COLLEGE OF SOCIAL & BEHAVIORAL SCIENCES
Women in Science & Engineering

Bio/Diversity Project:
Lesson Title: Butterflies and Moths

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Grade Level: 4th grade

Arizona Science Standard:	*4.L4U1.11* ● *Analyze and interpret environmental data demonstrate that species either adapt and survive or go extinct over time.*
Content Objective: Math, Reading, Science, Writing, Other:	● *Students will be able to describe adaptations in coevolution between butterflies, moths, and plants in the Sonoran Desert.* ● *Students will be able to differentiate between different species of butterflies, moths, and the plants they pollinate*
Scientist of the Week:	● *Eduardo Rendon-Salinas* ● *Part of the Monarch Program at the World Wildlife Fund -- Mexico* ● *Studies monarch butterflies and the links between migration and deforestation* ● *Publishes in both English and Spanish*

Vocabulary	Materials
● Proboscis ● Diurnal ● Nocturnal ● Predation	● Non-noise making party blowers ● Double sided tape ● Small plastic cups ● Yellow and orange colored pom-poms ● http://butterflyprojectnyc.org/wp-content/uploads/2009/12/butterfly-curriculum.pdf (page 11 handouts)
Guiding Questions: ● How do different butterfly and moth species pollinate different flower species? ● What are adaptations that butterflies and moths have developed over time?	

Engagement/Introductory Activity:
Start the lesson with the topic of *butterflies*:

- Ask students how many species of butterflies they think there are in the world
  - Answer: over 160,000 different species of butterflies
  - In the Sonoran Desert: 250 species
- List a few common species that are specific to the Sonoran Desert and the plants they pollinate
  - American Snout -- Aster
  - Mormon Metalmark -- Rabbit brush
  - Pipevine Swallowtail -- Pipevine
- Show students a video of how butterflies collect nectar and pollinate

    - https://www.youtube.com/watch?v=Zb-x9Nvg4jg
- Butterfly Adaptations – have long thin legs, and don't have a place to store pollen
    - They are not as efficient as bees in pollinating flowers

Next, move on to the topic of *moths*:

- Ask students how many species of moths they think are in the world
    - Answer: 142,000 species
    - In the Sonoran Desert = ~ 2,750 (not a precise number)
- List a few common species that are specific to the Sonoran Desert and the plants they pollinate
    - Yucca moth -- yucca
    - Hornworm -- tobacco
    - Looper -- cabbage, broccoli
- Moth Adaptations:
    - White flowers that are visible at night
    - Flowers that are sweet smelling
    - Some can hear sounds that bats make

Show students a diagram on how to differentiate butterflies and moths. Share with them the following information:

- When a butterfly lands and rests on a plant, it holds its wings vertically, while moths tend to rest with their wings folded back almost horizontally
- Moths have heavy, furred bodies, whereas the butterflies have more delicate, slender bodies with little hair
- Butterfly antennae are thin and end with a knob at the tip. Moth antennae are often feathery and without a knob.
- Not all moths are night fliers

Exploratory Activity:

- Students will explore how yucca moths collect pollen from the yucca flower while avoiding natural conditions, such as predators!

    Prep work:

    - Place cups with double sided tape on the bottom around the classroom tables. Fill every cup with yellow colored pompoms, and fill only a few with yellow and orange colored pompoms. Orange pompoms (in every cup) represent nectar while yellow pompoms (in only a few) represent pollen.
    - Cover the tips of the party blowers with a thin line of double sided tape at the end. This will allow students to pick up pollen when they extend their proboscis.

    Game rules:

    - The moths will try to obtain nectar while also collecting pollen. They must try to transfer pollen to other cups to ensure that every cup has pollen in it.

- Moths cannot use their hands to reach into the flowers or collect nectar/pollen -- they can only use their proboscis! The only time they can use their hands is to drop pollen off at another flower.
- If a cup tips over and nectar or pollen spills, that flower is dead and out of play.
- If a party blower breaks, then the proboscis is broken, which means that moth is injured and dies.
- The teachers will be the predators (bats). While the moths are collecting pollen and nectar, the bats will have to walk around, clicking their tongues (simulating a bat's echolocation).
- When a yucca moth hears a bat approaching, it can avoid being eaten by sitting until the bat passes.
- If a bat tags a standing yucca moth, it is eaten. The moth must take a seat at their table and leave the play area.
- After a couple of minutes, end the activity and ask the moths to count how much nectar they collected on their proboscis. They need at least 5 pompoms to survive the game.

Explain:

- Ask students to reflect on the activity
  - Did they survive?
  - What was challenging?
  - What are other factors that could affect moth populations?
- Have students compare this process of collecting nectar and pollen to that of birds and bees. Which is more efficient? Which is least efficient?
- Have students color and label butterfly anatomy. Have them highlight the parts that are most important for pollination:
  - Proboscis, legs, bristles

Extension Activity/Questions:

- Explain how migration patterns of butterflies are affected by climate change
  - Monarchs rely on temperature cues to trigger migration in both directions
- Talk about how urbanization has affected light colored butterflies and moths so that they stand out more to their predators.
  - Ask students: How would this affect their populations? How would this affect pollination?
- Relate to the prior bee extension activity in how climate change is affecting bee populations.
  - Ask students: What would happen if both bees and butterflies / moths were impacted?

Evaluation Activity:

- Moths vs. Butterflies Matching Game:
  - Have students point to which images on a PowerPoint are butterflies and which are moths

- Have students assess which flowers would be pollinated by butterflies and which by moths and why