly wait for spring in the pine, cypress and eucalyptus trees.

Some Monarchs travel as much as 2500 miles during their migration southward, flying up to 100 miles per day. Once they reach their stopping place the Monarchs roost among the trees. Their bodies undergo a chemical change that puts them into an almost dormant or semi-hibernation state known as torpor. In torpor the Monarchs remain huddled close together in large groups for protection from predators and bad weather. The life span for these migrating Monarchs can be as long as nine months, most of which in spent in the state of torpor.

When the longer, warmer days of spring arrive hormonal and seasonal changes tell the Monarchs to start the return journey northward. The butterflies mate as they travel. Most of the eastern group travels only as far as Texas, Louisiana, Alabama
and Mississippi before they lay their eggs and die. The western group has a much shorter trip and a few Monarchs finish the entire round-trip back to their first nesting grounds before they lay eggs and die. The next generation of Monarchs continues their parents’ northward migration and the cycle continues.

How Monarchs know exactly where to go when they migrate is a mystery, since they have never made the journey before. But year after year, a new generation of Monarchs travels the same route and finds the same sites. Recently a third group of Monarchs has been discovered. It is now known that Florida has its own group of Monarchs that do not migrate. This group does not need to migrate because the mild climate allows Milkweed to grow all year long, giving Monarchs an endless food supply to support a constant population and regular life cycle all year. These butterflies live the usual 2 to 6 week life cycle.

**Why Butterflies Are Important**

Butterflies, like bees, pollinate fruits and vegetables. However there are important differences between the ways the two species’ pollinate. For instance, bees stay close to their hives and collect and deliver nectar for their entire colonies. Because their range is small bees only pollinate flowering plants within a short distance of home. Honeybees have always been used as the main pollinators for crops because there are so many of them and they stay close to home. But recently a mysterious disease is killing entire colonies of bees, greatly affecting the population. With many fewer bees farmers are understandably worried about how their crops will be pollinated. Could butterflies be the answer???
Butterflies do not live in colonies so they do not have to provide nectar for others, only themselves. Butterflies travel great distances to find host plants on which to lay their eggs and so they are able to pollinate many flowers over a very wide range. This helps plants as well as the butterflies because it allows **genetic diversity**, which insures stronger plants and stronger butterflies. This wide range of pollination could also save some threatened or endangered plant species from extinction.

**The Importance of Butterfly Gardens**

Butterflies are beautiful and fun to watch. Observing and raising butterflies allows us to witness the miracle of metamorphosis and the life cycle. A butterfly garden gives us a peaceful place to relax and appreciate Nature, which has been proven to be very helpful and healthful to our minds and bodies.

Pan’s Garden is home to a variety of native Florida plants, all which bloom at different times of the year and provide constant food and shelter for many different species of butterflies. It is an outstanding example of a butterfly garden.

**The Importance of Native Plants in a Butterfly Garden**

Butterfly gardens can be planted in flower pots, small yards or many acres. Creating a butterfly garden using native plants provides habitat that attracts butterflies and gives them a place to live and reproduce. Native plants are well-adapted to Florida’s warm, dry winters and hot, humid summers and don’t need large amounts of water to survive. Planting many different kinds of host and nectar plants gives food and shelter to every stage of the butterflies’ life cycle. In return the butterflies pollinate the flowers and give us something beautiful and fun to watch.
Monarch Activities

Most of the following activities can be adjusted according to grade/ability level
Coffee Filter Butterflies

Materials List
Pipe cleaners
Paper coffee filters
Water color paints or washable markers
Water
Cups and paper towels
Paper plates or newspapers
Clothes pins

Procedure:
1. Flatten coffee filter and place on newspaper or paper plate
2. Paint or color with water colors or markers-allow to dry completely
3. Fold coffee filter accordion style- may need adult help
4. If using pipe cleaners, wrap pipe cleaner stem around the center of the folded coffee filter
5. If using clothes pin as a body, insert filter into clothes pin to hold wings
6. Fan out butterfly wings
7. Hang in a window and enjoy!
Monarch Life Cycle

**Introduction:** Use this activity to demonstrate the Monarch butterfly’s life cycle with young children.

**Objective:** To help young students understand and remember the term metamorphosis and the life cycle of the Monarch butterfly.

**Background:** Monarch butterflies go through a complete metamorphosis (an insect’s transformation from egg, larva, pupa and adult).

**Discuss:** Ask students, “How do butterflies grow?” Explain that Monarchs begin as eggs laid on the underside of the leaves of Milkweed plants. When the eggs hatch tiny caterpillars or larvae are born and spend all of their time eating and growing. The caterpillars grow very quickly and turn into chrysalis or pupa. Ask students, “What do you think happens inside the chrysalis?” The pupae are changing from caterpillars into beautiful butterflies in a process called metamorphosis. Use a life cycle diagram to help illustrate the process.

**Method:** To further demonstrate metamorphosis, ask students to copy your hand movements:
- The first stage in a butterfly’s metamorphosis is??? An egg- students clutch their hand into a tight fist.
- The second stage in a butterfly’s metamorphosis is??? Caterpillar- students unclench fist and use index finger as a caterpillar.
- The third stage in a butterfly’s metamorphosis is??? Chrysalis- students wrap their index finger with other hand.
- And the last stage of a butterfly’s metamorphosis is??? The adult butterfly- students interlock thumbs and making flying movements with hands.
Teacher Information

Butterfly Life Cycle Pasta Activity

**Background:**

Students should have an introduction to the butterfly life cycle by reading good trade books such as From Caterpillar to Butterfly by Deborah Heiligman

**Objective:**

To help students learn the different stages of the butterfly life cycle

**Materials:**

Life cycle worksheet
Glue
4 shapes of pasta

Round-represents the egg (couscous or orzo pasta)  
Spiral-represents the caterpillar (larva)

Shell-represents the chrysalis (pupa)  
Bowtie-represents the adult butterfly

**Procedure:**

1. Review the Monarch life cycle: egg, caterpillar (larva), chrysalis (pupa) and adult
2. Hold up a small round piece of pasta and ask students what stage of the butterfly life cycle the pasta resembles (the egg)
3. Invite students to glue the round pasta to the Life Cycle paper under the EGG label
4. Repeat this procedure for each different shape of pasta- spiral shape is the caterpillar, shell shape is the chrysalis and bowtie is the adult butterfly
Butterfly Life Cycle Pasta Activity

Name__________________________________________
**Scent Game…How Do Butterflies Find Host Plants and Food?**

**Objective:**

Students explain how butterflies or other insects locate host and nectar plants through using scent.

**Materials:**

- Small containers with tops such as old pill bottles, small condiment containers or small re-sealable plastic bags
- Strong scents such as vinegar, vanilla, lemon, orange, strawberry, peppermint, garlic, onion, oregano, basil, geranium, almond, banana, maple syrup, etc.
- Cotton balls to soak with liquid scents

**Procedure:**

1. Collect a variety of scents
2. Soak a cotton ball in each chosen scent…be sure they are well-soaked for a strong scent
3. If using a piece of food material rather than liquid there is no need for a cotton ball, just cut off a small piece and make it so a student cannot identify it- for example squish a small bit of banana, garlic or strawberry and place it in the bottom of the scent container
4. Place one scented cotton ball or one piece of food material into a container with a lid
5. Place one container of each scent around the classroom-remove lid/top just prior to activity so as to retain the strong odor
6. Make up a scent container for each student -scents may be used more than once
7. Have children choose a butterfly name for themselves- names can be that of a real species such as Monarch or Swallowtail, they can use their own name or invent one
8. Each student role-plays as a butterfly (if students made coffee filter butterflies, they can use those as props)
9. Individually or in small groups ask the “butterflies” (students) to fly around the “garden” (classroom) and find their host/food plant by smelling its scent
10. Ask each student to try and describe their scent

**Follow-up:**

Ask students:

1. Was your host/food plant easy or hard to smell from far away?
2. Did some plants smell similar to others?
3. Did that make it hard to choose which was yours?
4. What did you do if there was another “butterfly” at your host/food plant?
5. If a butterfly could not smell its host/food plant, what other sense could it use to find it?
Write a Monarch Story

Introduction:
This can serve as a wonderful individual or whole-group activity that combines language arts (story-telling) with science (facts about Monarch butterflies) and could even include a follow-up work of art (illustrate the story).

Objective:
To allow students to showcase their knowledge of butterflies in their own words.

Background:
Students should first understand the anatomy, adaptations, habits and habitat of Monarch butterflies. Use the background information supplied in this manual or other books and materials on Monarch butterflies; see listed resources for more information.

Discuss:
Tell students they are going to write a story (for younger children as a group or individually for older children) that tells about a day in the life of a Monarch butterfly.

Method:
Ask the entire class to author a story about a Monarch butterfly at any or all stages of its life cycle. For younger students invite each student to contribute a sentence or two and write them on the board or overhead as they volunteer ideas. Suggestions to begin the story: “Once there was a caterpillar named (ask class to decide the name) who lived on a Milkweed plant in a field near (the name of your school or town)...”, or “A little girl (or boy) found a chrysalis that had fallen on the ground...” Older students can write individual stories. Urge students to incorporate as many butterfly facts as they are able into the story.

Create:
A story authored by individual students or the entire class; stories and pictures make a great bulletin board decoration or individual booklets for each student; don’t forget to include their illustrations!

Evaluation:
The inclusion of scientific facts regarding butterflies should demonstrate students’ understanding of the Monarch’s life cycle, anatomy, adaptations and habitat.
Butterfly Charades

Overview: This is a fun way for students to learn anatomy and function.

Objective: To teach students how to identify parts of the butterfly/caterpillar body and their function.

Background: Discuss butterfly/caterpillar anatomy and complete activities.

Procedure:

- List the basic body parts of caterpillars and butterflies on the board; head, abdomen, thorax, compound eyes, spiracles, etc. (for younger children you can draw pictures of them).
- Explain that this activity has two parts: acting and guessing.
- Acting: One student chooses a part of a butterfly or caterpillar from the list on the board and acts it out using their body, sound and/or movement, but no words to represent that body part. Allow one minute.
- Guessing: the rest of the class guesses what body part the student is acting out.
- To end the activity, all students will act out their body parts at the same time and gather to make a complete butterfly/caterpillar.

A variation:
- divide the class into teams
- each team has an artist at the board
- when the team guesses the body part, the artist draws it on the board
- the game is finished when the butterfly/caterpillar is complete

Another variation (Pictionary):
- divide the class into teams
- teams take turns; students take turns drawing
- one student chooses a body part and draws it on the board for teammates to guess
- if teammates unable to guess, opposing team guesses
- one point for each correct answer
Label the Caterpillar

Label the parts of the caterpillar listed below by matching the correct letter with the body part

A. **Abdomen** - the long hind part of the body behind the thorax

B. **Abdominal prolegs** - pairs of “false” legs located on each of the abdominal segments 3-6 of the caterpillar that disappear during metamorphosis; the number of pairs varies depending on species

C. **Anal prolegs** - pairs of “false” legs located on the abdominal segments 9-11 (which are fused together) of the caterpillar that disappear during metamorphosis

D. **Antennae** - sensory organ on the head; larval antennae are very small, while adult antennae are very large

E. **Crochets** - tiny hook-like parts located on each of the caterpillar’s prolegs to aid it as it climbs and clings to plants; they also help secure caterpillar to its silk button when it hangs upside down in the “J” formation to form a chrysalis

F. **Head** - the part of the caterpillar’s body that contains the eyes, mouth, antennae, etc.

G. **Mandibles** - located on the head and part of the mouth; jaws

H. **Ocelli** - simple eyes of caterpillars; there are six pairs located on the head; sight is very poor

I. **Palps** (plural-palpi) - organs on either side of the caterpillar’s head around the mouth used to sense and taste food

J. **Setae** - tiny hairs that cover a caterpillar and adult bodies that provides a sense of touch

K. **Spinnerets** - located below the palpi this organ produces the sticky silk thread a caterpillar uses to make a silk button from which to hang and form a chrysalis

L. **Spiracles** - rows of tiny holes located on the caterpillar’s side used for breathing; one pair is on the first thoracic segment and on the first eight abdominal segments

M. **Tentacles** (also called filaments) - the fleshy black extensions at the front (first thoracic segment) and rear (the fused 9-11 segments) of the Monarch larvae, which function as sense organs; these are NOT antennae but are meant to confuse predators trying to attack the head

N. **Thorax** - the middle section of a caterpillar’s body

O. **True legs** - legs that are jointed (like knees) with one pair located on each thoracic segment; these legs remain for the adult after metamorphosis
Caterpillar Anatomy Activity Student Sheet

Caterpillar Head Close-Up

Caterpillar Body
Caterpillar Anatomy Activity Teacher Answer Sheet

Caterpillar Head Close-Up

J
H
D
I
K

Caterpillar Body

G
F
O
A
L
N
E
B
C
M
Design Your Own Caterpillar

Students can learn a great deal about caterpillar anatomy by designing and constructing their own caterpillar models. Encourage them to create their models based on information they have already learned.

When designing their caterpillars, students should keep in mind that caterpillars can bend and turn because their bodies are made up of 13 segments plus a head. This gives students a basic body plan to work from. Here are a few ideas:

• Make a paper chain caterpillar of 13 links plus a round disc for a head.

• Cut apart egg cartons or use Styrofoam balls for body sections and heads; join together using pipe cleaners or toothpicks.

• For body parts use edibles such as marshmallows or gumdrops; don’t forget anatomical detail such as spiracles, antennas, legs and eyes.

• Buttons, stickers, pipe cleaners, yarn, beads and other craft items are great for adding anatomical details.

A Swallowtail caterpillar eats parsley
Butterfly Anatomy Student Activity

Label the parts of the butterfly listed below by matching the letter with the correct body part.

A. **Abdomen**- the tail area of a butterfly that contains most of the digestive system, the heart, trachea (breathing system) and reproductive organs

B. **Antenna**- organ attached to the butterfly’s head that gives it the sense of smell and balance; there are two narrow, club-shaped antennae that have knobs at the ends

C. **Ommatidia**- butterflies have two large compound eyes that can see in almost every direction

D. **Forewing**- the two upper wings

E. **Hindwing**- the two lower wings

F. **Head**- the part of the butterfly that contains the brain, two compound eyes, the proboscis, the pharynx (beginning of the digestive system) with two antennae attached

G. **Leg**- adult butterflies have six legs

H. **Proboscis**- the straw-like mouth or tongue that adult butterflies use to drink nectar

I. **Thorax**- the segment of the butterfly’s body between the head and the abdomen. The legs and wings are attached to the thorax
Butterfly versus Moth

Introduction:
Butterflies and moths may look very similar, but they have many differences in anatomy and behavior.

Objective:
To learn the differences between butterflies and moths.

Background:
Knowledge of butterfly anatomy and behavior. Encourage students to research moth anatomy and behavior; compare similarities and differences of butterfly and moth anatomy and traits.

Discuss:
Talk about the purposes of specific butterfly anatomy and behavior. You may want to read “What’s the Difference Between a Butterfly and a Moth?” by Robin Koontz

Method:
Show the class a picture of a butterfly and a moth; tell students “There are three main differences between butterflies and moths. Look closely and compare each; what differences do you see?” Invite students to share their observed differences in anatomy and any prior knowledge they have of moths. Use a diagram similar to the following to illustrate shared and different traits; this can either be a whole group activity or an individual lesson.

Listed below are some of the differences between most butterflies and moths (there are some exceptions).

<table>
<thead>
<tr>
<th>Butterflies</th>
<th>Moths</th>
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<tbody>
<tr>
<td>Fly during day</td>
<td>fly at night</td>
</tr>
<tr>
<td>Brightly colored on wing tops</td>
<td>earth-toned colored on entire wings</td>
</tr>
<tr>
<td>Slender antennae, with knobs at ends</td>
<td>feathery-looking</td>
</tr>
<tr>
<td>Warm bodies to fly by basking in sunlight</td>
<td>warm bodies to fly by “shivering”</td>
</tr>
<tr>
<td>Slender bodies</td>
<td>thick, stout bodies</td>
</tr>
<tr>
<td>Smooth scales</td>
<td>thick, furry-looking scales</td>
</tr>
<tr>
<td>Smell using sensors on feet &amp; antennae</td>
<td>smell using antennae only</td>
</tr>
<tr>
<td>Front &amp; hind wings not connected</td>
<td>front &amp; hind wings connected</td>
</tr>
<tr>
<td>Less numerous in population</td>
<td>more numerous in population</td>
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</table>
Butterfly versus Moth Student Activity

Here are some traits of butterflies and some traits of moths. Write the letter of each butterfly trait in the “butterfly traits” circle; write the letter of each moth trait in the “moth traits” circle and write the letter of traits that both share in the area where the circles overlap.

A. usually brightly colored  
B. makes a cocoon  
C. has six legs  
D. antennae are club-shaped at the ends  
E. head, thorax and abdomen  
F. two pairs of wings  
G. hatches from an egg  
H. makes a chrysalis  
I. has two antennae  
J. usually active at night  
K. body is thick and looks hairy  
L. usually active during the day  
M. mouth is a proboscis  
N. is an insect  
O. usually colored in earth-tones  
P. antennae are often thick and feathery  
Q. has compound eyes  
R. body is thin and looks sleek  
S. undergoes complete metamorphosis
**Teacher Information-Butterfly versus Moth Activity**

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**Teacher Information: Build a Bug Activity**

**Objective:** Students apply their knowledge of good, bad and ugly bugs and create their own insect based on knowledge gained from observing insects in their natural habitats.

**Materials:** paper, colored pencils or markers, Build a Bug work sheet

**Procedure:** Invite each student to use their imagination to create and illustrate a really cool insect based on real observations they made. Give each student a Build a Bug work sheet to fill out first to help them plan and create their insect. They must answer all questions about their insect and be prepared to describe their pictures before the entire class.

Sample of the Build a Bug Work Sheet

1. Bug Name______________________________________________________________

2. Where do I live?_________________________________________________________

3. What do I eat?___________________________________________________________

4. What eats me?___________________________________________________________

5. How am I adapted to my environment?

   Movement______________________________________________________________
       ___________________________________________________________________

   Shelter______________________________________________________________
       ___________________________________________________________________

   Size and shape________________________________________________________
       ___________________________________________________________________

   Color_______________________________________________________________
       ___________________________________________________________________

   Other_______________________________________________________________
       ___________________________________________________________________
Build a Bug Activity Work Sheet

Name: _______________________________________________________________________

**Directions:** Use your imagination to create and draw a really cool insect based on real observations you made. Fill out this Build a Bug work sheet first to help you plan and create your insect. Answer all questions about your insect and be prepared to talk about your insect picture with the entire class.

6. Bug’s name______________________________________________________________

7. Where does it live?_______________________________________________________

8. What does it eat?________________________________________________________

9. What eats it?___________________________________________________________

10. How is it adapted to its environment?

   Movement______________________________________________________________
   _____________________________________________________________________

   Shelter_______________________________________________________________
   _____________________________________________________________________

   Size and shape_______________________________________________________
   _____________________________________________________________________

   Color_______________________________________________________________
   _____________________________________________________________________

   Other_______________________________________________________________
   _____________________________________________________________________
Camouflage Activity

Introduction: Some animals like birds, ants, spiders and mice hunt butterflies and eat them as food. In order to protect themselves from predators butterflies have developed adaptations to help keep them from becoming food.

Objective: To assist students’ understanding of how camouflage works and its importance for survival.

Background: Students should be familiar with the terms warning coloration, camouflage, and mimicry and defense patterns. Students can find pictures of different types of camouflage on the internet, in magazines, or even a Nature walk on school grounds.

Teacher Background:

- **Warning coloration**: in Nature the colors red, orange, yellow and white warn predators to stay away and that the targeted prey tastes bad, is poisonous or may sting or bite.
- **Camouflage**: earth tone colors or patterns that allow butterflies to hide from predators by blending into their surroundings such as leaves, branches or tree bark- this is called cryptic coloration.
- **Mimicry**: color patterns that make butterflies appear as something else in Nature, such as a less tasty insect, plant or animal. There are two types of mimicry:
  - Batesian Mimicry- harmless species that copy the appearance of a poisonous or distasteful species; they pretend to be poisonous to avoid being eaten.
  - Mullerian Mimicry- two species that not only appear alike (using the same color pattern), but are also poisonous or distasteful; once a predator attacks one, it remembers the bad taste and the coloration and will not attack the other.
- **Defense patterns**: a bright spot or spots that appear as eyes and scare the predator into thinking the prey is a larger predator.

Discuss: Review camouflage terms by asking the class, “Name all of the ways butterflies can protect themselves using color”. List them on the board and ask for descriptive explanations of each.

Materials: drawing paper, scissors, crayons or markers, tape

Method:

- Tell students they will each design a butterfly that will appear camouflaged to blend in with some area in the classroom.
- Distribute art materials to each student.
- Invite them to look around the classroom carefully and choose a small area to hide their butterfly.
• Instruct students to color their butterflies using colors and patterns that will camouflage their butterflies; then cut them out.

• When everyone is finished have students place a folded piece of tape on the backs of their butterflies.

• Break the class into groups of 5 or more.

• While the remainder of the class closes their eyes, have the first group “hide” their butterflies in areas of the classroom where the butterflies appear camouflaged.

• When the group’s butterflies are hidden, encourage the rest of the students to find the camouflaged butterflies.

• When all of the butterflies are found, ask another group to hide their butterflies.

• Continue until all groups have hidden their camouflaged butterflies.
Teacher Information

Now You See Me, Now You Don’t Camouflage Activity

Objective: Students learn the importance of camouflage to a creature’s survival.

Materials: M & M’s candy, candy corn, large shallow foil baking sheet, paper plates, plastic spoons, graph, red, orange, yellow, blue, red and brown colored pencils, crayons or markers

Preparation:
1. Separate each color of M & M’s candy, making sure that there is the same number of each color. There should be at least twice as much candy corn as M & M’s
2. This activity is best done in groups of 4 or 5 students
3. Place the same number of each color of M & M’s on each groups’ baking sheet
4. Measure and place the same amount of candy corn on each baking sheet—remember the amount of candy corn should be at least double that of M & M’s
5. Carefully mix up the two kinds of candies
6. For each group set out one tray of mixed candies, one plastic cup, one plastic spoon and one graph

Procedure:
1. Break students into equal groups
2. Tell students they are hungry predators looking for a meal—they are hunting for the M & M “bugs” only (candy corn is the background of which the prey is camouflaged)
3. This is a timed event—the activity begins and ends upon the teacher’s direction
4. Students will take turns capturing “prey”
5. Using the plastic spoon the first predator in each group captures ONE prey item and places it into the plastic cup
6. The spoon is then passed to the next predator in the group to repeat the hunt—remember predators may only capture ONE prey item per turn
7. Allow about 30 seconds to one minute for “The Hunt”—predators STOP when the teacher directs
8. Each group counts the number of each color of M & M
9. Either together as a whole group or in individual small groups, have students graph their results according to color

Conclusion:

Hold a classroom discussion about the findings of this activity and ask the following questions.

1. Which color was found the most? Why? (The color was easiest to see.)
2. Which color was found the least? Why? (The color was most difficult to see.)
3. If graphs were done in groups, compare and combine results onto one large graph on the board
4. What did you learn about camouflage?
**Teacher Information**

**Now You See Me, Now You Don’t Graph**

Make a bar graph of your findings by coloring with your pencils, crayons or markers the number of M & M’s prey you found. This is a sample of a student’s graph.

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![Image of candy corn]  ![Image of M&Ms]
**Now You See Me, Now You Don’t Graph**

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</tbody>
</table>
Teacher Background Information

Beneficial Insects

Background Information:

Lots of insects are pests. They bite us and eat our crops. It’s easy to forget that lots of insects help us. Some insects and spiders are predators that eat pests that harm our vegetables or invade our homes. The difference between pest and beneficial insects is in the eye of the beholder. For example, honey bees are usually thought of as beneficial because they pollinate crops and produce honey; however, if a swarm takes up residence in your home and you get stung, you are more likely to define them as pests.

Even plant-feeding organisms may be considered beneficial if they are feeding on unwanted plants like invasive exotics but if those same bugs start eating your favorite flowers you may not think of them as beneficial. Bees, flies, butterflies, praying mantids, wasps and lady bugs are the easiest “good bugs” to recognize and they all help pollinate flowers. Aphids, cutworms, mealy bugs and other pests are “bad bugs” that prey on the leaves of our flowers and eat wholes in our vegetables.

Organisms are said to be beneficial when they help reduce pest damage. The action of one living organism controlling the population of another organism is called biological control. Organisms that feed on pests are called natural enemies. All insect pests and a few plant pests have some natural enemies. Natural enemies can help reduce pest populations, the damage they cause and the need for costly pesticides or other controls. Natural enemies are classified into three general groups: predators, parasites or parasitoids, and pathogenic organisms. Predators are selected for their ability to feed directly on nuisance insect or plant species. An example of a predator is the green lacewing which feeds upon aphids or beetles that eat vegetables in our gardens. Instead of using harmful, expensive chemicals many gardeners and farmers use “good bugs” to control pest outbreaks. These insects are the natural enemies of garden pests. In most cases, they’ll leave the good bugs alone and only prey on the bad bugs.

Besides the larger predators like lacewings, spiders and mantids, there are many other helpful garden insects that go unnoticed and under-appreciated because of their small size. They are the beneficial parasites, or more correctly, parasitoids of the garden. In Nature parasites usually only weaken or sicken their hosts. Parasitoids kill and actually eat their prey. Unlike predators which easily move around and consume many prey, parasitoids usually feed on only one host.

Parasitic wasps are among the most effective and common parasitoids in the garden, yet few gardeners notice them. These tiny insects lay their eggs either inside or on their host. Once these eggs hatch, the wasp larvae feed on blood and tissues inside the host, eventually killing it. Although one parasitoid only kills one host, each female parasitoid lays her eggs in dozens or hundreds of hosts.

Pathogens are bacterial, fungal, or viral organisms that cause disease or upset the lifecycle of harmful insects or plants. For example, Bacillus thuringiensis, called Bt, is a bacterium is used to control harmful insects like gypsy moth caterpillars, Colorado potato beetle larvae and mosquito larvae. Disease outbreaks can cause large pest populations to “crash” without using dangerous chemicals.
**Beneficial Insects**

**Objectives:**

Students learn that not all insects are pests, how to identify beneficial insects and how insects can benefit a garden.

**Materials:**

Clipboards
Pencils
Beneficial Insect Data Sheets
Beneficial Insect Identification Sheets
Hand Lenses

**Procedure:**

School gardens, playgrounds, adjoining natural areas or even the landscaping plants around the building are great places to find beneficial insects without having to take a field trip. With some background information and a little preparation students can carefully search, observe and learn how to identify some common beneficial insects. If you have access to an insect field guide allow students to use them as they discover bugs they don’t recognize.

1. Copy and use the Beneficial Insect Identification Sheet to identify the most common insects.

2. Invite students to search, observe (*carefully* with hand lenses), identify (using identification sheets) and record (on their Data Sheets) how many of each kind of beneficial insect they see.

3. Encourage students to take good notes that will help them with their follow-up writing.

4. Have a class discussion on which insect they found most interesting or ugly or gross.
**Beneficial Insects Data Sheet**

Name:________________________________________________________

Search for and observe as many different kinds of beneficial insects listed below that you can. Place a tally mark beside each insect as you find one. Record notes about each insect.

<table>
<thead>
<tr>
<th>Predator</th>
<th>Tally</th>
<th>Field Notes/Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Praying Mantis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lady Bug</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green Lacewing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wasp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assassin Bug</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spider</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Pollinator**

<table>
<thead>
<tr>
<th>Pollinator</th>
<th>Tally</th>
<th>Field Notes/Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butterfly/Moth</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Beneficial Insects Identification Sheet

Assassin Bugs- These flying bugs have a huge appetite for many kinds of pests. They catch and suck the juices from their prey using their tube-like mouthparts but they also can bite people.

Lady Bugs- The beetles are very common in gardens and have a huge appetite for aphids. Most lady bugs are red or orange with black spots and are very easily recognized. Lady bugs fly.

Green Lacewings- Lacewings look like small, green dragon flies but are most closely related to beetles. They eat aphids and fly from plant to plant.

Praying Mantis- These arthropods catch their prey in their front legs and chew them up with their mouthparts. Mantids are excellent jumpers and occasionally fly.

Spiders- There are many shapes and sizes of spiders and they are all very efficient predators. Some have venom that kills their prey, but most are not dangerous even though they look scary. Most spiders make webs that catch their meals.

Wasps- Wasps are very helpful because they feed on caterpillars and other pests. Some lay their eggs inside their prey where they hatch and eat the pest. Because they can deliver a painful sting it is best to move slowly and give wasps their space.

Pollinators- Bees, flies, butterflies and moths are important pollinators. They are attracted to brightly colored flowers where they feed on nectar. As they feed, the furry bodies of these insects picks up and holds pollen, which is transferred when they move from flower to flower sipping their food. Some of these insects, like some species of flies or moths, hover like hummingbirds so they don’t have to land. Most of the pollinators have a long tongue called a proboscis that allows them to drink nectar from deep inside the flowers.
Beneficial Insects Description

Name:______________________________________________________________________

Directions: Write a description of the insect or spider you liked the most or that you spent the most time observing then answer the following questions.

1. What did the insect look like?

2. Do you think it was a predator or a pollinator?

3. Could it be both? Why or why not?

4. Was it camouflaged or brightly colored?

5. Was it on a plant? Where?

6. Was it eating anything? What?

7. What else was it doing?

8. What else would you like to know about this insect?
**Teacher Information**

**Friend or Foe?**

**Insect Observation Sheet**

**Objective:**
Students search for a variety of insects and decide if the bugs are good, bad or both, based on their observations.

**Materials:**
Hand lenses, clipboards, pencils and The Good, the Bad and the Ugly Bugs Friend or Foe? worksheet, ruler

**Procedure:**
Students work in pairs or small groups and walk around the school grounds searching for insects and/or evidence of insects. Students will record a least 3 different types of insects using hand lenses to observe size, shape, color and insects’ activities/behaviors.

Students will observe and fill out the worksheet and answer the questions below for each of three insects they find. Allow about 30 minutes’ observation time-10 minutes for each insect

What kind of insect are you observing? _______________________________________________________

Size: ___________ inches/centimeters wide, ___________ inches/centimeters long

1. Shape (draw outline)
2. Color (describe all colors)
3. Where was it found (under leaves, on plants stems, on sidewalk)?
4. What evidence did you see that told you to look here for insects here?
5. What was it doing?
6. Do you think it is a good bug, a bad bug or both?
7. Why?
Friend or Foe?
Insect Observation Sheet

Names___________________________________________________Date________________

First Insect

What kind of insect are you observing?__________________________________________

Size: ______________inches/centimeters wide, _______________inches/centimeters long

1. Shape (draw outline)

2. Color (describe all colors)

3. Where was it found (under leaves, on plants stems, on sidewalk)?

4. What evidence did you see that told you to look here for insects here?

5. What was it doing?

6. Do you think it is a good bug, a bad bug or both?

7. Why?

Second Insect

What kind of insect are you observing?__________________________________________

Size: ______________inches/centimeters wide, _______________inches/centimeters long

1. Shape (draw outline)

2. Color (describe all colors)

3. Where was it found (under leaves, on plants stems, on sidewalk)?
4. What evidence did you see that told you to look here for insects here?

5. What was it doing?

6. Do you think it is a good bug, a bad bug or both?

7. Why?

**Third Insect**

What kind of insect are you observing?

Size: ___________ inches/centimeters wide, ___________ inches/centimeters long

1. Shape (draw outline)

2. Color (describe all colors)

3. Where was it found (under leaves, on plants stems, on sidewalk)?

4. What evidence did you see that told you to look here for insects here?

5. What was it doing?

6. Do you think it is a good bug, a bad bug or both?

7. Why?
Teacher Information and Answer Sheet
What’s Bugging You???

Objective:
Students learn that some insects are beneficial, some are detrimental and others can be both, depending on the environment where they are present.

Materials:
Hand lenses, magnifying jars

What’s Bugging You???

1. What is YOUR definition of a pest?
   *An animal that causes economic loss or significant visual damage to structures, crops or the environment*

2. How are some insects helpful?
   *Eat other insects that are pests, pollinate crops, pretty to look at (Butterflies), food for other animals, decomposers reduce organic waste to humus*

3. What can cause insects to get sick and die?
   *Other insects, disease or chemicals, temperature extremes, drowning, suffocation, food poisoning*

4. What do humans do to keep pests under control and from taking over our homes or gardens?
   *Recognize them; exclude them; discourage them by crop selection/rotation or environmental changes; kill them with chemicals, bio-control; monitor*

5. Define:
   Pathogen - *an organism which causes disease (fungi, bacteria, virus, nematode)*
   Parasite - *an organism that feeds on another living thing (host) for part of its life*
   Parasitoid - *an organism that feeds on another living thing and kills it*
   Host - *an organism damaged by a disease or another organism*
   Predator - *an organism that hunts and kills its food*
   Prey - *an organism that is food for a predator*

6. How do pesticides impact the environment?
   *Vapors may pollute air; spills pollute water and soil, may kill non-targeted creatures, residues may be poisonous on crops*
What’s Bugging You???

Name______________________________________________________Date____________

What is YOUR definition of a pest?

How are some insects helpful?

What can cause insects to get sick and die?

What do humans do to keep pests under control and from taking over our homes or gardens?

Define:

Pathogen-
Parasite-
Parasitoid-
Host-
Predator-
Prey-

How do pesticides impact the environment?
Milkweed Bug Investigation by:

Name: _______________________

Date: _____ Time of Day: _______ Weather Conditions: _________________________

Observe Milkweed bugs on the plants. Then use a hand lens carefully to look more closely at the Milkweed bugs and answer the following questions.

1. What colors are the Milkweed bugs?
2. On what part or parts of the plant are they found?
3. What are the bugs doing?
4. Are the bugs by themselves or in groups?
5. Do all Milkweed bugs have the same colors?
6. Do they all have the very same markings or patterns?
7. Do Milkweed bugs have wings?
8. Are their heads large or small compared to the rest of their bodies?
9. How many eyes do they have?
10. How many legs do they have?
11. Do Milkweed bugs have antennae? If so, what do you think they are used for?
12. What do you think Milkweed bugs eat?
13. How do you think Milkweed bugs eat?
14. Do you think Milkweed bugs are good or bad? Why?
15. Describe things about Milkweed bugs you noticed with the hand lens that you didn’t notice when you observed them using only your eyes.
16. What do you still wonder about Milkweed bugs?
17. On the back of this sheet or on another piece of paper draw what you saw....
Insect Observation Investigation

**Objective:** Students will learn about insects by observing them

**Materials:**
- Clipboards
- Pencils
- Insect Observation Sheets
- Insect Parts Diagrams
- Hand lenses

**Background Information:** Remember, insects have three main body parts: head, thorax, and abdomen; six legs, and one pair of antennae, and may have one or two pairs of wings.

**Procedure:**
1. Find an insect and observe it
2. Be quiet and still—DO NOT TOUCH…only watch
3. Draw the body parts in the boxes on your observation sheet—label them
Insect Observation Sheet

Name: ____________________________________________________________

Directions: Quietly find and observe an insect with a hand lens. Draw the insects doing the activity or behavior listed below and record their location. You may not see every behavior listed.

<table>
<thead>
<tr>
<th>Behavior or activity</th>
<th>Location</th>
<th>Draw insect (label body parts)</th>
<th>Behavior or activity</th>
<th>Location</th>
<th>Draw insect (label body parts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating</td>
<td></td>
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<td>Communicating</td>
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<tr>
<td>Drinking</td>
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<td>Flying</td>
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<td>Resting or waiting</td>
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<td>Raising young</td>
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<td>Hiding</td>
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<td>Other?</td>
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<tr>
<td>Dying</td>
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<td></td>
<td>More?</td>
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<tr>
<td>Building a home</td>
<td></td>
<td></td>
<td>Very Cool?</td>
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</tbody>
</table>
Insect Observation Investigation Follow-Up

Name_______________________________________________________

1. What activity or behavior did you observe a butterfly or other insect doing to survive?

2. If it appeared to be doing nothing, what behavior(s) might it have been doing?

3. If a butterfly or other insect was eating, how was it eating?

4. What was it eating?

5. Did you observe two or more butterflies or insects together?

6. What did they seem to be doing?

7. Where were the butterflies or insects located?

8. How can we tell if butterflies or other insects are communicating?

9. What is the most interesting activity or behavior you observed? Why?

10. What new thing did you learn?
Finding Host Plants

**Introduction:** Butterflies travel long distances in search of mates and host plants for their offspring. Female butterflies use their senses to find host plants on which to lay their eggs. In the process they drink nectar from, and pollinate, many flowers which helps maintain strong plant species, resulting in increased plant populations and survival rates.

**Objective:** To teach students the power and importance of the senses; how butterflies find host plants.

**Background:** Students should be introduced to which senses butterflies use.

**Discuss:** Remind students the purpose of host plants and their importance to butterflies’ survival; talk about the senses of smell, feel, taste, sight.

**Materials:** 2 small paper plates for each student; 1 index card for each student; 6 jams & jellies--all similar in color, some can be the same flavor provided the texture is slightly different--but colors are the same.

**Method:**

1. For each student set out 2 small paper plates and an index card.
2. Assign a number to each of the 6 jams/jellies.
3. Write numbers for each of the jams/jellies on one of each student’s plates.
4. Place a small dab of each jam/jelly next its number on the plate.
5. Write the name of 1 jam/jelly on the second plate and place a small dab of that jam/jelly next to it.
6. Explain that every species of butterfly caterpillar is adapted to eat only the host plant and so the female butterfly must search carefully to locate the correct host plant on which to lay her eggs.
8. Write the ways a butterfly recognizes the host plant on the board.
9. Tell students that the labeled jam/jelly on their plate is their “host jam/jelly”; tell them to pretend they are butterflies and their baby caterpillars can only eat that “host jam/jelly”.
10. Ask students to use their senses to carefully examine their “host jam/jelly” on the second paper plate; they are to record all observations on the index card.
11. Students then use their senses and observations to determine which of the six mystery jams/jellies is their “host jam/jelly”?
12. When they make their choice, tell them to write down the number (1-6) of the jam/jelly on the index card.
13. When everyone is finished, share results; ask students what observations and sense they used to determine their host jam/jelly. Explain that butterflies use this same procedure to find their host plants, food and mates.

**Variation:** A similar activity can be set up using cotton balls scented with a variety of scents (vanilla, lemon, lavender, etc.) to determine how butterflies locate nectar sources (flowers) or each other for mating (pheromones).
A Lesson in Mimicry

**Introduction:** This is a fun, but very purposeful whole class activity.

**Purpose:** To clearly demonstrate the concept of mimicry as a butterfly defense mechanism.

**Background:** Mimicry is a defense used by brightly colored butterfly species that taste good to predators. Their color patterns appear very similar to those poisonous butterflies. A harmless Viceroy has the same coloration as a poisonous Monarch. A predator that once made the mistake of taking a bite from a Monarch would never attempt to eat any species of similar color.

**Materials:** Some type of food students enjoy (please check for food allergies prior to performing this activity); see suggestions below; small paper plates.

**Discuss:** Ask students, “How do predators learn to avoid prey that tastes terrible?”

**Method:** Buy/prepare one of the foods suggested below. Allow enough for the entire class to sample and divide chosen food into two batches. One batch should be prepared to taste “normal”; the second batch should taste terrible but be the same in appearance. Examples of easy food to use:

- popcorn: one batch popcorn normal- the other very heavily salted
- chocolate chips: one batch sweet chips-the other unsweetened
- powdered chocolate: one batch sweetened-the other unsweetened
- Kool-Aid: one batch made normally- the other add some vinegar
- Home-made cookies: one batch made normally-the other without sugar & too much salt

1. Without informing students, divide the class into two groups.
2. Group A will receive a batch of the “normal” food, and Group B will receive the terrible-tasting food.
3. Ask all students to eat their food (and enjoy the reactions!!).
4. Now offer a second sampling of only the “normal” food to all students without telling them it is “normal”.
5. How many students avoid/decline a second helping?
6. Explain how this experience is the way a predator learns to avoid butterflies that appear the same (mimicry).
7. How many students did not want to chance that a perfectly “normal” food might taste terrible?
8. Now compare the Monarch and Viceroy butterflies. Both species are colored the same (warning coloration) and both have a similar color pattern (mimicry), but the Monarch tastes bad and the Viceroy does not (to many predators). The Viceroy is a mimic of the Monarch. If you were a predator would you take the chance of a bad tasting meal???
The Secret Likes of Butterflies

Introduction:
Flowers provide food in the form of nectar for butterflies. The activities listed below can be performed individually, in pairs or in small-groups. Use the sample Butterfly Observation Sheet below as a template and tailor it to each specific activity.

- Do butterflies prefer the taste of one species of flower over another?
- Do butterflies prefer a certain color of flower over another?
- Do butterflies prefer a specific shape of flower over another?

Objective:
This activity is designed to sharpen students’ observation skills and demonstrate how sight, color, smell, taste and touch help locate and determine which flowers is preferred food by butterflies.

Background:
Students should have prior knowledge of local flowering nectar plants in the area where the study will take place. A butterfly garden or nearby park are ideal places to conduct this study. If your school does not have a butterfly garden, planted landscape or open area with wildflowers/weeds, you may either set out potted plants brought from offsite or simply use whatever plant material is growing naturally. Do not use plants that have been exposed to chemicals, as this could be fatal to the butterflies. Bring potted plants several days in advance to draw butterflies and remember to water them generously. Place plants in a safe area free of much activity to encourage visitation. Use field guides to identify all butterfly and plant species utilized in the study. A good understanding of butterflies’ senses also assists students with this activity.

Discuss:
Do butterflies drink nectar from a variety of flowers? Do certain species of butterflies like the taste of certain species of plants? Or do all butterflies visit only a certain kind of flower? (You may want to break this into three different studies)

Materials:
Field Guides for Wildflowers, Garden Flowers, Herbs and Butterflies; clipboards, paper, pencils, colored pencils

Method:
- Find an area on school grounds with several different kinds of flowering herbs, weeds, flowers
- Remind students to move slowly and quietly as they approach the study area
- Invite students to observe butterflies as they visit the area’s flowers
- Instruct students to make up a tally sheet of the different species of flowers and the different species of butterflies. Use colored pencils to represent the common names and/or colors of the flowers used in this study
- Encourage students to identify and follow an individual butterfly for as long as possible
- Each time the butterfly visits a flower, s/he makes a tally mark in the appropriate category
- After observations are complete share data and discuss
<table>
<thead>
<tr>
<th>Butterflies Observed Color/Species/ Shapes Of Flowers</th>
<th>Queen</th>
<th>Gulf Fritillary</th>
<th>Zebra Longwing</th>
<th>Monarch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Salvia Lip-shaped</td>
<td>![](Red Salvia Lip-shaped.png)</td>
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</tr>
<tr>
<td>White Viburnum Star-shaped</td>
<td>![](White Viburnum Star-shaped.png)</td>
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<tr>
<td>Yellow Dune Sunflower Strap-shaped</td>
<td>![](Yellow Dune Sunflower Strap-shaped.png)</td>
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<tr>
<td>Purple Porterweed Saucer-shaped</td>
<td>![](Purple Porterweed Saucer-shaped.png)</td>
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<tr>
<td>Pink Beauty Berry Funnel-shaped</td>
<td>![](Pink Beauty Berry Funnel-shaped.png)</td>
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</tbody>
</table>
Monarch Chrysalides Investigation

Objective:
To learn if the length of a butterfly’s chrysalis stage is affected by light

Materials:
6- large Monarch (or other butterfly) caterpillars (larvae) order from Insect Lore, Carolina Biological, Shady Oaks Butterfly
3- small butterfly cages (Nasco’s 1-½ gallon flex-tanks with domed lids are great for this)
Lots of fresh milkweed (for food until larvae pupate)
Light source

Procedure:
1. Keep 6 caterpillars (larvae) in clear cages (2 in each cage) with plenty of fresh Milkweed to eat until they pupate
2. Once the chrysalides are fully formed, number them (on the outside of the cage) and place the cages as described below
3. Keep 1 clear box with 2 chrysalides under constant light (not too hot!!)
4. Keep 1 clear box with 2 chrysalides in a totally dark environment (inside closet, cabinet or with a dark cloth over it)
5. Keep 1 clear box with 2 chrysalides on a counter top or table in the classroom, exposed to natural light of day and night-this is the CONTROL group
6. Students hypothesize what they think happen to the chrysalides in each setting
7. Students observe and record chrysalides daily until butterflies emerge
8. Students record their findings on the Data Sheet

Follow-Up Discussion:
1. Did the 6 chrysalides vary in the time they spent in the chrysalis stage?
2. Which chrysalis emerged as an adult first and from which condition?
3. From which condition did an adult emerge from chrysalis last?
4. Do you think the amount of light affected the amount of time the butterfly spent in the chrysalis stage? What is your evidence?
5. Which condition was the most normal of the three? This condition is called the control-it is used to compare the other conditions.
6. Was there a condition of variable you found hard to keep the same? What was it?
7. Why was it difficult to keep this the same?
8. Do you think this affected the results of your experiment? Why or why not?
9. If you were to do the experiment again, what might you do differently?
10. What other experiments could you do using chrysalides?
## Chrysalides Investigation Data Sheet

Name______________________________________________ Chrysalis #___________

Location of Chrysalis (circle one)            Constant Light  Constant Dark  Natural Light

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Appearance</th>
<th>Other Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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How High Do They Fly?

Introduction:
This is a wonderful whole class outdoor activity when done in an area heavily populated with a variety of butterfly species. Students observe the (approximate) flying heights of varying species of butterflies.

Objective:
To observe different species of butterflies fly at different heights and the purposes for the behavior.

Materials:
Binoculars, clipboards, data sheets, pencils, yard sticks or measuring tapes

Background:
Different species of butterflies fly at differing heights for the following reasons:
- Food sources (the size/height of their host or nectar plants)
- Varying microclimate (wind speed, temperature, light intensity)
- Color (in order to blend into shadows or backgrounds)
- Migration (fly higher to avoid predation & use wind currents to assist)
- Environmental temperature (heat regulation to circulate hemolymph)

Research:
Students should be able to identify a given area’s most commonly found butterfly species and their behaviors.

Discuss:
Ask students why they think butterflies fly at different heights; list reasons on the board. Students can then help invent a data sheet to record their observations; important inclusions could be:

- the species of butterfly
- the specific behavior observed (nectaring, free-flying, laying eggs, mating, fighting, etc.)
- approximate height of flight (measuring will be approximate-wait until AFTER the butterfly departs)
- weather conditions (windy, cloudy, sunny)

Method:
Invite students to carefully observe butterflies as they fly, note their behavior and pay attention to proximity to the ground (or other objects) to help them estimate vertical height for measuring purposes. Record observations and note evidence and reason for flight height.
Monarch Migration Activity

**Introduction**: This could be a combination writing, science and geography activity. Students will need some background in Monarch migration (see article and websites). Students may work individually or in groups and present their research reports to the entire class orally, or turn in as a written report. Encourage students to illustrate maps and draw pictures as an added dimension to their reports.

**Objective**: To learn about butterfly migration

**Background**: See above article and visit Monarch websites for more information

**Discuss**: The term migration, its meaning, what animals migrate, why they migrate

**Research**: Use books, internet websites listed below

**Method**: Pretend you are a Monarch butterfly. You were born in the late summer in North America, and now you are planning to migrate to Mexico for the winter. You will have to know where to go, how to get there and when you will be back.

Use a map of North America to plan your migration and answer the questions below:

- How will you know when it is time to migrate?
- Where will you start?
- When will you start?
- Why will you start then?
- Which direction are you heading?
- How will you know where to go?
- What is your final destination?
- What are some of the dangers you could encounter?
- What will you eat on your trip?
- Where and when will you sleep?
- Will you fly during bad weather conditions?
- How far will you fly in one day?
- When will you return next spring?
- How will you know when to start back?

**Create**: a map of your migratory flight pattern

**Evaluation**: Teacher can pre-determine the number of points to be awarded for map(s), report, drawing(s), and presentation.

**Resources**:
Monarch Monitoring Project: [http://www.concord.org/~dick/mon.html](http://www.concord.org/~dick/mon.html)
Suggestions for Long Term Butterfly Studies

The following are ideas for some long term projects related to butterflies:

We know that Monarchs will feed for dishes containing sponges and artificial nectar. The sponges are available in a variety of colors (use only new from the package and rinse thoroughly before using- do not use previously used sponges). Make up artificial nectar using 1 teaspoon of sugar (do not use any type of artificial sweetener) mixed into 1 cup of pure bottled water.

- Can Monarchs see color?
- Can Monarchs learn colors?
- If given a choice of colors associated with feeding dishes, do Monarchs have a preference for a certain color?
- Do butterflies prefer sugar to artificial sweeteners?
- How much leaf tissue (in weight) does a Monarch eat through its entire larval stage?
- Since male Monarchs are larger and heavier than females, do male larvae eat more leaf tissue?
- Milkweed species vary greatly in leaf toughness and chemistry. Do Monarchs reared on different Milkweed species all grow at the same rate and reach the same size?
- Do Monarchs raised in the classroom in September join the wild Monarchs and migrate?
- What plants do Monarchs frequent for food? Are there plants they never feed from?
**Milkweed Plant Study**

**Introduction:** This activity can be done individually, in small groups or as a whole class observation.

**Purpose:** To learn and observe the life cycle of Milkweed plants.

**Background:** Students should know basic plant anatomy and function such as the roots, stems, leaves, flowers. Milkweed is a perennial plant and will continue to grow after eaten down or cut back. After the plant blooms, seed pods are formed and then fuzzy seeds emerge and are blown about by the breeze to grow new plants.

**Materials:** Milkweed plants (preferable) pictures of Milkweed plants in all stages (only if live plants cannot be obtained), hand lenses, rulers/tape measures, thermometers, data sheets, clipboards

**Discuss:** Animals are not the only organisms that experience growth or life cycles. Milkweed plants undergo many changes during their life cycles. Describe how Monarchs use Milkweed as their host plant. Ask students to identify the purpose of each plant part.

**Method:** Using potted or planted Milkweed plants; encourage students to keep a journal of the growth and development of a plant. Invite them to obtain and record periodic measurements such as height, surrounding temperature and general observations at regular intervals (daily, weekly, twice per week). Some possible observational questions you may ask them to discuss/write about in addition to the obvious environmental/developmental conditions could be:

- Are bugs chewing on the plant?
- Are there insect eggs laid on the undersides of the leaves, if so identify them
- Color(s) of the plant
- Are any polka dots present on the leaves?
- What color are they?
- Why are they present?
- What are those pods growing from the plant?
- What are they for?
- What part of those fuzzy things is the actual seed?
- What function does the fuzz provide?

When pods are ripe, split some open and observe the seeds within, plant some of the seeds. Caution: handle plants with care as the milky white sap can be irritating to the skin. Children should NOT touch their mouths, nose or eyes until hands are washed. To avoid any problems, have students wear disposable vinyl gloves (from pharmacy). Monarch larvae strip the entire plants of their leaves-can the plant survive? Ask students to draw and write about the entire growth and development sequence in their journals.
Old or New?

Introduction:
This activity sharpens students’ observation skills by requiring they closely examine the leaves on which caterpillars are feeding. This investigation can either be performed outdoors in the caterpillars’ natural habitat or inside while housed in a caterpillar “condo”.

Objective:
To determine if caterpillars prefer to ingest younger or older leaves; are there benefits, advantages or disadvantages to their eating preferences?

Background:
Monarch and other caterpillars feed on their specific plants’ leaves in order to gain: vitamins for proper growth, minerals to insure reproduction, chemicals to strengthen immune systems against disease and chemicals for protection against predators. Be certain students can easily recognize the physical appearances of young versus old leaves/plants (examples: thin, pliable branches vs. thick, stiff branches; smaller, lighter green leaves vs. darker larger leaves, etc.).

Discuss:
Review the concept and purpose of host plants. Ask students to site possible physical differences between young versus old plants; then inquire how these differences may assist or hinder caterpillars. How does an old plant or leaf appear? How would you recognize a young leaf?

Method:
Students observe caterpillars eating plant leaves (natural habitat preferred). If performing this activity in captivity have plenty of differing ages of leaves/plants readily available for caterpillars dining enjoyment. Remind students they are to assess the plants and Invite students to record observations.

Research:
Before choosing/identifying the designated caterpillar species for observation, it is imperative to identify its particular host plant(s) and be sure there is a copious supply (and in varying ages).

Follow-up Discussion:
List observations on the board and ask students
How may the differences you recorded affect the caterpillar? Why? Discuss the appearance, quality (taste), nutrition, texture (feel), strength, as a water source, smell, etc. of young versus old leaves/plants would make them preferred food for the caterpillars.
How do caterpillars choose which leaves they will eat? (by touch? smell? feel?)
Ask students to justify their determination that caterpillars prefer old/young leaves (they can do this by citing for instance; older leaves have more chemicals built up inside, therefore older leaves are more beneficial for chemical protection…or younger leaves are more tender and easier to chew).
Air Quality and Plants Activity

Introduction:
The following activity will help students understand how leaves filter pollution for the air and how the residue from the pollution can hinder the natural processes of the plant, ultimately leading to permanent damage or death.

Objectives:
- Observe evidence of air pollution
- Determine possible damage to foliage and resulting consequences for entire tree
- Describe ways trees can benefit air quality
- Determine how to use landscape materials to decrease energy use

Background:
Trees are much more than something pretty in your yard. They are important for a number of reasons:
- reducing run-off of water
- providing habitat for wildlife
- providing people with forest products
- providing recreation sites
- economic value
- aesthetic value

In addition, trees and plants have a great impact on our air quality. Trees act like filters. Their leaves capture small particles, such as dust, pollen and smoke and remove them from the air. They also remove and store carbon dioxide and reduce our need for energy.

Trees act like a carbon warehouse. In the process of photosynthesis, plants remove carbon dioxide from the air and release oxygen. A healthy tree uses over 20 pounds of carbon dioxide each year. The carbon is stored in the tree (wood is actually about 45% carbon) and the oxygen is released back into the atmosphere.

Trees are like air conditioners. They provide a natural way to shade and cool your house in the summer and can shield your home from the cold winds of winter. A person can save energy by landscaping with trees. Deciduous trees planted in the south, west and east sides will protect your home from the direct rays of the sun in the summer and keep it cooler. This reduces the use of your air conditioner, thereby saving energy. In the winter, without their leaves, they allow most of the sun’s energy to reach the house and keep it warmer. Conifers to the north and west can block cold winter winds. This reduces energy use to heat your home.

A successful urban tree program can also impact whole communities. Cities are often 10 degrees warmer than suburbs, partially due to the “heat island effect” caused by concrete, steel and asphalt of building that absorb and retain heat. Planting trees can help keep that effect to a minimum.
Method:

1. Have students draw a map to scale of their yard or school site. Be sure they include all features of the given area on the map: buildings, driveways, roads, trees and other plants, etc.

2. Using a clean, damp white cloth, students carefully wipe a leaf from each tree or bush in the yard. Be sure to use a new, clean cloth for each plant.

3. Students answer questions and fill out the following Backyard Pollution Observation Sheet.

Discuss:

Compare observations with the entire class.

Ask students how the pollution / material / dirt students found on plant leaves interfere with the photosynthesis, transpiration and reproduction processes.

Examples:

A. Carbon dioxide and other airborne pollutants enter plants through their tissues and are stored in their cells.

B. When plants perform photosynthesis (make food), the pollutants are distributed throughout the plant in the food and can weaken or even kill it.

C. A buildup of pollution (dirt) on the plant’s leaves inhibits respiration and transpiration processes which can severely weaken or kill it.

D. Weakened plants either don’t reproduce at all, or produce unhealthy offspring.
Air Quality and Plants Observation Sheet

On a separate piece of paper, draw a detailed map of your yard (or schoolyard). Be sure to include all buildings, fences, driveways, roads, etc. and all larger plants, including trees, bushes and shrubs.

Using a clean damp (not wet) white cloth for each plant, carefully wipe a leaf from each tree, bush or shrub.

A. Is the cloth dirty? ✔️ NO

B. Can you tell what kind of dirt / material is on the cloth? ✔️ NO

C. If so, what is it? If you can’t, take a guess

On your map record which tree, bush or shrub had the most dirt on the cloth.

A. Which direction (north, south, east or west) was the tree, bush or shrub in the yard?

B. What other feature(s) is (are) near that plant (examples: road, house, and fence)?

C. What was the source(s) of the dirt / material?

What do you think will happen to the dirt / material on the leaves in one week? In one month?

What effect could the dirt / material have on the plant’s health?
You Can Help Conserve the Monarchs

The butterfly population, including Monarchs, is rapidly becoming endangered because of loss of habitat. Much of Florida’s natural landscape has disappeared due to industry and development. Human activities that involve the clearing of land, such as for forestry, farming, building roads or new neighborhoods, change or destroy the habitat that supports the life cycle of butterflies. Chemicals that kill undesirable plants (also known as weeds), control plant diseases and plant eating pests or are meant to protect humans and animals from disease-causing mosquitoes all destroy butterflies in all life stages.

We can all help butterflies by encouraging the conservation of land as wildlife habitats; especially important are milkweed fields which are crucial for Monarch survival. You may be surprised by how many people will become involved- but first they need to know what is happening to the Monarch’s habitat. Here are ways you can assist butterfly survival:

- Have a contest to write the best slogan for saving the Monarchs and the Milkweed fields and invite everyone in your neighborhood or school to participate
- Paint posters, signs and banners for your school, community center or library; make Monarch T-shirts with helpful sayings
- Ask your teacher if your class could work on a community or school project to raise awareness, such as planting a school milkweed or butterfly garden
- Start a Monarch and Milkweed Club, declare Monarch Awareness Day or Week and celebrate
- Organize a trip to a Monarch sanctuary or observation site and invite the public to come along
- Write letters to your local newspaper, your city, county or state government and environmental groups asking them to support laws that save open lands and help preserve wildlife habitats
- Plant a Butterfly Garden that are safe for and attractive to butterflies in your school yard, backyard, library or park-be sure to get the proper permission and remember to include a large variety of host plants and nectar sources
- Organize a fundraiser (a bake sale, carwash, sell T-shirts) and contribute the money to a Save the Monarch Foundation
- Ask community officials to plant butterfly friendly plants in area parks, playgrounds and easements
- Obtain permission from school administrators to plant butterfly gardens as class science projects
- Raise caterpillars and chrysalides and release the adult butterflies in your own butterfly garden at home
Why Plant a Butterfly Garden at School?

- To beautify the schoolyard
- To provide habitat for threatened species of butterflies and plants
- To provide a natural area that will stimulate senses, imagination, outdoor awareness, stewardship
- To provide an area to be utilized for science investigations and many other subject themes for all grade levels

How to Begin

The dream of building a beautiful, successful and educational butterfly garden begins with one enthusiastic class of students and some very important planning. It is imperative that you acquire permission from the building principal first. You may have to lobby vigorously as there are many important details to consider before ever picking up a shovel! The more carefully thought out your plan is, the easier it may be to convince your principal and entire school to provide support.

It is important to point out that all grade levels can provide support and work for the garden on some level. Of the many subjects, themes and concepts that can be taught in such a wonderfully rich outdoor environment Science is the most obvious. There are countless enriching hands-on experiments, activities and investigations that provide outstanding memorable experiences. But it doesn’t stop there! Other subjects that can be transformed into very special experiences are:

- Science…senses, observation skills, similarities & differences, keep records, living/non-living things, seasons, plant anatomy, heredity, classification, plant & animal interaction with the environment, solar & wind energy, producers & consumers, weather, life cycles, basic needs for survival, practice the scientific method, earth materials, natural resources, human activities & natural events majorly impact environment, changes in matter, adaptations, interrelationships, pollution, natural selection, data collection, conservation
- Social Studies…civic responsibility, good stewardship, community service
- Mathematics…units of measure, addition, subtraction, multiplication, division, budgets, graphs, ratios
- Art…color, texture, water colors, pen & ink, photography
- Language Arts …creative, descriptive and expository writing, journaling, poetry
- Music…song writing, interpretation & visualization
- Physical Education…interpretive dance, creative movement
- Other…group collaborative activities, presentations, modeling…

Oh, the possibilities are endless! Just being outdoors is proven to lower blood pressure, increase spatial awareness and envelope us with a sense of calm. Outdoor lesson plans that include the above listed disciplines encourage higher level and critical thinking skills, deductive reasoning, creativity and stimulate the senses. The very excellent book “Last Child in the Woods” by Richard Louv makes an outstanding case for teaching students about Nature outdoors, outside of a sterile, uninspiring classroom. Help save our children from “Nature Deficit Disorder”…get them outside…plant a butterfly garden!!!
**Important Management Considerations**

- Who will perform the actual work of planning, breaking ground, maintaining (water, fertilize, weed, trim, etc.)? All grades can help with this, but it should be well organized and clearly scheduled.
- Who will maintain the garden during vacation times? Building maintenance crews are very busy folks and may not be available to help out.
- Who will pay for the plants, equipment, garden materials? (plant donations from home gardens or garden centers, parent/school organizations, monetary donations from parents, grants- be creative)?

**Tips for Planning and Planting**

- Find out which species of butterflies visit your area and be sure to plant specific host plants for these butterflies in your garden.
- Use a variety of nectar rich flowering plants, such as asters, pentas and salvias to provide food for adult butterflies-different species of butterflies have different nutritional tastes and needs; a wide variety insures a constant source of nectar and blooms.
- Place your garden where you can observe the butterflies from inside and outside.
- Plant your garden in full sun.
- Be sure there are bushes and trees nearby to provide hiding places for butterflies.
- Don’t use chemicals in your garden!!! Pesticides and herbicides kill caterpillars and butterflies.
- Remove pests by hand or use a strong stream of water from the hose to spray them off.
- To conserve resources, plant plants of similar needs for water, light and soil type close to each other.

**Plants for Butterflies**

<table>
<thead>
<tr>
<th>Butterfly Species</th>
<th>Host Plants</th>
<th>Nectar Plants</th>
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<tbody>
<tr>
<td>American Painted Lady</td>
<td>aster</td>
<td>Lantana</td>
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<tr>
<td>Cloudless Sulphur</td>
<td>cassia</td>
<td>Spanish Needles</td>
</tr>
<tr>
<td>Black Swallowtail</td>
<td>carrot, dill fennel and parsley</td>
<td>Aster</td>
</tr>
<tr>
<td>Giant Swallowtail</td>
<td>citrus, wild lime</td>
<td>Blue Porterweed</td>
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<tr>
<td>Gulf Fritillary</td>
<td>passionflower</td>
<td>Milkweed</td>
</tr>
<tr>
<td>Monarch</td>
<td>milkweed</td>
<td>Salvia</td>
</tr>
<tr>
<td>Queen</td>
<td>milkweed</td>
<td>Verbena</td>
</tr>
<tr>
<td>Ruddy Daggerwing</td>
<td>strangler fig</td>
<td>Pentas</td>
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<tr>
<td>Skippers</td>
<td>canna</td>
<td>Petunias</td>
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<tr>
<td>Viceroy</td>
<td>willow</td>
<td>Plumbago</td>
</tr>
<tr>
<td>Zebra Longwing</td>
<td>passionflower</td>
<td>Firebush</td>
</tr>
<tr>
<td>Zebra Swallowtail</td>
<td>paw paw</td>
<td>Buttonbush</td>
</tr>
</tbody>
</table>

**Local Sources for Milkweed**

Most Garden Centers like Home Depot and Lowes’s; Meadow Beauty Native Plants.
**Build a Butterfly Cage**

This simple, versatile and inexpensive cage is a safe place for eggs to hatch, caterpillars to feed, chrysalises to pupate and butterflies to emerge.

**Materials:**

Fabric- a piece of netting, over 36 inches long (bridal veil type: light colored will encourage butterflies to breed more quickly; darker colors will keep them calmer)  
Tomato “Cage” Wire Support  
String, rubber band or clamp- to close the cage  
Clay pot with soil  
Milkweed plant (be sure it is chemical free)

1. Spread the netting flat on a table.  
2. Stand the tomato cage with bottom in the center of the netting material.  
3. Gather the netting material, gently pull it upward and twist slightly.  
4. Push “cage” into soil in clay pot containing Milkweed plant.  
5. Secure it with string, a rubber band or clamp.
Releasing Butterflies

Before attempting to raise any species of butterfly, research which species live in South Florida. If the species is not found in our area naturally, it’s because the host or nectar plants needed for survival are not present in Nature and the butterflies will die.

Do:

- Become an expert first; research the species of butterfly and its needs before buying or finding eggs, caterpillars or chrysalides to raise.
- Use local (Florida) sources for eggs, caterpillars or chrysalides—specimens from other parts of the country may carry non-native diseases or be injured or die enroute.
- Handle very gently; use a small paintbrush or cosmetic brush to handle caterpillars.
- Release butterflies into your garden at the proper time of year; a wide variety and quantity of nectar plants should be readily available; avoid Florida’s coolest and most unpredictable weather—usually during January and February.
- Use only healthy and active butterflies.
- Encourage others to nurture and release butterflies.
- Clean and disinfect rearing houses completely in between rearing sessions.

Do Not:

- Import live butterflies from other countries.
- Ship live butterflies out of your home state unless you have secured permits from the United States Department of Agriculture.
- Purchase butterflies from breeders who do not have the proper permits.
- Release butterflies into an area where they would not naturally be found.
- Release butterflies at a time of year when they would not normally be flying (remember—butterflies cannot fly when the temperature is under 60 degrees).
- Collect butterflies from state or federal parks.

The Plant Protection Act makes it illegal to transport a butterfly across state lines—there is a $50,000 fine!!!
**Vocabulary**

**Abdomen** - rear part of an insect: the elongated portion of the body behind the thorax. It is usually segmented and contains the heart, reproductive organs and most of the digestive system.

**Abdominal Prolegs** - stumpy legs located on the abdomen.

**Adaptation** - change to suit environment: the development of physical and behavioral characteristics that allow organisms to survive and reproduce in their habitats.

**Air pollution** - air that has been made dirty or impure and is harmful to breathe.

**Anal Prolegs** - stumpy legs located at the end of the abdomen.

**Antennae** - an organ on the head of an insect used for feeling, smelling and tasting.

**Balance** - steady, stable, even, neutral; a state of equality; in nature one species does not have an advantage over another.

**Basking** - to lie in or be exposed to enjoyable warmth, especially from the sun.

**Bioindicator** - a piece of nature that can tell if the environment has something wrong with it.

**Biological control** - the action of one living organism controlling the populations of another organism.

**Biologists** - an expert or scientist who studies the life and structure of living things.

**Biomonitoring** - the term scientists use to describe the use of animals, plants or an entire ecosystem to determine the extent of pollution.

**Camouflage** - a method of disguising or hiding animals or objects to appear as part of their surroundings.

**Carbon dioxide** - (CO2) an odorless, colorless poisonous gas produced from gasoline engines, exhaust from car, boat or other engines.

**Carbon Monoxide** - a very poisonous gas that causes people and animals to become sick or die.

**Cardiac glycosides** - a poisonous chemical present in Milkweed plants that protects the few insects that can safely ingest it from predators.

**Chemoreceptors** - nerve cells that smell or taste chemicals.

**Chrysalides** (plural form of chrysalis) - butterfly pupas.

**Chrysalis** - the stage when a caterpillar sheds its skin for the last time, and, in which a butterfly forms.

**Cocoon** - the outer covering of a moth’s pupa.

**Cold-blooded** - having a body temperature that varies with the temperature of the surrounding environment.
Complete metamorphosis- metamorphosis through all stages: a metamorphosis that involves the four stages of egg, larva, pupa, and adult in insects such as butterflies, beetles, flies, and bees

Compound eyes- the eyes of the adult butterfly made up of many separate (6-sided lens) units or parts, each one of which allows it to see in a slightly different direction

Conifer- evergreen trees and shrubs in the pine and cypress families that contain both pollen and seeds in cones

Consume- eat

Crochets-hook-like attachments on caterpillars’ legs that allow them to walk climb and hang on plants without falling

Cryptic coloration- an animal that is colored to blend in with its surroundings

Deciduous- the shedding or falling off of leaves at a particular time of season or stage of growth

Dense-thick in volume

Deter- to discourage or prevent something from happening

Diapause-a period during which the metabolism of some animals or insects slows down, temporarily suspending their bodily development and growth usually due to seasonal or environmental changes

Diversity- the number, variety and distribution of species that live in a specific area

Dormant- inactive, as in sleep, being in a state with no activity or growth

Dwindling- to decrease little by little in size, number, or intensity and approach zero

Eclose-to emerge from or come out of the pupa stage

Ecosystem- a system formed by the interaction of a community or group of organisms with their environment

Egg- the first stage in the life cycle of an insect

Emerge- comes out, hatches

Endangered- a species facing possible extinction due to very low population

Entomologist- a scientist or person who studies insects

Exclusively-being the only one

Exoskeleton- the outer shell of an insect

Extinction-the destruction or killing off of a species
**Eyespots**-color patterns on an insect’s body (usually the rear end) that look like eyes to give a larger or more dangerous appearance that help in protection from predators

**False legs**-legs of a caterpillar that disappear during metamorphosis; also called prolegs

**False targets**-a survival aid of coloration or body parts that direct the attention and attack of predators away from the head and toward a less important part of the body

**Fungicide**-chemicals used to kill or inhibit the growth of fungi

**Generation**- one complete life cycle of a family or a group of people, animals, or plants; the individual members of that stage; children, parents, grandparents

**Genetic Diversity**-differing kinds of inherited traits

**Head**- the part of the caterpillar that contains the brain, eyes, mouthparts, etc.

**Hemolymph**- the name for the blood of insects

**Herbicide**-chemicals used to kill or inhibit the growth of plants

**Hibernate**-to be in a state resembling sleep over the winter while living off reserves of body fat, with a decrease in body temperature and pulse rate and slower metabolism

**Hormones**-a substance produced in the body of an insect that regulates various growth and development such as the change from larva to adult

**Host**- an organism that is damaged by another organism or a disease

**Host Plant**-a plant species that an organism depends upon, usually as a food source; the larvae of caterpillars and moths, for example, must eat specific plants to develop properly

**Host Plant Specialization**-the dependence upon an exact species of plant for food, shelter, etc. required for survival purposes

**Immune**-protected by the effects of a disease or chemical due to an adaptation

**Inclement**-unpleasant in being stormy, rainy, or snowy

**Indicator**-something that shows what conditions are; something observed or calculated that is used to show the presence or state of a condition or trend

**Ingest**-to eat

**Insecticide**-a chemical used to kill or inhibit the growth of insects
**Instar**- period between molts; in the life cycle of an insect a stage between two successive molts

**Interdependence**- depending on each other; relying on each for support, help, food

**Larva**- a caterpillar; the second stage of a butterfly’s life

**Larvae**- caterpillars; more than one larva; plural form of larva

**Lepidoptera**- the insects known as butterflies and moths are members of this order of scientific classification; all Lepidoptera have four wings covered in scales, six legs, an exoskeleton, two antennae, compound eyes, three body segments known as head, thorax and abdomen, and undergo a complete metamorphosis

**Limiting Factors**- conditions or actions that control or affect an animal’s survival rate

**Loss of habitat**- the disappearance of an ecosystem due to development, climate change, etc.

**Mandibles**- the jaws of an insect; a caterpillar has 5 teeth on each mandible; a butterfly has no mandibles

**Metamorphosis**- a complete change from one form to another; the transformation of a larval insect into its winged adult form

**Methane**- a colorless odorless flammable gas

**Migrate**- to move periodically from one region, climate or pace to another

**Milkweed**- the host plant for Monarch butterflies; a plant in the family asclepiadaceae

**Mimicry**- a behavior or color pattern of plants and animals to look or act like another species for protection purposes and help increase survival rates

**Molt**- the shedding of an old layer of skin; Monarch caterpillars molt 5 times, the last time becoming a chrysalis

**Monarch**- a species of butterfly

**Natural enemies**- organisms that feed on pests; a predator, parasite, parasitoid or pathogen of another animal, especially an insect

**Nectar**- the sweet liquid that flowering plants produce as a way of attracting the insects and small birds that assist in pollination

**Nectaring**- the act of sipping and ingesting nectar from flowers for food by insects

**Ocelli (plural)**- the simple eyes of some insects; Monarch larvae have 12 ocelli

**Ocellus**- the singular form of ocelli

**Offspring**- the children or young of a species
**Ommatidia** (plural)-the units that make up the compound eye of insects

**Ommatidium**-singular form of ommatidia

**Organ**- a group of tissues of different kinds working together to perform a task

**Osmeterium**-a fork-shaped defense organ located on the thorax that when displayed, serves to frighten predators; it looks like fierce horns and gives off a bad odor

**Ozone**- a form of oxygen produced when ultraviolet light passes through air or oxygen; in the upper atmosphere ozone absorbs harmful ultraviolet rays preventing them from reaching the Earth’s surface; near the Earth’s surface ozone is harmful air pollution made up of three atoms of oxygen (O3)

**Palpi or palps** (plural)-sensory organs on the heads of insects which serves to detect food and guide it into the mouth

**Palpus**-singular form of palpi or palps

**Parasite**- an organism that feeds on another living thing (host) for part of its life; parasites usually only weaken or sicken their hosts

**Parasitoid**- an organism that feeds of another living thing (host) and kills it; parasitoids usually feed on only one host

**Pathogen**- an organism that causes disease (fungi, bacteria, virus)

**Perennial**-plants that live for years

**Photosynthesis**- the process by which a plant uses sunlight to produce its own food

**Polluted**-air, water, soil or an entire environment made dirty or impure by adding harmful substances

**Pollinators**-insects or animals that collect and transfer pollen from plant to plant; animals that fertilize plants for reproduction

**Predator**-an animal that hunts another to kill it for food

**Prey**- an organism that is food for a predator

**Proboscis**- the long, coiled drinking straw-like feeding tube butterflies use for sucking nectar

**Prolegs**-the “false” legs on the abdominal segments of butterfly larvae; these legs disappear during pupation

**Prolific**-to produce many

**Protozoa**-a group of one-celled microscopic organisms

**Puddling**-the butterfly act of sipping moisture from the ground from damp water puddles
**Pupa**-the third stage of metamorphosis, after the larval stage, that usually lasts 8-13 days in Monarchs

**Pupae**-plural form of pupa; more than one pupa

**Pupate**-to change from larva (caterpillar) to pupa (chrysalis)

**Roost**-Monarchs perch or gather to settle in and go into the state of torpor

**Scales**-overlapping pieces of exoskeleton on a butterfly that insulates the body and wings, helps them fly and gives them color and patterns

**Sequester**-to store something in a certain area without changing it; chemicals in Milkweed are stored in Monarchs’ bodies without breaking them down as protection from predators

**Setae**- tiny hairs on the bodies of a caterpillar and butterfly that give them the sense of touch

**Silk button**-the pad made by larvae on which they attach themselves and hang upside down in order to pupate

**Simple eyes**- organs on the head that can detect light and dark

**Sparse**-thinly scattered; very few

**Species**-a class or group of things of the same kind and with the same name; a category of living things that ranks below a genus, is made up of related individuals able to produce fertile offspring, and is identified by a two-part scientific name

**Spinneret**-the organ located on the bottom of the larvae’s head from which silk is spun to produce the silk button

**Spiracles**- tiny holes along the caterpillar’s body that it uses to breathe; a Monarch has 9 pairs

**Suffocation**-to kill by stopping the breathing

**Tarsi** (plural) - the fifth segments of an insect leg

**Tarsus**-singular form of tarsi

**Thoracic legs**- six jointed legs on the caterpillar’s thorax

**Thorax**- the middle section of an insect’s body to which six legs and wings are attached

**Torpor**-a semi-dormant state

**Transparent**- thin or fine enough to easily be seen through

**True legs**-jointed legs located on the thoracic segment of the larvae
**Warning Coloration** - in Nature bright colors (usually black, red or yellow) warn predators of poisons or other harmful defenses

**Yolk** - the inside part of an egg
Resources for Monarchs and Milkweed

Butterfly supplies
www.butterflyskyfarm.com

Raise an On-line Butterfly
Adopt an on-line Monarch and watch the life cycle of a butterfly
www.livemonarch.com

Beautiful Books:
Take a Walk with Butterflies and Dragonflies
By Jane Kirkland

My Monarch Journal
By Connie Muther

The Life Cycle of a Butterfly
By Bobbie Kalman

Florida’s Fabulous Butterflies
By Thomas Emmel

The Family Butterfly Book
By Rick Mikula

North American Butterfly Association
Atala Chapter
Palm Beach County, FL

Wonderful Websites:
www.floridamonarch.com
http://www.monarchwatch.org
www.butterflyschool.org
www.learnaboutbutterflies.com
www.monarch-butterfly.com
www.monarchteacher network-westerncanada.com
www.learnnc.org
www.fed.us/monarchbutterfly/index.shtml
http://butterflywebsite.com
www.thebutterflysite.com
www.earthsbirthday.com
www.enchantedlearning.com
www.ButterflyGardeningAndConservation.com
Monarchs and Milkweed
The Sunshine State Standards (revised 4-2013)

Pan’s Garden Educational Programs and the Teachers’ Manual that accompany them were developed using the Next Generation Sunshine State Standards as a guideline as listed below:

SC.K.L.14.1: Recognize the five senses and related body parts.
SC.K.L.14.3: Observe plants and animals, describe how they are alike and how they are different in the way they look and in the things they do.
SC.K.N.1.2: Make observations of the natural world and know that they are descriptors collected using the five senses.
SC.K.N.1.5: Recognize that learning can come from careful observation.
SC.1.E.6.1: Recognize that water, rocks, soil, and living organisms are found on Earth’s surface.
SC.1.L.14.1: Make observations of living things and their environment using the five senses.
SC.1.L.14.3: Differentiate between living and nonliving things.
SC.1.N.1.2: Make observations of the natural world and know that they are descriptors collected using the five senses.
SC.1.N.1.5: Recognize that learning can come from careful observation.
SC.2.L.16.1: Observe and describe major stages in the life cycles of plants and animals, including beans and butterflies.
SC.2.L.17.2: Recognize and explain that living things are found all over Earth, but each is only able to live in habitats that meet its basic needs.
SC.2.L.17.3: Explain that empirical evidence is information, such as observations or measurements, that is used to help validate explanations of natural phenomena.

SC.3.L.14.1: Describe structures in plants and their roles in food production, support, water and nutrient transport, and reproduction.
SC.3.L.17.1: Describe how animals and plants respond to changing seasons.
SC.3.L.15.1: Classify animals into major groups (mammals, birds, reptiles, amphibians, fish, arthropods, vertebrates and invertebrates, those having live births and those which lay eggs) according to their physical characteristics and behaviors.
SC.3.L.17.2: Describe how animals and plants respond to changing seasons.
SC.2.N.1.1: Raise questions about the natural world, investigate them in teams through free exploration, and generate appropriate explanations based on those explorations.
SC.2.N.1.2: Using the five senses as tools, make careful observations, describe objects in terms of number, shape, texture, size, weight, color, and motion, and compare their observations with others.

SC.3.N.1.2: Compare the observations made by different groups using the same tools and seek reasons to explain the differences across groups.
SC.3.N.1.3: Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.
SC.3.N.1.4: Recognize the importance of communication among scientists.
SC.3.N.1.5: Recognize that scientists question, discuss, and check each other’s evidence and explanations.
SC.3.N.1.6: Infer based on observation.
SC.3.N.1.7: Explain that empirical evidence is information, such as observations or measurements, that is used to help validate explanations of natural phenomena.
SC.4.L.16.3: Recognize that animal behaviors may be shaped by heredity and learning.
SC.4.N.1.1: Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both individual and team investigations through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

SC.4.L.16.4: Compare and contrast the major stages in the life cycles of Florida plants and animals, such as those that undergo incomplete and complete metamorphosis, and flowering and nonflowering seed-bearing plants.
SC.4.L.17.4: Recognize ways plants and animals, including humans, can impact the environment.
SC.4.N.1.2: Compare the observations made by different groups using multiple tools and seek reasons to explain the differences across groups.
SC.4.N.1.4: Attempt reasonable answers to scientific questions and cite evidence in support.
SC.4.N.1.5: Compare the methods and results of investigations done by other classmates.
SC.4.N.1.6: Keep records that describe observations made, carefully distinguishing actual observations from ideas and inferences about the observations.
SC.4.N.1.7: Recognize and explain that scientists base their explanations on evidence.
SC.5.L.17.1: Compare and contrast adaptations displayed by animals and plants that enable them to survive in different environments such as life cycles variations, animal behaviors and physical characteristics.
SC.5.N.1.1: Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.
SC.5.N.1.3: Recognize and explain the need for repeated experimental trials.
SC.5.N.1.6: Recognize and explain the difference between personal opinion/interpretation and verified observation.
SC.5.N.2.2: Recognize and explain that when scientific investigations are carried out, the evidence produced by those investigations should be replicable by others.
SC.6.N.1.2: Explain why scientific investigations should be replicable.
SC.6.N.1.1: Define a problem from the sixth grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations, experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.
SC.6.N.1.3: Explain the difference between an experiment and other types of scientific investigation, and explain the relative benefits and limitations of each.
SC.6.N.1.4: Discuss, compare, and negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation.
SC.6.N.1.5: Recognize that science involves creativity, not just in designing experiments, but also in creating explanations that fit evidence.
SC.7.L.17.2: Compare and contrast the relationships among organisms such as mutualism, predation, parasitism, competition, and commensalism.
SC.7.L.17.3: Describe and investigate various limiting factors in the local ecosystem and their impact on native populations, including food, shelter, water, space, disease, parasitism, predation, and nesting sites.
SC.7.N.1.1: Define a problem from the seventh grade curriculum, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigation of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.
SC.8.N.1.1: Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.
SC.8.P.8.8: Identify basic examples of and compare and classify the properties of compounds, including acids, bases, and salts.
SC.8.N.1.3: Use phrases such as "results support" or "fail to support" in science, understanding that science does not offer conclusive 'proof' of a knowledge claim.
SC.8.N.1.6: Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence.
SC.8.N.4.1: Explain that science is one of the processes that can be used to inform decision making at the community, state, national, and international levels.
SC.8.N.4.2: Explain how political, social, and economic concerns can affect science, and vice versa.