Butterfly: The Story of a Life Cycle

Hudson Vagabond Puppets

Wednesday, May 1, 2019

10am

Young Auditorium

UNIVERSITY OF WISCONSIN–WHITEWATER

HORIZONS

PERFORMANCE GUIDE

Welcome!

Young Auditorium, located on the University of Wisconsin - Whitewater campus, welcomes you to the school-day performance of *Butterfly: The Story of a Life Cycle*, produced by Hudson Vagabond Puppets. This performance guide provides information, discussion topics, activities, and resources to use both before and after the performance. The materials are designed to help you integrate the show with learning objectives in many areas of the curriculum. We look forward to seeing you at Young Auditorium!

Online - www.youngauditorium.com/education
Email - horizons@uww.edu
Reservations - 262-472-4444
Questions or comments? - Shannon Dozoryst, dozoryss@uww.edu or 262-472-1432

Butterfly: The Story of a Life Cycle
Study Guide

This study guide is designed for students coming to see the Hudson Vagabond Puppets' production of *Butterfly: The Story of a Life Cycle*. You will be coming to the theater to take a look at the insect world as if you were looking through a magnifying glass. This production will follow the transformation of a caterpillar, which hatches from its egg under the leaf of a milkweed plant, forms a chrysalis and emerges as a beautiful monarch butterfly. As winter approaches, this butterfly makes the long journey to Mexico to hibernate, wakes in the spring and lays her eggs to start the whole cycle over again.

This study guide is divided into six sections containing material that will help you learn about monarchs and puppetry, making your theater experience more complete.

I. Science- life cycle and characteristics of the monarch butterfly
II. Puppetry- description of how we designed and operate the main characters
III. Conservation- ideas on how you can help the monarch butterfly survive its long journey
IV. Activities- projects you can do at home or in the classroom
V. Vocabulary List
VI. References- websites and books used to create this study guide and our production

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The Monarch Butterfly

Kingdom: Animalia (animals)
Phylum: Anthropoda (animals with jointed legs)
Class: Insecta (insects)
Order: Lepidoptera (butterflies and moths)
Family: Nymphalidae (butterflies with dwarfed front legs)
Subfamily: Danaidae (milkweed butterflies)
Genus & Species: Danaus: Plexippus (monarch butterflies)

Life Cycle

Egg

A monarch takes one month to mature from an egg to an adult butterfly. An egg is about 3 millimeters long, spherical, ridged and white. The female lays about 400 eggs on separate milkweed leaves in the spring and summer. It takes about a week for each egg to hatch.

Caterpillar

A newborn caterpillar is 2 millimeters long. First it eats the egg shell, then it eats the milkweed leaf that housed the egg, and then it keeps eating milkweed plant until it is 1/2 centimeter long and weighs 2700 times more that when it was hatched. It eats so much that its skin becomes too tight, so it sheds its skin for more room. Then it eats some more until its skin gets tight again and it repeats the process. This is called **molting**.

Eating the poisonous milkweed plant causes the caterpillar (and subsequently the butterfly) to be poisonous, which provides protection from predators. Its bright yellow and black stripes warn its predators that the caterpillar might be a dangerous meal. A caterpillar has 3 pairs of thoracic legs and 5 pairs of large **prolegs**, which are used to grip. It has 2 pairs of **filaments**, sensory tentacles, one on the head and one on the abdomen.

After about two weeks, the caterpillar becomes restless and leaves the milkweed plant in search of a safe transformation place. Once it finds a twig or leaf, it uses its **spinneret**, a special gland in its mouth, to weave a small silk button. It attaches its tail end to the lump and hangs upside down in the shape of a "J".

Pupal Stage

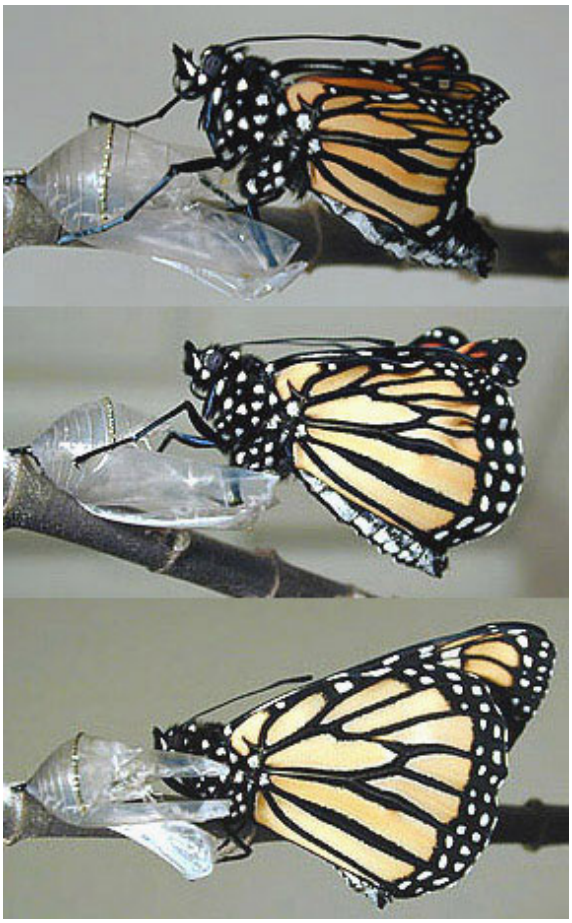
The caterpillar wriggles for 5 hours to molt one last time until it looks like a giant, green droplet. This "droplet", called a **chrysalis**, is about 3 or 4 cm long and slowly changes shape and color as the outer layer hardens into an emerald case with golden dots. Inside the chrysalis, the caterpillar's body parts completely break down into a liquid and are reformed into the organs and wings of the butterfly. This change is called **metamorphosis** and takes about two weeks. The case becomes transparent and you can see the butterfly inside.

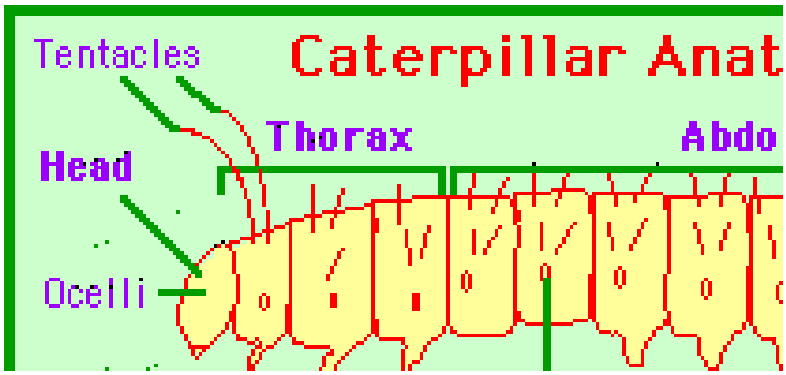
Adult

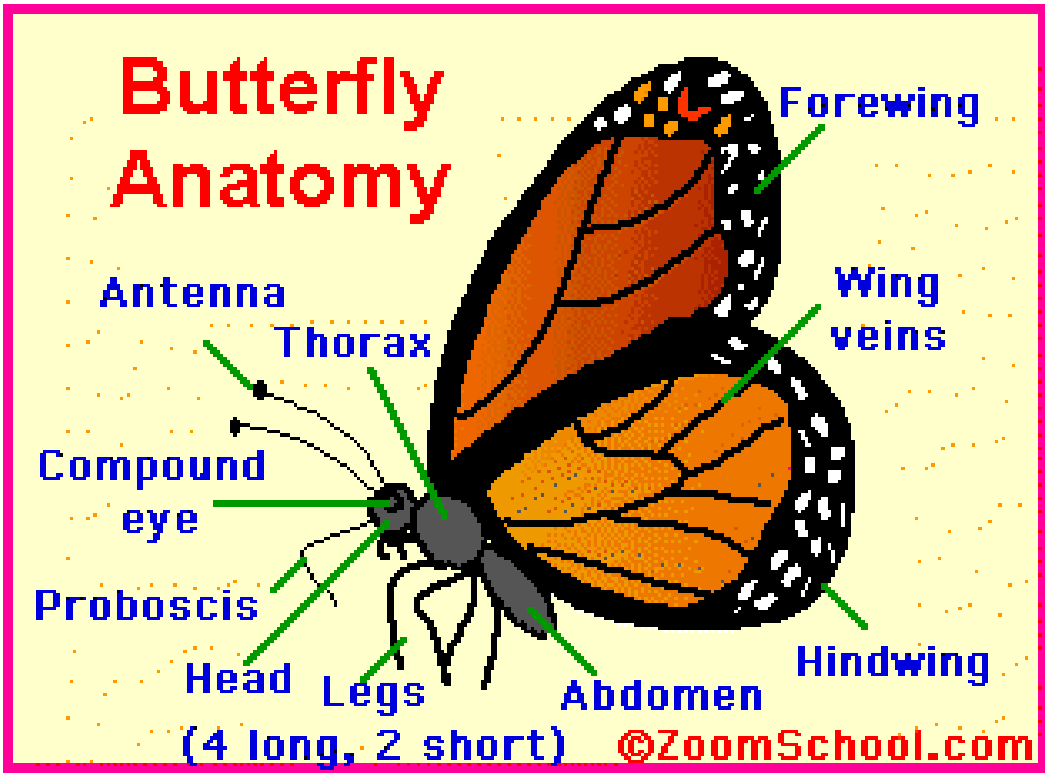
Once the butterfly breaks through, it clings to the casing of the chrysalis while fluids from the body are pumped into the veins of the wings expanding them. After a few hours, the wings are dry and the butterfly flies away. Adult monarchs have 2 pairs of bright orange-reddish wings that feature black veins and white spots along the edges. Their wingspan is about 4 inches and they weigh less than ½ an ounce. It takes five monarchs to equal the weight of one penny.

Males are slightly bigger than females and have scent glands called **stigmata**. You can see them as a spot of dark scales in the center of its hind wings. The females have broader black vein lines compared to the males.

The butterfly obtains energy for flying by sipping nectar from flowers, such as milkweed, red clover, thistle and golden rod. It does this by uncoiling its **proboscis**, a long, flexible tongue that is used like a straw to sip the nectar.




Tentacles
Caterpillar Anat
Thorax
Abdo
Head
Ocelli

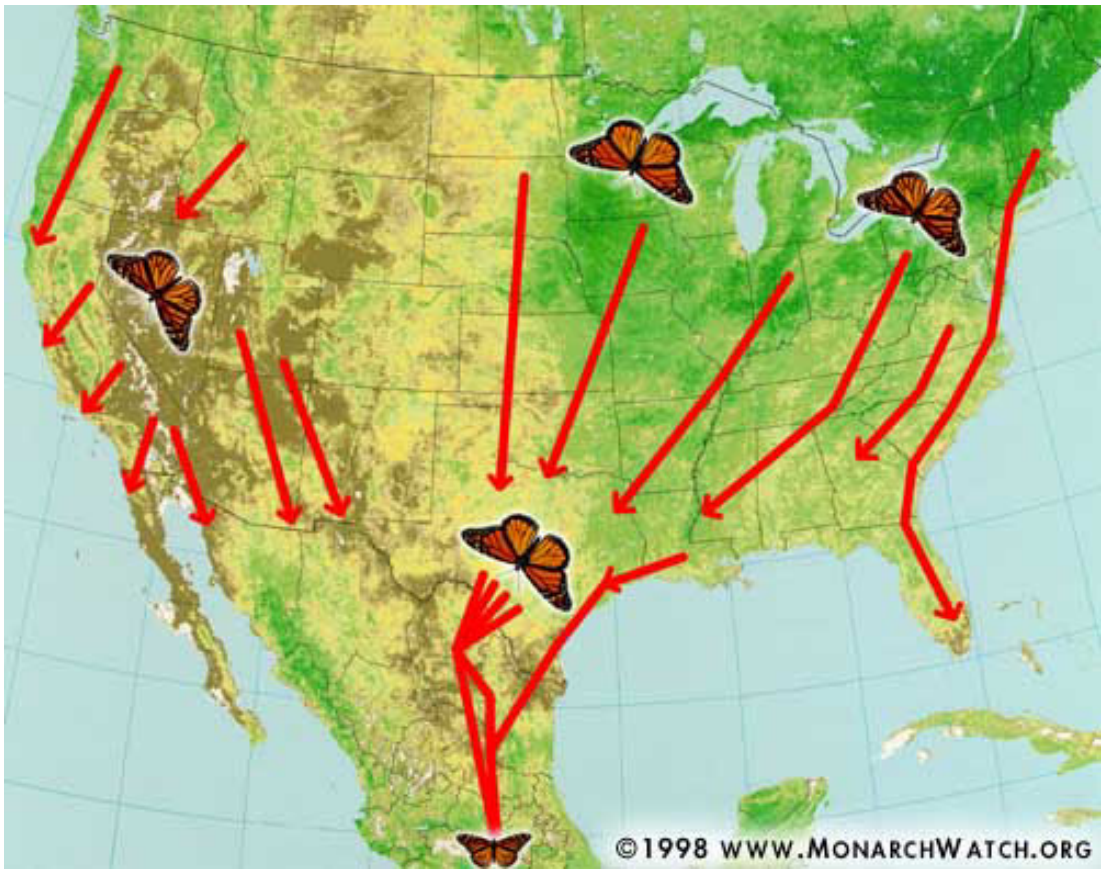

Butterfly
Anatomy
Forewing
Antenna
Thorax
Wing
veins
Compound
eye
Proboscis
Head
Legs
Abdomen
Hindwing
(4 long, 2 short)
©ZoomSchool.com

Migration

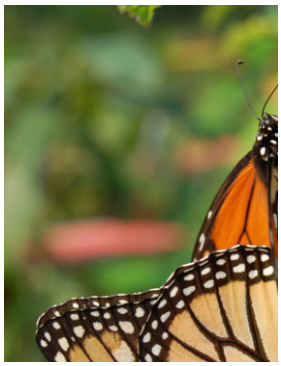
Most monarchs have a life span of 4 to 5 weeks, but a special generation born in late summer survives for 7 or 8 months. This generation makes the **migration**, the long journey south from Canada and the northern US all the way to Mexico, Cuba or southern California in search of warmer weather to survive the winter.

Their migration is guided by the sun's orbit. They have an internal, biological compass that functions according to the movement of the sun. Butterflies are most active from the morning until about 1pm, flying an average of 50 to 80 miles per day. During their journey, they are at great risk to predators and bad weather.

After about two months of traveling, they reach their destination at the end of October or beginning of November. From mid-November to mid-February they hibernate in giant clumps and then come down from the slopes to mate. It is their offspring that begin the trip back north.



Reproduction



The courtship is fairly simple and takes place in two stages. During the aerial phase, the male pursues nudges and eventually takes down the female. In the ground phase, the male transfers its **spermatophore** to the female. For the over-winter population, the spermatophore contains sperm plus fat and other nutrients. This provides the female with energy to find the nearest milkweed plants to lay her eggs.

Photo credit: William Zittrich
Monarch Butterfly Photo Gallery
www.geocities.com/wyllz/id/77.htm

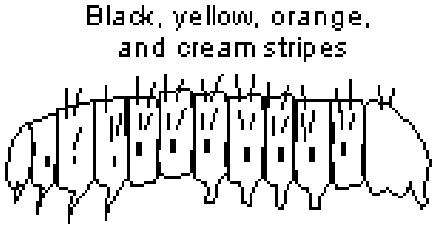
Butterfly Life Cycle

Metamorphosis of a Monarch Butterfly

Egg

Larva = Caterpillar

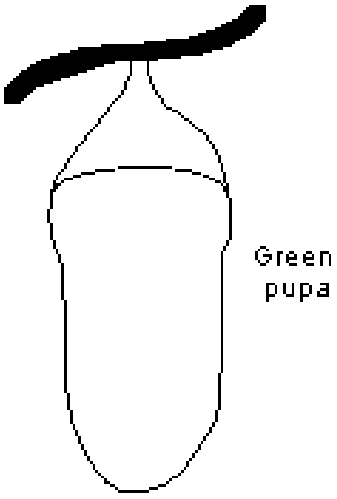
The egg hatches into a tiny larva (caterpillar).



Larva = Caterpillar

The caterpillar eats and grows a tremendous amount.

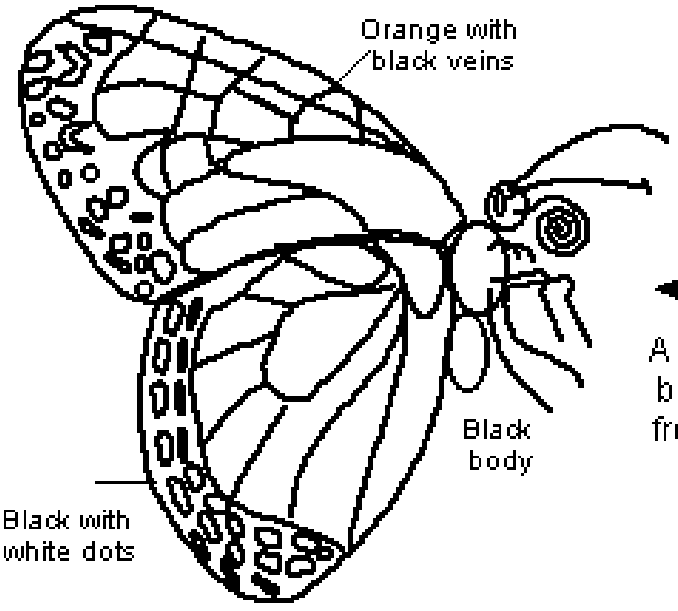
The caterpillar attaches itself to a twig and forms a hard outer shell.



Pupa = Chrysalis

Inside the pupa, the caterpillar changes into a butterfly. Pupas are often camouflaged to hide from predators.

A fully-grown adult butterfly emerges from the chrysalis.



Adult = Butterfly

Adults live for only a short time. They cannot eat; they only drink through their straw-like spiral proboscis. They will fly, mate, and reproduce.

The adult female lays an egg that was fertilized by the male.

Puppets

Butterfly

The butterfly is operated by two people, one behind the other. The front puppeteer carries and operates the head and body with a flag pole holder. There is a pole that extends up into the head, which allows the puppeteer to turn the head from side to side. A bicycle brake lever operates the eyes. Bellows push air into the proboscis, which is made from a party favor blower. The back puppeteer has bamboo poles that manipulate the wings. The wings are made of a thin, wire frame, covered with painted fabric.

Caterpillar

The caterpillar is built like a giant slinky. There are steel rings covered with a sleeve of white fabric. The white fabric is layered with bands of yellow and black fabric. The puppeteer's hand slides inside the mouth in order to open and close it. There is a hole inside the mouth which allows the puppeteer's hand to draw in the pieces of the leaf.

Giant Milkweed Leaf, the Flowers, and the Oak Leaf

These are all made from heating and bending plastic pipes, which are then covered with fabric and painted.

Scenery

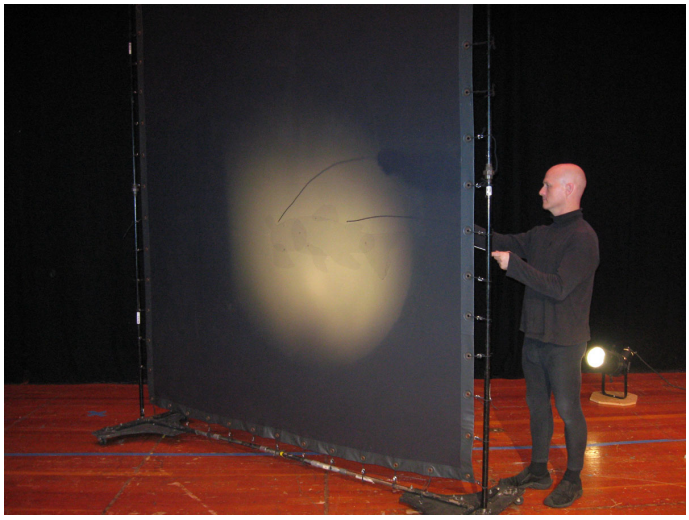
Two scrolling drapes dominate the stage. Each roll contains 70 feet of fabric (about the length of a Mac truck). There are two spools, one above the other. During the show, the puppeteers pull the fabric from top spool onto the one below. This creates the illusion that the caterpillar is climbing upward.

Shadow Show

Elements of a shadow show:

Screen- a translucent material stretched over a frame
Light- a directed light source like a flashlight or theater light
Puppets- cut-outs made of dark material (such as cardboard, leather, wood, metal) or colored, translucent material (such as plastic)

The first generation of shadow shows came into being in the 1st century BC in China, India and Indonesia. We will be using a shadow screen to track the journey of the butterfly to Mexico. There will also be a light source and a screen and our puppets will be made of colored, translucent (semi-see-through) plastic, which will create colored shadows on the screen.



Conservation

Monarchs are in danger. Humans have had a negative impact on the preservation of their habitat for two main reasons:

1- **There has been logging in the fir trees in the central Mexico highlands, where the monarchs have their overwintering sites.**
2- **Milkweed is being cut away all over the US for commercial development.**

1- The top priority in the world of butterfly conservation is to protect the forest ecosystem in Mexico. The monarch's survival is dependent on the protection of high-altitude oyamel fir forests. As the population grows, the trees are cut down for agriculture, sold for lumber, or used by local residents for fuel and home building.

2- Milkweed and the monarch have a **symbiotic** relationship, which means that they are dependent on each other for survival.

Milkweed provides for the monarch:
1- **Nectar**, a milky sap, for the butterflies to eat
2- Place for the butterflies to lay their eggs
3- Food for the monarch caterpillar
4- Protection for the monarch caterpillars and butterflies from predators. When the monarchs eat the toxic milkweed plant, they become poisonous to those that eat them.

The monarch assists the milkweed in **pollination**. As the butterfly sips nectar, its feet get dipped in pollen. When the butterfly goes to the next plant to eat, it drops off the pollen from the first plant onto the second. This pollen fertilizes the milkweed seed and allows the plant to reproduce.

How can you help the monarchs?

1- **Plant native milkweed and encourage others to do the same.**

Create monarch **waystations**, places that provide resources necessary for the monarch's survival. You can do this in home gardens, at schools, businesses, zoos, nature centers, along roadsides and other unused plots of land. Butterfly Encounters www.butterflyencounters.com and Monarch Watch www.monarchwatch.com contain information on which milkweed plant would be best in your area and sell seeds.

2- **Help protect small natural areas that support milkweed patches or overwintering sites.**

Write letters encouraging people to preserve the monarchs' sanctuaries, and plant milkweed and other plants for the butterflies. The Monarch Butterfly Sanctuary Foundation http://www.learner.org/jnorth/sm/aboutmbsf.html is dedicated to protecting the Mexican overwintering grounds for the monarchs. Friends of the Monarchs www.pgmonarchs.org works to protect and preserve the area in and around Pacific Grove, California and throughout the world.

3- **Help to educate the public on the importance of protecting monarchs and their habitat.**

Start locally! Mount a campaign in school or community groups to get the word out about the monarch butterfly. Ideas on raising awareness can be found in Lynn Rosenblatt's book Monarch Magic! or in the activity section, including forming an M & M Action Club and declaring a Monarch Awareness Week in your area.

4- **Report sightings or tag monarchs.**

There are many unanswered questions about the fall migration of the monarchs east of the Rocky Mountains. In order for scientists to track the butterflies to learn about their patterns, they depend on the efforts of volunteer taggers to obtain sufficient data to answer these questions. Specific instructions on this activity can be found at Monarch Watch www.monarchwatch.org. Go to Friends of the Monarchs www.pacificgrove.com/butterflies, Journey North www.journeynorth.com and the Monarch Monitoring Project www.concord.org/~dick/mon.html to report sightings of butterflies.

5- **Donate to or volunteer for organizations that specialize in the protection of monarchs.**

Hold bake sales or hold a performance to raise money and donate the proceeds to your favorite organization.

Vocabulary List

Chrysalis- the case in which a caterpillar changes into a butterfly

Conservation- the careful protection of something

Filament- a thread-like object, including the sensory tentacles of a caterpillar

Metamorphosis- a change of physical form, structure or substance by supernatural means

Migration- a long journey, usually every year, from one region or climate to another for feeding or breeding

Molting- shedding of skin

Pollination-the transfer of pollen (tiny seeds) from one plant to another

Proboscis- a long, flexible tongue that is used for sipping nectar

Proleg- fleshy leg of a caterpillar used for gripping

Spinneret- a special glad in the caterpillar's mouth which creates the attachment for the caterpillar to hang upside down to create its chrysalis

Spermatophore- a mixture of sperm plus fat and other nutrients

Stigmata- scent glands found on the hind wings of male monarch butterflies

Symbiotic- a relationship in which two organisms (plants or animals) depend on each other for survival

Tagging- the act of marking an animal in order to keep track of its migratory patterns

Waystation- a place that habitually provides resources for migrating animals

Activities

Create a Performance

Below are the lyrics to the theme song by Bernie Garzia from *Butterfly: The Story of a Life Cycle*. Appoint a director of the production. Have each student (or pair of students) create a movement gesture about the life cycle of the butterfly. The director will determine which movements go with which words. The class can either memorize the lines or have one person read them aloud as the rest of the class performs the movement.

Round…round…and round it goes
For as long as I can recall
Round like a rubber ball
Like summer into fall

Round…round…and round it goes
Like a circle with no end
From here…to here…and then
It all begins again

And it happens over and over
But it's special…every one
From life…to life…to life…to life…
And a new one's just begun!

Round…round…and round it goes
Like hello and good-bye
The sun up in the sky
Watch and you'll see why
I sing to the life
Of our butterfly
Of our butterfly
Of our butterfly
Our butterfly!

Create Poetry

Choose one of the following forms of poetry and create an ode to a caterpillar or a butterfly.

1- **Haiku** is a Japanese form of poetry which is usually about nature. The 17-syllable verse is formed by three lines. The first line consists of 5 syllables, the second has 7, and the third has 5.
2- **Limerick** has a highly controlled rhyming pattern. Lines 1, 2 and 5 rhyme; lines 3 and 4 rhyme.
3- **Couplet** contains a pair of lines of poetry that are usually rhymed.
4- **Diamante** is made of descriptive words that form the shape of a diamond. The first line is one word, the second line is two words, the third is three, the fourth is four, the fifth is three, the sixth is two, and the seventh is one. If you center all of the lines, the poem looks like a diamond.

Create a Shadow Show

The simplest shadow can be made by casting hand shadows against a white wall. By holding small objects, the shadows can become more complex (like pencils that could act as legs for a flamingo).

To create a show, place a stretched sheet in front of a doorway. Place a light about two feet behind the screen with the audience on the opposite side in a dark room. Create and tell a story of the transformation of the caterpillar into the chrysalis and then into a butterfly. Cut out the figures using paper or cardboard. You can create your own colored plastic shadow puppets by:

1- Take a gallon size plastic milk jug.
2- Trace the outline of your figure on the jug.
3- Cut out the figure.
4- Color in your figure using colored sharpies
5- Tape a popsicle stick to use as a handle.

Use your imagination to make the story come to life. For example, add a milkweed plant set or a bird searching for food.

References

Monarch Butterflies

Bronx Zoo Butterfly Garden
http://www.bronxzoo.com/plan-your-trip/exhibits/butterfly-garden.aspx
The Bronx Zoo has a butterfly garden, which includes monarchs. There is information on how to organize a class field trip.

Butterfly Encounters
http://www.butterflyencounters.com/
Butterfly Encounters contains information on milkweed and is a resource for obtaining seeds.

Enchanted Learning
http://www.enchantedlearning.com/subjects/butterfly/species/Monarch.shtml
This site contains an easy to understand description of the life cycle plus handouts for students including "Life Cycle Label Me", "Read and Answer Worksheet" and more.

Friends of the Monarchs
www.pgmonarchs.org
Friend of the Monarchs works to protect and preserve the Monarch Butterfly and its habitat by increasing public awareness and community involvement in restoration and preservation of their habitats in and around Pacific Grove and throughout the world.

Journey North
http://www.learner.org/jnorth/
Journey North engages students in a global study of wildlife migration and seasonal change. K-12 students share their own field observations with classmates across North America. They track the coming of spring through the migration patterns of monarch butterflies and other birds and mammals; the budding of plants; changing sunlight; and other natural events. Find migration maps, pictures, standards-based lesson plans, activities and information to help students make local observations and fit them into a global context.

Kids Zone
www.kidszone.ws/animals/monarch_butterfly.htm
Kids Zone contains information and activities fro kids. The life cycle hand outs in this study guide are from this site.

Monarch Butterfly Photo Gallery
http://www.geocities.com/wyllz/id177.htm
Most of the photos in this study guide were taken from this website by William Zittrich (wyllz@yahoo.com).

Monarch Butterfly Sanctuary Foundation

http://www.learner.org/jnorth/sm/aboutmbsf.html

This organization protects the monarch's wintering habitats in Mexico. This site also contains materials for teachers, an in-depth resource for teaching tools, classroom lessons and student materials.

Monarch Butterfly USA

http://www.monarchbutterflyusa.com/Cycle.htm

This website gives an in-depth view of the life cycle with pictures at every stage. It even includes a video of the butterfly emerging from the chrysalis and a map of migration routes.

Monarch Magic

http://www.monarchmagic.com/

Monarch Magic sells Monarch Life Cycle Kits, books and videos for the classroom.

Monarch Monitoring Project

www.concord.org/~dick/mon.html

Based at the Cape May Bird Observatory in New Jersey, this group monitors migrant monarch populations along the east coast.

Monarch Lab

http://www.monarchlab.org/default.aspx

Here you can learn about the University of Minnesota *Monarch Lab*, the *Monarchs in the Classroom* program, plus find lots of information about the Monarch Butterfly. *Monarchs in the Classroom* is a program of University of Minnesota Extension and Department of Fisheries, Wildlife and Conservation Biology.

Monarch Picture Story

http://www.kidzone.ws/animals/monarch_butterfly.htm

This site features crafts and jigsaw puzzles of the monarch butterfly.

Monarch Watch

http://www.monarchwatch.org/

A cooperative network of students, teachers, volunteers and researchers dedicated to the study of the Monarch Butterfly. This site sells a Monarch Waystation Seed Kit with complete instructions on how to create a garden that will both attract and help monarchs on their migration. It also sells Monarch Tagging Kits (recommended for 2nd Graders and older), which contain instructions and materials to tag butterflies.

National Wildlife Refuge System

http://www.fs.fed.us/monarchbutterfly/conservation/index.shtml

This site is a resource for activities for teachers and students, identified by grade level from pre-k through 12th grade. It also contains in-depth information about the continental conservation of the monarch. monarch_butterfly@fws.gov

Raising Monarch Butterflies

http://www.nicertutor.com/sketches/monarch/monarch.html

Here you can find information on observing monarch butterflies in their native habitat.

World Wildlife Foundation

http://www.worldwildlife.org/species/finder/monarchbutterflies/item3004.html

World Wildlife Fund, in collaboration with the Mexican Fund for the Conservation of Nature, has designed an innovative conservation strategy to protect and restore the monarch butterflies wintering habitat in Mexico.

Xerces Society

http://www.xerces.org/Monarch_Butterfly_Conservation/index.htm

This society works to protect monarch groves in California and to educate the public about these important habitats. They specialize in reporting on monarch sightings and tagging monarchs so that they can be tracked.

Books

The Monarch Butterfly
Biology and Conservation

Karen S. Oberhauser (Editor); Michelle J. Solensky (Editor)
Cloth, 2004 ISBN: 0-8014-4188-9
Book can be bought at http://www.cornellpress.cornell.edu/cup_detail.taf?ti_id=4081
The knowledge of citizen scientists, biologists, and naturalists informs this book's coverage of every aspect of the monarch butterfly's life cycle (breeding, migration, and overwintering) from the perspective of every established monarch population (western North American, eastern North American, and Australian). The unique combination of basic research, background information, and conservation applications makes this book a valuable resource for ecologists, entomologists, naturalists, and teachers.

Monarch Magic!
Butterfly Activities & Nature Discoveries

Lynn M. Rosenblatt
Williamson Books, 1998 ISBN: 1-885593-23-6
For children ages 4-12, this book is written by an elementary school teacher in easy-to-follow text and filled with more than 100 full-color photos. It is divided into two sections: The Monarchs Adventure and A Butterfly Activity Bonanza.

An Extraordinary Life
The Story of a Monarch Butterfly

Laurence Pringle with paintings by Bob Marstall
Scholastic, 2001. ISBN: 0-439-28866-5
This is a biography of Danaus, a caterpillar who transforms into a monarch butterfly and migrates to Mexico. Grounded in scientific facts, this story is both an educational and interesting account of the life of a monarch.