2018 Grants: CMB

Title: Montana Science Center "It's a Bug's World" Exhibit

Concept Statement: Insects create an engaging science subject for children of all levels, and through our exhibit we will excite visitors about insects while providing an educational experience aligning with teachers' science education needs, when appropriate.

Concept Description: Insects are fascinating to children and adults alike, yet they are misunderstood on the simplest levels. Because there is no end to discovering new insects, scientists continue to study and examine them as a critical part of the world around us. This exhibit introduces visitors to local and global insect species. Additionally, as insects become a more viable food source, introducing entomophagy to children early is an essential step to increasing that industry.

Project Goals and Objectives: The Children's Museum of Bozeman enriches our community by engaging children and adults in the magic of shared learning and discovery. CMB's powerful interactive exhibits and educational programs are designed to provide deep learning opportunities in science, technology, engineering, art and math. CMB welcomes more than 16,000 visitors each year to our 4,000-square-foot facility in Bozeman's historic downtown. Installing a new 600 square foot exhibit for It's A Bug's World! will increase our overall visitation from new guests and members alike. Our Museum is more sustainable when members, in particular, can experience new and exciting exhibits, encouraging them to renew their membership. Additionally, new exhibits with high educational value encourage area teachers to incorporate our Museum into their field trip plans, therefore making our Museum more sustainable. Adding educational field trips to a classrooms' structure creates a dynamic year of

learning for all children. The goal of this exhibit is to encourage children and families to creatively and critically think about the world of insects, learning about the anatomy of bugs, their distinct differences, and the ways in which we interact with bugs on a daily basis. For some age groups, it will be an introduction to insects, and for others it will provide an in depth lesson on habitats, anatomy, and characteristics of bugs. The exhibit features include:

- Get up close and observe ants in action in our tabletop formicarium.
- Learn about a cricket's life cycle in our cricket habitat, and how they become food.
- Learn about insect biology and habitat at our vibrant info stations throughout the exhibit.
- Imagine life as a bug with costumes to wear as you move through a giant grassy path.
- Test your motor skills as you maneuver a tech-savvy hexbug through a maze. Challenge a friend to see who can get their bug through the maze first.
- Design a unique bug from puzzle pieces on a magnetic table. -Touch and listen to insect sounds on the sensory touch wall.
- Students will also visit the space during class field trips with specially designed curriculum.
- Live bugs will be featured at Family Science Days during the duration of the exhibit. Additionally, museum staff will develop curricula to guide visiting classrooms through our exhibit for additional education in entomology and entomophagy.

As teachers increasingly need access to curriculum that aligns with standards, we will work to create easy, applicable science education activities centered around our insect exhibit which facilitate learning and instruction within the classroom at a level that is comfortable for teachers and engaging for students of grade school age.

Project Budget: The funds will cover the finalization of this exhibit, including developing a usable curriculum for classroom field trips to directly interact with this exhibit. We will develop short, usable activities and instructions for moving about the museum in order to facilitate education. Additionally, this portion will invite visiting families to engage with each other in the exhibit for collaborative learning between parent and child, therefore increasing the effectiveness of each section of the exhibit. (see details)

2018 Funding: Requested $750. Fully funded.

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Chris Stelzig, CAE
Entomological Society of America
3 Park Place, Suite 307
Annapolis, MD 21401

March 15, 2019

Dear Mr. Stelzig
First and foremost, we are excited to announce that the Children's Museum of Bozeman rebranded on March 14, 2019 to Montana Science Center. We are looking forward to a bright future.

As a recipient of one of the Foundation's 2018 Regular Grants, it is my pleasure to report on the successful development and implementation of a new K-3 field trip curriculum to be used in conjunction with our *It's A Bug's World* exhibit. Your generous support has allowed us to continue to provide quality programs for the children and students of the Greater Gallatin Valley.

Specifically, the following upgrades have been made to the *It's A Bug's World* exhibit area:

- the addition of a new exhibit component about metamorphosis which includes a large color infographic as well as magnetic life cycle puzzle pieces to arrange on a magnetic tabletop.
- the purchase of a live termite habitat from Termitat.
- the purchase and procurement of Tobacco Hornworm eggs, larva, and adult specimens as well as vials and Ryker mounts for display.
- the purchase of butterfly costume wings (Monarch and Blue Morpho) and butterfly antennae for imaginative play.
- purchase of new insect puzzle pieces for our Build A Bug magnet wall.
- the purchase of plastic life cycle models of an ant, stag beetle, Monarch butterfly and chicken for our K-3 Metamorphic Magic field trip.
- the purchase of a small critter tote for hatching cricket eggs.

Additionally, grant funds were used for staff to develop a field trip curriculum for grades K-3 which focusses on the life cycles of insects. In early March, we piloted the program with 80 first graders from a Bozeman elementary school and the response was very positive. Our goal for 2019 is to bring more than 30 classrooms into the museum for hands-on learning about life cycles as well as giving them an opportunity to observe and touch live insects. We have also been very fortunate to partner with a Montana State University graduate student who is currently studying Tobacco Hornworms and she has been able to provide expertise and outreach to our visitors. We are excited to be able to offer even more opportunities for our visitors to learn about the exciting world of insects for the rest of 2019 and beyond.

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In the pages that follow, please find our Metamorphosis Magic field trip curriculum as well several photographs of students in one of our pilot field trips.

Again, we are so grateful to the Entomological Society for the opportunity to develop this program and to continue to upgrade our *It's a Bug's World* exhibit.

With kind regards,

Pamela Jacques
Director of Exhibits & Design
Montana Science Center (formerly Children's Museum of Bozeman)

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FIELD TRIP CURRICULUM

Grade Level: Grades K-3
Subject: Life Sciences
Suggested Time: 45 min

Overview:
Insects are everywhere—in fact, they are the largest group of animals in the world. There are over 1 million different species and scientists believe there are many more which have yet to be discovered.

Through exploration and observation, even the most timid child may realize that insects aren't something to run from. And because insects are relatively easy to find and capture, they are a great way to introduce kids to many environmental education concepts. Studying insects can even be a stepping stone to an eventual career in entomology, engineering, robotics, criminology, food science, and many other fields.

METAMORPHOSIS MAGIC

Goals:
Students will observe live bugs and be able to identify the head, thorax, and abdomen.
Students will understand what a cycle is and identify cycles seen in nature.
Students will be able to sequence the events in the life cycle of a butterfly, stag beetle, chicken, and ant.

Pre-Trip:
Grades K
Read *The Very Hungry Caterpillar*. Ask kids what they know about caterpillars. Have they ever seen or touched them? Discuss some of the changes the hungry caterpillar went through on its way to becoming a butterfly. Ask them to name other things that change as they grow.

Grades 1-3
Watch PBS video called *Metamorphosis: Change of Plans* as a class. (https://montana.pbslearningmedia.org/resource/tdc02.sci.life.cyc.metamorph/metamorphosis-change-of-plans/)

Grades K-3: Introduce and discuss relevant vocabulary:

head
thorax
abdomen
life cycle; life stages
metamorphosis
egg
nymph
larva
pupa
chrysalis
coccoon

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At the museum:

When group arrives:

Welcome and rules. If there are more than 20 students, divide into 2 groups. Send one group to Bugs and one group to Craft area (toddler room or maker space depending on number of students).

In Bug's World:

K-3 Activity 1: Build-A-Bug

Ask students to name a few bugs. How many of you have ever picked up a bug? What kinds of things have you observed about bugs? (habitat, appearance, nuisance, etc).

Let's invent our own bug...what does our bug need to make it an insect? Have a student volunteer choose a head from the magnetic bug puzzle pieces and place it on the board. What else do we need? Have the volunteer choose a thorax and abdomen. What other things might our bug have? (wings and antennae).

DISCUSSION: How do scientists name bugs? What could we name our bug?

Kindergarten Activity 2: very Hungry Caterpillar Narrative Pantomime

Materials: Butterfly wings and antenna, leaf with eggs, fabric leaves (caterpillar food), 3-4 adult coats, chrysalis (blue pop-up tunnel).

Have the students sit in a group in the Bug's World exhibit. A staff member dressed as a butterfly swoops in and places a leaf with tiny eggs on a table. Have a staff member or volunteer act as a caterpillar. They will pretend to eat leaves and get bigger and bigger by putting on increasingly larger winter coats. Once the caterpillar is nice and fat, the caterpillar is ready to pupate. Place the chrysalis tunnel over the head of the caterpillar. Ask the volunteer to take off each coat one at a time and hand them to you. Once the coats are off, hand the caterpillar the butterfly wings and then the antennae to put on. A fair amount of movement inside the chrysalis is good and represents how this is a very active stage with a lot going on inside. Once the caterpillar is dressed as a butterfly, remove the chysalis. Voila! Explain how after the butterfly mates, the cycle begins anew as the butterfly lays its eggs.

DISCUSSION: Can you name other animals which go through metamorphosis?

Grades 1-3 Activity 2: Each One Teach One Extension

How many of you have read The Very Hungry Caterpillar? (show the book?) How many of you have ever seen a caterpillar in real life? A butterfly? Do they look similar? Has anyone heard the word "metamorphosis" before? What does that word mean? Explain that the root morph means to change and that in the insect world, metamorphosis refers to the transformation or change that occurs from a tiny egg to an adult bug. Can you name an animal that goes through metamorphosis (most will know about frogs).

Break into 4 groups. Give each group one of 4 plastic life cycle models (chicken, butterfly, stag beetle, ant). Ask students to look at the models and decide which life cycle stage each part represents. Have them arrange the pieces in a circular order. When they are finished, one person from each group will tell the class about their life cycle.

DISCUSSION: How does the development of insects differ from that of the chicken? Can you name other animals with life cycles like the chicken? Why do you think the life stages of an organism are arranged in a circle? If time, give some fun facts about each of the plastic insect species.

K-3 Activity 3: Direct Observation
Students will observe tobacco horn worms in several stages of metamorphosis. Students will have the opportunity to touch and hold specimens if they desire.

Students may also observe Madagascar Hissing Cockroaches and have the opportunity to touch specimens if they desire. An exoskeleton may also be available to observe and touch.

Activity 4: Butterfly Life Cycle craft (see attached activity plans)
Students will use materials to create a craft to take home which illustrates a butterfly's life cycle.
Grades K: Paper Plate and Pasta Craft
Grades 1-3: Toilet Paper Tube Chrysalis craft

Post Trip: Back in the classroom
- Go on a bug scavenger hunt on your school's property (see attached)
- Plant a butterfly teaching garden
- Make a bug jar or mini bug hotel

RESOURCES:

The Very Hungry Caterpillar by Eric Carle

Born to be a Butterfly by Karen Wallace

Change of Plans Quicktime Video: https://montana.pbslearningmedia.org/resource/tdc02.sci.life.cyc.metamorph/metamorphosis-change-of-plans/

The Incredible Journey of the Butterflies (available at Amazon.com for about $13)

www.butterflyschool.org

www.kidsbutterfly.org

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BUTTERFLY AND CHRYSALIS CRAFT

MATERIALS

wooden clothespins
glue
pom poms
googly eyes
toilet paper tubes
coffee filters
liquid watercolors
pipe cleaners
white, brown or green yarn
photographs of butterflies

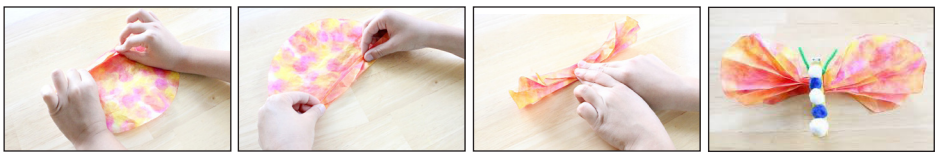
TO DO

1. Make the butterfly
Look at some photographs of butterflies to get some inspiration for yours. Spread out a coffee filter. With a paintbrush, dab on liquid watercolors. Let your coffee filter dry.

2. Make the chrysalis
Apply some glue to outside of toilet paper tube. Wrap yarn around the tube so it sticks to the glue.

3. Make the caterpillar
Glue pom poms and googly eyes to one side of your clothespin. Add pipe cleaner antennae.

4. Put it all together
Fold your coffee filter accordian style (see photo) and place in between the clothespin. Now carefully fold the wings and place inside the chrysalis.



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BUTTERFLY LIFE CYCLE PASTA CRAFT

MATERIALS

Paper plates, one per student
Rulers
Markers
Scissors
green construction paper
Glue
Dried white beans
Rotini pasta
Small shell pasta
Bowtie pasta
small twigs

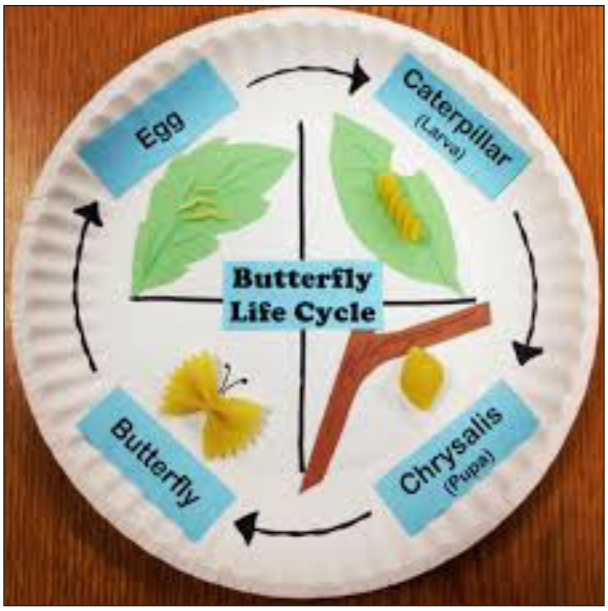
TO DO

1. Use a ruler to 2 perpendicular lines so you have 4 equal sections.

2. Cut two leaf shapes out of the green paper. Use a marker to make veins if desired. Glue leaves into top two sections.

3. Glue several beans to the top left leaf. These represent the eggs. Now glue the rotini to the other leaf to represent the caterpillar. For the pupa, glue a twig and shell pasta to the bottom right section. Finally, glue a piece of bowtie pasta in the bottom left section.

4. Use a marker to label the stages: egg, caterpillar (larva), chrysalis (pupa), butterfly.



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INSECT SCAVENGER HUNT

Divide into groups. Pick an area for your hunt: it could be your school's playground or it could be a nearby park or forest. Give students 30 minutes to explore and see how many points they can score. Tell students not to harm any insects! Make sure to pack a field guide for reference.

✓	ITEM	FIELD NOTES (describe what you see)	POINTS
	an ant		2
	a bee or wasp		2
	a fly		2
	a butterfly or moth		2
	a grasshopper or cricket		5
	a ladybug		5
	a boxelder bug		8
	a whirligig		8
	a stink bug		8
	an arthropod which is not an insect		10

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MINI BUG HOTEL

Insect hotels are easy to make and can be assembled from a variety of found, recycled, or up-cycled materials. Some bee, wasp, ladybug, butterfly, and moth species hibernate over the winter, and safe little homes where they can stay warm and dry until springtime will help ensure their survival. Here's a simple insect inn your students can make in class and take home to their gardens.

WHAT YOU NEED

clean, plastic bottles (Two-liter size works best.)
scissors
stapler
hole punch
twine
items to put in your hotel, such as twigs, leaves, bark, pine cones, broken clay pot pieces, rolled up newspaper, blocks of wood, hollow reeds (bamboo works best), etc.
mesh produce bag (optional)

WHAT YOU DO

1. Create the compartments: cut the bottom five inches off each bottle. (Ask an adult for help.) Staple the bottle "cups" together as shown or create your own arrangement.
2. Prepare for hanging: punch two holes about an inch apart in each cup. Thread twine through the holes until you have wrapped it all the way around the cups. Tie the ends of the twine in a knot at the top.
3. Fill the hotel: tightly fill each compartment with the items you have collected. To prevent some of the objects from falling out, you can cover one or more of the cups with a piece of the mesh bag.

TIP: Non-stinging bees love neat, round holes. To attract more bees, you can drill holes into a block of wood and add it to your hotel. Just make sure the wood isn't "pressure-treated" with chemicals.

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PLANT A BUTTERFLY TEACHING GARDEN

Depending on the scope of your project, either add plants to an existing garden or create a dedicated teaching garden space on your school's property.

1. RESEARCH: Find out which butterflies and moths are common to your area and research what food sources they prefer.

2. PLANT SELECTION: Many flowering plants will attract butterflies to your location, but not all flowers are created equally in the compound eyes of a butterfly. Selecting plants that will feed butterflies while also encouraging them to stick around for a while, laying eggs and creating a new generation of butterflies, is your goal. To do this, you will need to choose plants that fall into two groups: nectar plants that will provide adult butterflies with energy and caterpillar food plants that will feed caterpillars. With careful selection from these two groups, your garden will provide for the entire life cycle of butterflies. Local gardening centers may be very helpful in selecting plants for this purpose.

TIP: This website has information specific to attracting butterflies in Montana (https://www.thebutterflysite.com/montana-butterflies.shtml).

3. SITE SELECTION: Analyze the garden to site to make sure there is adequate shelter, sun, and water.

4. PLANT FLOWERS AND WATCH YOUR GARDEN GROW! Invite parents to help with the digging and planting. Set up a watering schedule. Make plant markers. Have students come up with reasons why it's important to plant gardens for butterflies and bees.

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First graders arranging plastic life cycle stages of an ant.

Students get up close & personal with a cockroach molt.

Kids use simple materials to craft a butterfly life cycle.