



BRUCE MUSEUM

One Museum Drive • Greenwich, CT 06830-7100

The Bruce Museum of Arts and Science Education Department Presents: Educator Guide

BUTTERFLIES AND INSECTS



The Bruce Museum of Arts and Science Education Department develops Educator Guides to provide detailed information on field trip planning, alignment with Connecticut State Goals and Learning Standards and New York Education Standards, as well as suggested hands-on classroom activities to do before, during, and after your visit to the Museum.



Teacher Notes:

This educator's guide is separated into eight parts:

- Exhibition guide
- Curriculum Connections
- Teacher and Student Resources
- Games and Puzzles
- Activities
- Vocabulary List
- How to schedule your Museum visits
- Education Staff List

Students explore symmetry in nature while learning about the structure of butterflies and insects. The life cycle, adaptations, habitats, and camouflage patterns of butterflies and insects are also covered. Museum specimens and photographs create a visually comprehensive classroom experience.

School programs are inquiry based and promote critical thinking, written, and oral expression. They feature hands-on-learning activities using objects from Museum collections and exhibitions. Many are interdisciplinary and address various learning styles.

For school program information contact Diane Clifford, Manager of School and Tour Services at 203-869-6786 Ext. 324 or by email dclifford@brucemuseum.org. If you are interested in this program as a Bruce-mobile Outreach visit, contact Sheean Haley, Manager of Outreach Education at 203-869-6786 Ext. 323 or by email shaley@brucemuseum.org.

For reservations contact Anne Burns at 203-869-6786 Ext. 338 or by email anneburns@brucemuseum.org.

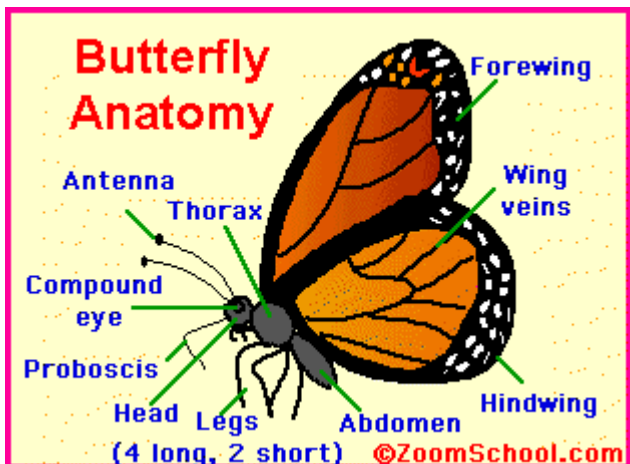


Exhibition Guide:

Butterfly Basics

Butterflies and moths are members of a taxonomic group of insects called Lepidoptera. It is estimated that there are about 150,000 different species of butterflies and moths (there may be many more). There are about 28,000 butterfly species worldwide, and the rest are moths. Like all insects, they have six jointed legs, 3 body parts, a pair of antennae, compound eyes, and an exoskeleton. The three body parts are the head, thorax (the chest), and abdomen (the tail end).

The butterfly's body is covered by tiny sensory hairs. The four wings and the six legs of the butterfly are attached to the thorax. The thorax contains the muscles that make the legs and wings move. Butterflies and moths have two pairs of large wings covered with colorful, iridescent scales in overlapping rows. Lepidoptera (butterflies and moths) are the only insects that have scaly wings. Wings are attached to the thorax and veins nourish them with blood. Butterflies can only fly if their body temperature is above 86 degrees, so butterflies sun themselves to warm up in cool weather. As butterflies age, the color of the wings fades and the wings become ragged.



Flight speed varies among butterfly species (the poisonous varieties are slower than non-poisonous varieties). The fastest butterflies (some skippers) can fly at about 30 miles per hour or faster. Slow flying butterflies fly at about 5 mph.

What makes a butterfly a butterfly?

In general, the characteristics separating butterflies from moths are:

- Butterflies have knobbed antennae while those of moths range from straight filaments to feathery or branched.



- Butterflies have smooth, slender bodies and moths tend to be plump and fuzzy.
- Most butterflies are diurnal (fly during the day) while most moths are nocturnal (fly at night).
- Butterflies generally rest with their wings held upright, while moths spread them out.
- Most of the brightly colored Lepidoptera are butterflies.

Life Cycle

Butterflies and moths undergo complete metamorphosis in which they go through four different life stages.

- Egg - A butterfly starts its life as an egg, often laid on a leaf.
- Larva - The larva (caterpillar) hatches from an egg and eats leaves or flowers almost constantly. The caterpillar molts (loses its old skin) many times as it grows. The caterpillar will increase up to several thousand times in size before pupating.
- Pupa - It turns into a pupa (chrysalis); this is a resting stage.
- Adult - A beautiful, flying adult emerges. This adult will continue the cycle.



The caterpillar stage of a Monarch butterfly feeds on milkweed.

Diet

Caterpillars spend most of their time eating leaves using strong mandibles (jaws). A caterpillar's first meal, however, is its own eggshell. A few caterpillars are meat-eaters; the larva of the carnivorous Harvester butterfly eats woolly aphids.

Butterflies and moths can only sip liquid food using a tube-like proboscis, which is a long, flexible "tongue." This proboscis uncoils to sip food, and coils up again into a spiral when not in use. Most butterflies live on nectar from flowers. Some butterflies sip the liquid from rotting fruits and a rare few prefer rotting animal flesh or animal fluids (such as the Harvester butterfly).



The eastern tiger swallowtail can be found in North America east of the Rocky Mountains from Ontario south to the Gulf coast and northern Mexico.

Habitat

Butterflies are found all over the world and in all types of environments: hot and cold, dry and moist, at sea level and

high in the mountains. Most butterfly species, however, are found in tropical areas, especially tropical rainforests.

Many butterflies migrate in order to avoid adverse environmental conditions (like cold weather). Butterfly migration is not well understood. Most migrate relatively short distances, but a few (like some Monarchs) migrate thousands of miles.

Why are butterflies important?

Butterflies provide people with beauty and enjoyment, but they are also important ecologically. Eggs, larvae, pupae, and adult butterflies are an important food source for birds, small mammals, reptiles, and amphibians. Caterpillars help recycle nutrients in the environment, and adult butterflies help pollinate many flowering plants.

Butterflies are very sensitive to changes in their environment. Consequently, they are an important “indicator species”, detecting environmental changes before humans might otherwise become aware of them. A shift in butterfly numbers, distribution, or species composition in a particular area can indicate a significant change in habitat quality. Unfortunately, many butterfly species around the world are in decline, and others have already gone extinct. Their biggest threat is habitat loss. Loss of habitat can occur through deforestation, agriculture, urbanization, introduced non-native species, global climate change, and pollution.

Butterflies in your backyard

The best thing to do to help butterflies and encourage them to visit the backyard is to support a healthy butterfly habitat. This can be done by planting wildflowers favored by butterflies and host plants for caterpillars. Avoid using pesticides, herbicides, or chemical fertilizers around the home, and try to reduce your carbon footprint.



Curriculum Connections:

Connecticut

Greenwich

Kindergarten

The Nature of Scientific Inquiry

- Recognize that careful observation is necessary to learn about living and nonliving things in this world (K-1.2).
- Orders living and nonliving things.

Zoology

- Discusses these simple life functions: taking in and eliminating food and water, and moving.
- Describes how animals change and grow.
- Observes and records characteristics of parts of animals (K-9.4)

Ecology

- Recognizes that plants and animals often live in the same place.
- Recognizes that plants and animals depend on each other (K-11.2)

Grade 1

Zoology

- Discusses these simple life functions: responding to stimuli and producing offspring (1.93)

Ecology

- Recognizes that plants and animals are found just about everywhere in the world, but that the kind of plants and animals differ.
- Explains how living things depend on each other (1.11.2).
- Identifies adaptations of plants and animals that allow them to live in certain places (1-11.3).

Grade 2

The Nature of Scientific Inquiry

- Identifies multiple ways to group a set of objects and organisms.
- Compares and contrasts things in terms of number, size, texture, shape, weight, color and motion.

Zoology



- Name the characteristics of insects (2-9.4).
- Lists examples of insects.
- Describes the work that entomologists do in studying insects.
- Defines metamorphosis as a complete change in the form of an insect or animal.
- Describes the life cycle of a butterfly: egg, larva, pupa and adult (3-10.5).
- Recognizes that every kind of animal completes a life cycle: it is born; it goes through changes and it becomes an adult and reproduces.
- Locates and identifies butterflies in his or her community.
- Explains what mimicry is and gives examples of organisms that rely on it (3 – 11.2).
- Recognizes that many animals have specialized sensory organs to help them cope in their environment (3-9.6).
- Compares and contrasts corresponding parts of animals (2.9.6).

Ecology

- Defines an organism as one living thing, a habitat as the area where an organism lives.
- Describes how an organism's needs are provided for by its habitat (5-11.4).

New York

Kindergarten

- PI 4 (1.1) Students ask why questions in attempts to seek greater understanding concerning objects and events that they have observed and heard about.
- PI 4 (1.1b) Students will articulate appropriate questions based on observations.
- PI 5 (1.2) Students question the explanations they hear from others and read about, seek clarification and comparing them with their own observations and understanding.
- PI 75 (1.1) Students describe the characteristics of and variations between living and nonliving things.
- PI 75 (1.1a) Animals need air, water and food in order to live and thrive.
- PI 76 (1.2) Students describe the life processes common to all living things.
- PI 79 (3.1) Students describe how the structures of plants and animals complement the environment of the plant or animal.
- PI 79 (3.1a) Each animal has different structures that serve different functions on growth, survival and repair.
- PI 81 (4.1) Students describe the major changes in the life cycles of selected plants and animals.
- PI 81 (4.1a) Plants and animals have life cycles. These may include beginning of a life, development into an adult, and reproduction as an adult, and eventual death.
- PI 81 (4.1e) Each generation of animals goes through changes in form from young to adult. This completed sequence of changes in form is called a life cycle.
- PI 81 (4.1f) each kind of animals goes through its own stages of growth and development during its life span.
- PI 81 (4.1g) The length of time of an animal from birth to its death is called its life span.
- PI 83 (5.1) Students describe basic life functions of common living specimens.

Grade 1

- Standards from Kindergarten plus



- PI 79 (3.1c) In order to survive in their environment, plants and animals must be adapted to that environment.
- PI 79 (3.1C) Animal adaptations include coloration for warning or attraction, camouflage, defense mechanisms, movement, hibernation and migration.
- PI 80 (3.2) Students observe that differences within a species may give individuals an advantage in surviving and reproducing.
- PI 80 (3.2b) All individuals have variations, and because of these variations, individuals of a species may have an advantage in surviving and reproducing.
- PI 84 (5.2) Students describe some survival behaviors of common living things.
- PI 84 (5.2b) Animals respond to change in their environment.
- PI 84 (5.2c) Senses can provide essential information to animals about their environment.
- PI 84 (5.2e) Particular animal characteristics are influenced by changing environmental conditions.
- PI 84 (5.2g) The health, growth, and development of organisms are affected by environmental conditions such as the availability of food, air, water, space, shelter, heat and sunlight.
- PI 86 (6.1b) All animals depend on plants.
- PI 86 (6.1c) Animals that eat plants for food may in turn become food for other animals, this sequence is called a food chain.
- PI 86 (6.1e) An organism's pattern of behavior is related to the nature of that organism's environment, including the kinds and numbers of other organisms present, the availability of food and other resources, and the physical characteristics of the environment.
- PI 86 (6.1f) When the environment changes, some plants and animals survive and reproduce and others die or move to new locations.

Grade 2

- Standards from 1st Grade plus
- PI 79 (3.1E) Some animals have parts that are used to produce sounds and smells to help the animal meet its needs.



Student and Teacher Internet Resources:

<http://www.butterfliesandmoths.org/>

<http://www.enchantedlearning.com/subjects/butterfly/>

<http://www.enchantedlearning.com/subjects/butterfly/books/butterflylifecycle/>

<http://www.billybear4kids.com/butterfly/flutter-fun.html>

http://www.defenders.org/wildlife_and_habitat/wildlife/butterflies.php

<http://www.shrewsbury-ma.gov/schools/beal/curriculum/butterfly/butterflies.html>

<http://www.thebutterflysite.com/>

<http://www.fieldmuseum.org/butterfly/basics.htm>

Suggested Reading:

Duncan Edwards, Pamela. Clara Caterpillar: Harper Trophy, 2004.

Heiligman, Deborah. From Caterpillar to Butterfly (Let's-Read-and-Find-Out Science, Stage 1): Harper Trophy, 1996.

Howe, James. I Wish I Were a Butterfly: Voyager Books, 1994.

Ryder, Joanne and Lynne Cherry. Where Butterflies Grow: Puffin, 1996.

Swope, Sam. Gotta Go! Gotta Go!: Farrar, Straus and Giroux, 2004.

For a more extensive list of butterfly books, follow this link:

<http://www.earthsbirthday.org/butterflies/bflys/activitykit/books.html>

Games and Puzzles:

- Monarch Maze
<http://www.billybear4kids.com/butterfly/online-maze/monarch-maze.htm>



- Butterfly Match Game
http://www.primarygames.com/science/butterflies/games/match_up/butterfly_match.htm
- Academy of Natural Sciences Games
<http://www.ansp.org/museum/butterflies/index.php>

Activities

Handprint Butterfly (from enchantedlearning.com)

Materials:

A few pieces of colored construction paper (stiffer paper makes a more durable butterfly)
Pencils
Scissors
Glue, tape or a stapler
Crayons, paint, colored pencils or markers
Googly eyes (optional)
A pipe cleaner

What to do:

- 1) Trace a child's hand on a few pieces of construction paper, for a total of 6 times. These will be the butterfly's wings.
- 2) Cut out the tracings.
- 3) On a piece of dark construction paper, draw a butterfly's body (draw a long oval plus a smaller circle at one end).
- 4) Glue or staple the handprint tracings to the body, three on each side. The fingers should point outwards.
- 5) Fold a pipe cleaner in half. Curl the ends a bit or wad them into balls. The folded pipe cleaner will be the butterfly's antennae.
- 6) Tape or staple the bent part of the pipe cleaner to the back side of the butterfly's head.
- 7) Either draw eyes on the butterfly's head or glue on googly eyes. Decorate the wings with crayons or markers.

Thumbprint Caterpillar and Butterfly

(from <http://www.dltk-holidays.com/summer/mthumbprints.htm>)

Materials:

paper
Tempra or finger paint (at least 2 colors; with only 2 thumbs, you'll have to wash off in between colors)
black marker



What to do:

- 1) Make thumbprints on the paper. Options include:
 - a thumbprint caterpillar with alternating colors,
 - a thumbprint flower (4 prints for the petals and 2 prints for the leaves),
 - a thumbprint butterfly (4 prints of the same color),
 - a thumbprint sun (a whole bunch of prints in a circle),
 - a thumbprint bush (prints in a bunch) and
 - thumbprint grass (prints in a row)
- 2) For less experienced crafters, make small pencil marks on the paper to help guide them as to where they should be putting their thumbprints -- this helps with their hand/eye coordination, direction following skills and gets the caterpillars to look like caterpillars!
- 3) Let the prints dry.
- 4) With the black marker, draw legs and a face on the caterpillar, a stem and center on the flower, and a body and antenna on the butterfly.



Vocabulary List:

Abdomen - the segmented tail area of an insect (including butterflies and moths). An insect's abdomen contains its organs, and most of the digestive system (foregut, hindgut and rectum). It is protected by an exoskeleton.

Antennae - sensory appendages attached to the head of some adult insects. Antennae are used for the sense of smell and balance. Butterflies have two segmented antennae with a small club at the end of each. Moths have antennae without the club.

Caterpillar - the larval stage of butterflies and moths. Caterpillars eat almost constantly and molt many times as they grow.

Cocoon - a protective covering, made of silk, which protects a moth pupa (and some other insects). The cocoon is spun from the abdomen of the larva (caterpillar) before it pupates.

Exoskeleton - an external skeleton, a tough, structural body armor made of chitin. Arthropods (insects, arachnids, trilobites, crustaceans, etc.) have segmented exoskeletons.

Metamorphosis - the transformation of an animal during its life cycle (from larva to adult). The larval stage of butterflies and moths (the caterpillar) metamorphoses into a winged, flying adult (the adult butterfly or moth). Butterflies undergo complete metamorphosis.

Proboscis - a tube-like, flexible "tongue" that butterflies and moths use to sip their liquid food (usually flower nectar or the liquid from rotting fruits). The proboscis uncoils to sip food, and coils up again into a spiral when not in use. It consists of two halves which are joined together.

Pupa - the stage in a butterfly's (or moth's) life when it is encased in a chrysalis and undergoing metamorphosis. The pupa stage lasts from a few days to many months (some butterflies overwinter in the pupa stage, and the adult emerges in the spring).

Thorax - the chest area of an insect (including butterflies and moths). The thorax is divided into three segments; on each segment is a pair of legs.



How to schedule your museum visits

- Adult and school groups of 8 or more require advance reservations and are subject to a special group fee.
- Museum-Based School programs are available Tuesday through Friday at 10:00 am, 11:15 am, and 1:00 pm
- After-School Museum-Based programs are available Tuesday through Friday, last one hour, and start no later than 4:00 pm.
- The Bruce Museum is accessible to individuals with disabilities.
- Call Bruce Museum Reservations Manager, Anne Burns, at 203-869-6786 ext.338. You may leave a voicemail message at this number at any time. Please leave a choice of times to return your call.
- **Fees**
A confirmation/invoice will be mailed four weeks prior to the program. Pre-payment is preferred, however, Museum programs may be paid on day of visit. Payment is by check only, payable to Bruce Museum, Inc.
Museum-Based Programs: \$45 per program.
- **Scholarships**
Thanks to the generosity of our corporate members and sponsors, scholarships are available under special circumstances. Please contact the Museum for more information.
- **Cancellations**
There is a \$15 charge if cancellation is less than two weeks in advance of the scheduled program.
- **No Eating Facilities are available at the Museum**
In case of bad weather, classes will be permitted to eat in the Education Workshop if they reserve the room in advance.
- **Class Size**
In order to maintain quality education, classes are limited to 25 students. Pre-school class size is limited to 20 students.
- **Supervision: REQUIRED for all programs**
Museum visit: 1 adult for every 5 children, to accompany the children at all times.
Self-guided tours: If you would like your class to tour the rest of the Museum before or after the scheduled program, you must tell us when you make your reservation to avoid conflict with other groups.
Nametags: Help to personalize program and enhance student behavior.
- **Conduct**
In order to enhance everyone's enjoyment of the Museum, please go over these rules with your students in advance:
 - Please do not run in the Museum.
 - Please talk in quiet voices.



- Please do not touch paintings or objects

Special requests or curriculum needs

All of the programs are flexible and can be adapted to audiences with special needs or to your curriculum objectives. Please discuss with the Museum Education staff in advance.



Education Department Staff List

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Appendix I: Marine Food Web

