CLASSIFICATION OF ORGANISMS

SSS: SC.H.2.4.1, SC.G.1.4.1, SC.F.2.4.3

INTRODUCTION

Classification is simply an organizational tool utilized in some way by all life. Humans classify things such as, food, clothing, and friends. Fishermen classify fish, cooks classify spices, and biologists classify organisms. Biologists use the Linnaean system of classification (Kingdom, Phylum, Class, etc.) also known as taxonomy to group like organisms together. However, in the last decade biologist have turned to methods such as, cladistics and phylogenetic systematics to define relationships between organisms. This lesson meets the following benchmarks: SC.H.1.4.1, SC.H.1.4.2, SC.H.1.4.3, SC.H.2.4.2, SC.G.1.4.1, SC.F.1.4.2.

STUDENT LEARNING OBJECTIVES

1. Student will be able to list the classification levels
2. Student will be able to identify apomorphic, autapomorphic, and synapomorphic characters of animal species.

MATERIALS

Teaching Aids

Lecture Presentation: **Classification of Organisms – Part 1**
Photos: Two sets of six photos (SET A and SET B)
Evolution Cards (Cards with partial features of organisms): These cards are paired, so every card in the stack represents one part of the organism shown on the card.
Handouts: Classification WS1 + WS2

PROCEDURES

Agenda

- Quick Write: Why is it important to classify organisms?
- During lecture students complete WS1 for their journals
- Form groups and complete WS2
- Tomorrow's Topic: Classification of Organisms – Part 2

Lecture

Introduction (5 min): Students pull out a sheet of paper and discuss why they think it's important for scientists to classify organisms. Students generally understand the usefulness of organizing animals, but they don't understand that animals are organized based on rules governed by natural selection and that classification systems are hypotheses that give support to the theory of evolution

Hook (10 min): Handout two Evolution cards to each student. Tell students they have to find their matching card without moving. Students can stand up and describe the image on their card, but they cannot tell what it is. If another student thinks they have a match, they may walk over to that student and compare cards. After giving everyone a chance to

find their match, ask students which types of description seemed to be most effective i.e., which ones actually led to a match.

Body

Part 1 (10 min)**:** Using the PowerPoint presentation as a guide, teacher discusses taxonomy, systematics, and cladistics.

Students can easily classify their socks by color or their favorite movies by actors, but understanding and using multiple level classification systems requires practice. Ask students if they organize their books by Ficton/Non-fiction then Author then Year then # pages. None of the students would imagine doing such a nerdy thing. Yet, if they had a collection of a hundred books, they would certainly recognize the need for such a system.

For biologist, multiple level classification systems are necessary for tracking the millions of organisms on the planet. Traditional classification known as **taxonomy** is used to place organisms into discreet categories (Kingdom, Phylum, Class, etc) based on similar characters (Hair, wings, limbs), but this creates problems since not all characters should be weighted equally (wing development vs. toe-nail length), thus new methods for classifying organisms have been developed. Though taxonomy is still widely used by biologist and the classification levels still serve as the foundation for grouping organisms, new methods such as systematics and cladistics are becoming widely recognized as more natural methods for explaining relationships among extant and extinct organisms.

Systematics is the field of biology that reveals patterns of events used to reconstruct the "tree of life." Cladistics is the science of “who came from who,” or another way to put it “who are the ancestors and who are the descendents.” Students usually have a hard time understanding how systematics differs from taxonomy and taxonomy from cladistics. Here’s one example that may help differentiate between the two terms.

EX: Aliens come to Gainesville, randomly capture one hundred humans, and take them back to the space ship. In the space ship, the captives are exposed to space-gas. Thirty humans fall asleep and seventy do not. Why didn’t all the humans fall asleep, the aliens wondered. They check their taxonomic keys for a description of *Homo sapiens*, they verify all captives are *Homo sapiens*, but they just can’t find anything wrong. **Q:** Ask the students for possible explanations. **A:** Even though all captives are *Homo sapiens*, individual differences exist within.

The aliens are very scientific so they take blood samples from all the captives. **Q:** What do you think they found? **A:** Members of each group shared a common ancestor (a great-great grandfather) who was either immune or not immune to the chemicals in the space-gas. Perhaps, they should have just focused their capture on individuals from the same family line.

Part 2 (10 min): Students will need to find some way to memorize the levels of classification. At a set point in the lecture the teacher will stop lecturing and

handout WS1 for the students to complete. Each student should come up with a pneumonic for remembering the levels (Kingdom – Phylum – Class – Order – Family – Genus – Species), such as **K**mart **P**roducts **C**ome, **O**ut **F**or **G**reat **S**ales. The teacher should emphasize that a pneumonic is a great way to force words into the mind quickly, which scientist often need to do before they can make use of those words. WS1 goes in their scientific journals. Ask a few students to restate their pneumonic and then the levels of classification.

Part 3 (20 min): Students will divide into two groups. Each group will get a set of photos and a copy of WS2. Each member of the group puts his/her name at the bottom of the worksheet. Each group will be given 10 minutes to classify their set of photos. Using the cladogram as a guide each group will select taxon names (1-6) and synapomorphies (A-F) to classify their set of photos. Some possible taxon names and synapomorphies are listed on WS2, each can only be used once, but additional ones not listed may be accepted. After 10 minutes, the groups will exchange their set of photos for another and repeat the process all over again until they have completed two cladograms. Once all the groups have finished, they will turn in the worksheets and the teacher will show them the correct classification for each set of photos.

ASSESSMENT

Objective 1: Using WS1, students will create a pneumonic of the classification levels and draw circles around the levels of classification to illustrate the inclusiveness.

Objective 2: Using WS2, students will classify two groups of organisms using a predefined list of synapomorphies and taxon names, and propose a list autapomorphies unique to those taxa.

ADAPTATIONS

This lesson could easily be modified for lower division biology courses by removing the high-level systematic concepts (synapomorphies, symplesiomorphies, autapomorphies, etc) and just focusing on the simple concepts (derived, ancestral, unique). Simpler taxa could be used, or no taxa, just shapes and colors.

REFERENCES

American Museum Of Natural History
http://www.amnh.org/exhibitions/permanent/fossilhalls/cladistics/
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http://taxonomy.zoology.gla.ac.uk/teaching/Cladistics.pdf
The Tree of Life Web Project
http://tolweb.org/tree/phylogeny.html