Lesson Plan Two (Insect model)

Overview: This exercise provides hands on experience of researching and recreating an organism (specifically an insect) with distinct characteristics well suited for survival in its natural habitat.

Audience: This activity is designed for middle school students in grades 5-8.

Background:

It is important for students to understand the concepts of evolutionary processes, such as adaptation. Most organism populations have survived through time because they were successful in surviving their particular habitats. This survival is enhanced by how well suited the population is to its environment, enemies and prey. Natural selection has selected those populations that have certain adaptations (physically, physiologically and behaviorally) that are phenotypically (versus genetypically) expressed increasing its survival probability. For example, two of the most prominent physical adaptations that allow humans to be dominant populations in most areas of the world are bipedalism and increased brain mass to surface volume.

Different types of adaptations provide organisms different types of survival. Some organisms display preferences in food or life cycle requirements that are perfectly matched with seasons, plants and other environmental inhabitants. An example of physiological adaptations can be found in arctic fish where certain fish have special enzymes that allow it to survive below freezing waters. A common adaptation found in insect species is the ability to hide using camouflage and mimicry.

Mimicry is one type of deception commonly found in the insect world. They manage to avoid predation only because they look or act like some other unsavory creature. The viceroy butterfly, for example, is a pleasant tasting insect that predators avoid because its orange and black color pattern resembles the monarch butterfly, a very bad tasting species. Yellow and black bands on the abdomen of a bee or wasp warn predators of a sting. Yet many harmless flies and moths also escape predation because they mimic this color pattern.

Other insects deceive predators by blending in with the environment (cryptic coloration). Like soldiers wearing camouflage, these insects escape detection because they are so difficult to see among the leaves or twigs where they live. Some insects hide under bits of moss or pieces of bark that they glue onto their backs. Others resemble leaves, thorns, or dead twigs to escape notice by predators. Some butterfly larvae look like snakes; others are mistaken for bird droppings. Cryptic coloration is also used by some insect predators to hide among the leaves or flowers where they lie in wait for prey.

Insects are the most diverse groups of animals on the planet. Ninety-five percent of all the animal species on the earth are insects. They are so diverse because of the specializations and adaptations that each different species possesses to inhabit its own niche. Therefore, they are ideal organisms to use when studying adaptation. In order to do this, an understanding of the general insect makeup must be known. All insects have six jointed legs, three body parts (head, thorax and abdomen), two antennae and an exoskeleton. Most insects have one or two pairs of wing, but are not always indicative of an insect. There are also a number of reasons that many scientists believe that insects are so successful, such as the presence of the protective exoskeleton, their small size, the ability to fly and the amazing adaptations many have. All

characteristics that deviate from these initial identification tools are subject to inspection for adaptation abilities.

Time requirements: This activity can be completed in two 50-minute periods.

Objectives:

1. Explain the defining characteristics of a specific insect.
2. Describe how the defining characteristics of that specific insect suit its habitat and lifestyle.

National Science Education Standards:

Unifying concepts and processes in science.
- Form and function

Science as inquiry.
- Understanding about scientific inquiry

Life science.
- Structure and function in living systems
- Diversity and adaptations of organisms

History and nature of science.
- Nature of science

Materials:

- Styrofoam pieces in various shapes (round, rectangular, strips, etc.)
- Construction paper
- Tape, glue, and scissors
- Twigs from outside
- Buttons
- String/pipe cleaners
- Paper plates
- Markers
- Various other objects that could be used to construct an insect
- Library or internet access
- Illustrations of insects to research (See powerpoint attachment)

Anticipatory Set: Present the students with the Ant's Thermal Window of Opportunity (end of this lesson plan).

Procedure:

1. Present the above article (read to them, overhead or handouts). Ask the students if they think this is an isolated event where an organism is well suited to survive in its particular environment. Can anyone give examples of other organisms (not just insects). Discuss how these characteristics allow the organism to survive and reproduce. Are there some adaptations that are physically visible? Are these adaptations used as identifying characteristics?

2. Tell students that they are to pick an insect (or you will assign one to them) from the given list to research. The research should include habitats, food/prey, predators and features of the insect that make it well suited to live in its natural habitat. Tell the students to especially focus on any physical adaptations the insect possesses that give it an advantage to survive in its habitat.
3. For example, the mole cricket lives in the soil, it eats other smaller invertebrates, it has specialized from legs that look like shovels, these are to help it dig in the soil (they are adapted to live and move through soil), they are dark brown to black which also makes them look a lot like the soil providing camouflage so other organisms don't eat them and many other facts the students should be able to find.
4. The research is to be used for 2-5 minute presentations of their insects to the rest of the class.
5. Now, the students get to apply their knowledge of insects and adaptations. Tell the students to use the given materials to construct their own make-believe insect. This insect should still possess the general characteristics that make it an insect (6 legs, three body segments, etc). Also, they need to create their own specialized feature that allows the insect to live in a specific habitat/niche.
6. They will be expected to describe the insect they made by handing in a one-page summary of what they made and where it would live. Also, have them identify any adapted features that make it well suited for its habitat.

Closure:

1. Provide/Lead discussion about how all of these adaptations allow for several insects to live in the same area. Also, point out that habitat destruction limits or excludes these insects from their natural homes and adaptations.
2. Ask each student to hand in a sentence or two about another insect (besides the one they researched) that they learned about.

Adaptation: This activity may be adapted for elementary use. The teacher can have pre-made body parts for several insects to be discussed. The parts are placed in a box and students piece them together like puzzles using provided illustrations of the insects. A general description of what makes an insect an insect would want to precede the puzzle fun.

Suggested list of insects to research

Mole cricket – front legs like shovels
Tiger beetle – larvae have special holes to catch prey and strong jaws
Grasshopper – some look like leaves to hide or sneak up on prey
Mosquito – long sucking needle to obtain food
Walking stick – looks like a stick
Harvester ant (Pogonomyrmex genus) – special hairs that act as a basket to carry seeds
Monarch butterfly – warning colors/bad taste
Viceroy butterfly – mimics the warning colors of monarch butterflies
Bee-mimic fly – like name, mimics bees to escape predation
Acrobat ant (Crematogaster genus) – specialize abdomen to sting threatening creatures
Katydid – mimics leaves
Weevils – specialized nose
Firefly – specialized organs to allow for glowing at night to attract mates
Wasps or bees – warning coloration for dangerous stings
Water strider – special body structure and feet allows them to walk on water
Treehopper (thorn bug) – they look like thorns
Planthopper – look like leaves or buds
Io Moth – large eyespots to confuse predator

Ant's Thermal Window of Opportunity

When the heat of the Sahara's midday sun reaches about 116 degrees Fahrenheit and has driven all other creatures underground, the silver ants burst out from their burrows for the only opportunity they have all day to find food.

Able to tolerate temperatures that would kill other species, they forage for corpses of other insects that came out earlier but failed to retreat in time and died of overheating. Later in the day, when the temperature hits 128, even the silver ants must retreat.

Why don't the ants come out before it gets so hot? Because there is a species of lizard that lives near ant nests and gobbles up any that venture out too early. At about the temperature that forces the lizards underground, the ants come out, signaled by sensor ants that check the temperature at intervals.

Because ants are so small, their body temperature is about the same as that of the air. Even though silver ants can function at the highest temperature of any known land animal, when the temperature has risen another 12 degrees, they must retreat or die.

Vocabulary:

Adaptation: An alteration of adjustment in structure of habitat, often hereditary, by which a species or individual improves its condition in its environment.
Diversity: The variety and abundance of species, their genetic composition, their communities, and the ecosystems and landscapes of which they are a part. Biodiversity refers to native biological diversity; therefore, increases in species diversity resulting from the introduction of nonnative species would not constitute an increase in biodiversity.
Bipedalism: Walking upright on two feet as opposed to moving on all four limbs.
Evolution: The process by which all species develop from earlier forms of life. Natural variation in the genetic material of a population favors reproduction by some individuals more than others, so that over the generations all members of the population come to possess the favorable traits.
Genotype: the genetic makeup of an organism, as opposed to its physical characteristics (phenotype).
Individual: An independent organism separate from a group or population.
Natural Selection: The process, according to Darwin, by which organisms best suited to survival in a particular environment achieve greater reproductive success, thereby passing advantageous genetic characteristics on to future generations.
Niche: Organism's role, or job, in its habitat that it is physically, physiologically and/or behaviorally adapted to.
Phenotype: The visible characteristics of an organism resulting from the interaction between its genetic makeup and the environment.
Physiology: The way a particular body or organism works, including such functions as metabolism, respiration, and reproduction, rather than with their shape or structure.
Population: The number of individuals representing a species in a given area.