THE SCIENCE OF "FRINGE"

EXPLORING: ADAPTATION

A SCIENCE OLYMPIAD THEMED LESSON PLAN
EPISODE 315: **SUBJECT 13**

Overview:
Students will learn about adaptation and how the process helps organisms survive in their specific ecological environment.

Grade Level: 9-12

Episode Summary:
In a flashback to the 1980's, Walter works with children in Florida, including Olivia, on finding a way to transport over to the other side. Peter becomes more and more convinced that he was abducted from his real parents, while Walternate sinks into a depression over his missing son. When Olivia spontaneously appears 'over there' for a few moments, Walter focuses his efforts on finding what triggers her ability. After scaring her, she flees the school, and Peter uses her drawings to find that she has taken refuge in a special field of white tulips not native to the area.

Related Science Olympiad Event:
Ecology - Students will answer questions involving content knowledge and process skills in the area of ecology and adaptation by examining different ecosystems.

Learning Objectives:
Students will understand the following:

- Adaptation is a process whereby an organism becomes better able to live in its habitat.
- Adaptive traits can be structural (e.g. physical features of an organism), behavioral (e.g. the ability to learn), or physiological (e.g. growth and development patterns).
- Adaptation takes place over many generations of an organism.

FOX CODE

FOR SMARTPHONES

Episode Scenes of Relevance:
- Elizabeth and Peter driving past the field of tulips (11:44 'tulips don't' – 12:15 'flowers grow')
- Peter finding Olivia in the field of tulips (34:08 'hi' – 35:07 'not scared')

Online Resources:
- Fringe "Subject 13" full episode: : http://www.fox.com/watch/fringe
- Science Olympiad Ecology event: http://soinc.org/ecology_c
- Photos of Ecological Adaptations: http://waynesword.palomar.edu/lmexe10b.htm
- Wikipedia page on Adaptation: http://en.wikipedia.org/wiki/Adaptation

Procedures:
1. Tell your students that they are going to learn about adaptation and specifically how plants are physically adapted to their environments.
2. Have your students research plant adaptation in resources such as biology textbooks and websites and discuss what they have learned.
3. Divide your class into small groups. Have each group complete the following activity:
    a. Materials: leaves from a variety of plants and trees, scales, water, paper towels
    b. Select a leaf and weigh it on the scale. Record the starting weight.
    c. Soak the leaf in water for a few minutes and then use the paper towel to dry off any major droplets adhering to the outside of the leaf.
    d. Weigh the leaf again and record the result.
    e. Allow the leaf to sit in a warm, dry area, preferably in direct sunlight.
    f. Reweigh the leaf every 5 minutes for 30 minutes and record the result.
    g. Make a chart of the weights vs. time of the various leaves used to illustrate the rate of evaporation of water in each leaf
4. Discuss with the class the results of the activity. Be sure to address:
    a. Because of varying leaf size and shape, is it more appropriate to present the weights as absolute values or relative to the original weight of the leaf?
    b. How did the rates of evaporation relate to the overall shape and structure of the leaf?
    c. Can they infer from the rates of evaporation the typical biome the plant is best adapted for?

Additional Discussion Suggestions:
- The same types of plants, when growing in different biomes will have slightly different physical properties. Examples of this include pine trees near the Arctic Circle versus in the continental US. What other examples can the class think of?
- Agricultural research and technology has resulted in specialized adaptations to plants that wouldn't naturally occur, such as seedless grapes. What other examples can the class think of?

Extension to Other Subjects:
Social Sciences: Human populations also undergo adaptation to their local environment. Examples include societies living at high altitudes or in deserts. Research some of the unique traits and characteristics of such groups of people.

Chemistry: Some adaptations result in unique chemicals that can be utilizes for other purposes. One example is certain compounds first discovered in coral that now are utilized in sun screens. Research how scientists discover such chemicals and utilize them for other purposes.

History: Charles Darwin's finches from the Galapagos Islands played a critical role in the development of his theory of evolution. Research what special adaptations these finches possess and why they were such a big news story in London when they were first analyzed.

National Science Standards Alignment:
C. Life Science – Life science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

H.C.4 Interdependence of organisms

a. The atoms and molecules on the earth cycle among the living and nonliving components of the biosphere.
b. Energy flows through ecosystems in one direction, from photosynthetic organisms to herbivores to carnivores and decomposers.
c. Organisms both cooperate and compete in ecosystems. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.
d. Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite. This fundamental tension has profound effects on the interactions between organisms.
e. Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

H.C.5 Matter, energy, and organization in living systems

a. All matter tends toward more disorganized states. Living systems require a continuous input of energy to maintain their chemical and physical organizations. With death, and the cessation of energy input, living systems rapidly disintegrate.
b. The energy for life primarily derives from the sun. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. These molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars, and fats). In addition, the energy stored in bonds between the atoms (chemical energy) can be used as sources of energy for life processes.
c. The chemical bonds of food molecules contain energy. Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed. Cells usually store this energy temporarily in phosphate bonds of a small high-energy compound called ATP.
d. The complexity and organization of organisms accommodates the need for obtaining, transforming, transporting, releasing, and eliminating the matter and energy used to sustain the organism.
e. The distribution and abundance of organisms and populations in ecosystems are limited by the availability of matter and energy and the ability of the ecosystem to recycle materials.
f. As matter and energy flows through different levels of organization of living systems–cells, organs, organisms, communities–and between living systems and the physical environment, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy into the environment as heat. Matter and energy are conserved in each change.