COLLEGE OF SOCIAL & BEHAVIORAL SCIENCES
Women in Science & Engineering

Bio/Diversity Project
Lesson Title: Adaptations of Desert Animals and Desert Humans

Teacher: Rachel Juarez and Zach Stebner
Grade Level: 6-8
Adapted from: Animal Adaptations To The Desert & Water You Drink

Common Core Standard:	7.L1U1.11 ● Construct an explanation for how organisms maintain internal stability and evaluate the effect of the external factors on organisms' internal stability 6.S4.C1 ● Develop and use a model to explain how natural selection may lead to increases and decreases of specific traits in populations over time
Content Objective: Math, Reading, Science, Writing, Other:	● *Students will identify the adaptations of animals that allow them to live in the Sonoran Desert environment.* ● *Students will investigate the effects of heat and wind have on evaporation.* ● *Students will be able to define evaporation (for animals and plants) and adaptation.* ● *Students will write down one significant adaptation that allows Sonoran Desert plants or animals to stay cool in the desert.*
Language Objective: (Optional)	N/A
Scientist of the Week:	● *Marie Maynard Daly* ● *African American Chemist, Researcher, and Activist* ● *Queens, New York* ● *Marie Daly was the first African American woman to receive a Ph.D. in chemistry in the United States. She worked closely with scientist Dr. Quentin B. Deming and their work opened up a new understanding of how foods and diet can affect the health of the heart and the circulatory system.*

Vocabulary	**Materials**
● Evaporation ● Evapotranspiration ● Adaptation ● Heat ● Arid	● Copy of Student Handout - Animal Adaptations to the Desert for each student ● Bucket(s) of water ● Paper towels ● Pen/Pencil ● Journals ● Index Cards (with examples of animals that are depicted in the Student Handout)

Seasonality:

Monsoons	*Autumn*	*Winter*	*Spring*	*Dry Summer*
July-Sept.	Oct.-Nov.	Dec.- Feb.	Mar.-Apr.	May-June

Guiding Question:
- Why do animals and plants need to adapt to the desert climate and conditions?
- What adaptations are specific to Sonoran Desert Species

Preparation:

- Have your partner teacher or co-intern prepare the Exploratory Activity outside while one intern begins the Engagement/Introductory Activity. After the Engagement/Introductory Activity is complete, bring the students to the courtyard outside.
    - Preparation: Bring buckets of water and paper towels outside. Find a spot where pavement is in the sunshine and in shade.

Engagement/Introductory Activity: (5 min)

- Ask students the following questions, by displaying it on the board, to prompt them to think about adaptations and what adaptations look like: "List 3 activities that you do to keep cool when it's hot outside in Tucson."
    - Have students Think-Pair-Share their answers to the question.
- Provide examples of animals and/or plants that have adapted to be active at night or during cooler hours of the day
- Tell students that they will be going outside to do a series of activities to demonstrate adaptations that desert animals have to help them live in the desert.
- Lead the class to the courtyard for the Exploratory Activity.

Exploratory Activity: (20 min)

- Dip a paper towel in a bucket of water and wring the excess water into the bucket.
- Take the moistened paper towel and wipe it across the pavement that is in the sunshine. Watch the moisture begin to disappear.
- Ask the students, "What happened to the water?" (It evaporated into the air)
- Explain that here in the desert, it is hot and dry, and water disappears or evaporates into the air all the time.
- Ask the students, "What kinds of things does water evaporate from?" (clothes on a line, puddles, pavement, etc.)
    - If they don't think of it, ask the students, "Does water evaporate from plants and animals, too?" (yes)
- Ask, "Do you think it is hard for living things to live in the desert where there is not much water and it evaporates away?" "How do they survive?"
    - Students should generate examples of how animals/plants are able to survive in the desert.
- Explain that these are examples of adaptations – body parts or actions – that help animals and plants live here.
    - Organisms adapt to their environment. Desert environments pose interesting challenges for survival, and desert animals have developed unique adaptations for living here.
- ADAPTATION 1: RESTING IN SHADE OR IN A BURROW, ACTIVE AT NIGHT
    - Have the students dampen and ball up a paper towel and write their initials/names on the pavement on both the sunny side and shady side.
    - Ask them to closely observe which one dries up more quickly. (the one in direct sunshine)
    - Ask, "What does this tell you about the sunny side?" (that water dries up more quickly in the sun) "Which side feels hotter?" (the sunny side)
    - Ask, "If you were an animal living out in the desert, what might you do to keep cool and try not to lose much water?" (rest in the shade during the hottest times of day, come out when it is cooler)
    - Explain that many desert animals are active either at night or in the cooler hours of the day. They pass the heat of the day resting in deep shade or down in burrows out of the sun.
    - Provide examples, on index cards, of animals and/or plants that have adapted to be active at night or in cooler hours of the day.
        - **Kangaroo rat** (genus Dpodomys) is a nocturnal mammal, active at night. It reabsorbs nearly all the water in its kidneys before it urinates. A tubule within the kidney of the kangaroo rat, called Henle's loop, is proportionately the longest of any mammal.
        - **Desert tortoise** (Xerobates agassizii, formally classified as genus Gopherus) store water in their bladders and move underground in burrows up to thirty feet long to escape the heat. With extreme dryness and heat, they become active at dusk and dawn (or become crepuscular). Sonoran Desert subspecies are protected in Arizona; Mojave Desert subspecies are threatened with extinction.

        - **Saguaros** (Carnegia Gigantea) have spines that provide shade and reduce wind, providing for less water loss due to evaporation. It also has: 1) a huge network of shallow roots to gather water, and 2) ridges which store water, swelling when water is abundant and shrinking as it gets dry. More than four-fifths of a saguaro's weight may be water store in its stem to be used in times of drought. A specialized chemical system, abbreviated CAM, enables the plants to take in carbon dioxide at night and the store is for photosynthesis during daylight. (USGS)
- ADAPTATION 2: PANTING OR SWEATING
    - Ask the students: "What happens to us when we get hot and our body tries to cool us down?" (We sweat.) "How does sweating cool us off?" (Our sweat evaporates and cools us.)
    - To illustrate this, have the students roll up their sleeves and dip one arm in the bucket of water, leaving the other arm dry.
    - They should wave both arms in the air. Ask: "Which arm is cooler? Why?" (Evaporation on wet-arm cools the air down around the arm, making it feel cooler.) "Do you think very many desert animals sweat?" (no) Why?"
    - But there are other ways to keep cool. Ask, "What do dogs do to keep cool?" (pant)
    - Explain that when [dogs] they pant, dogs' blood is cooled as it passes through their tongue because water evaporates from dogs' tongues and cools them down. Coyotes, mountain lions, birds, and many other desert animals pant to cool down.
    - Provide examples, on index cards, of animals and/or plants that have adapted to pant to cool down.
        - **Black-tailed jackrabbit** (Lepus Californians) has long, thin ears (large surface area) with prominent veins that act as radiators, losing heat without sweating or losing any water. This mammal seeks shade in rocks or vegetation to keep cool. Also, pant through their noses as a form of evaporative cooling. Long legs also help release body heat into the air.

Explain: (10 min)

- Return to the classroom.
- Pass out Student Handout - Animal Adaptations to the Desert to each student.
- Point out that part of the picture represents daytime, the other part night.
- Ask the students to look at the picture and describe the adaptations they see that animals have to save water and keep cool.
    - They should notice those already discussed – a fox in its den in the heat of the day, javelina resting in the shade beneath a tree, a bird painting, a kangaroo rat active at night. Have them circle these.
- Ask, "Can you see any other animal adaptations for life in the desert in this picture?"
    - The desert tortoise and jackrabbit are both resting in the shade. These animals have other desert adaptations as well. Desert tortoises store water in their bladders and can go a long time without drinking, but when it is hot they retreat to their burrows. Jackrabbits rest in the shade and use their big ears to cool down their blood. Their warm blood circulates into their ears and is cooled when exposed to the cooler air.
- Point out each animal in the picture, explaining their adaptations.
- Have the students circle them.
- Then ask, "Which animal does not seem adapted to the desert?" (The black bear.) "Why?" (It has thick hair and is out in the sunshine in the middle of the day.) Have them put an X over the bear
- Have the students color the picture. Remind them to distinguish between day and night.

Extension Activity/Questions: (10 min)

- CREATE A DESERT CREATURE!

- Using playdough, the students should create their own animal or plant with its own adaptations for desert survival.
- Ask students to share their creations with each other to see if others can figure out the creatures' adaptations.

Evaluation Activity: (5 min)

- Instruct the students to pull out their journals.
- Ask the students to "Write 1 significant adaptation that allows desert plants or animals to stay cool in the desert."
  - Ask guiding questions like: What do you remember from the evaporation activity? What is something you found interesting today? Was there something that surprised you from today's activity?