Youngstown City Schools

SCIENCE: BIOLOGY - - Grade 10

Unit 5: CLASSIFICATION SYSTEMS (2-3 WEEKS)

SYNOPSIS: The students will look at the vast diversity of living things on Earth but also learn how shared characteristics among them can indicate common ancestry and degrees of evolutionary relationship. Students will compare the early attempts of naturalists to classify organisms based on their structure with today's techniques that use molecular evidence. Students will analyze both types of evidence to confirm or disprove the evolutionary relationship suggested for a possible new species or other unfamiliar organisms.

STANDARDS

III. Diversity and Interdependence of Life

A. Classification systems

1. These frameworks were created by scientists to describe the vast diversity of organisms and yet indicate the degree of relatedness between organisms.
2. The great diversity of organisms and ecological niches they occupy result from more than 3.5 billion years of evolution.
3. Recent molecular-sequence data generally support earlier hypotheses regarding lineages of organisms based upon morphological comparisons.
4. Both morphological comparisons and molecular evidence must be used to describe biodiversity (cladograms can be used to address this); study of the diversity and similarity of organisms (molecular level).

LITERACY STANDARDS: READING (RST) and WRITING (WHST)

RST.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST.4 Determine the meaning of words, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grade 9-10 texts.

MOTIVATION

1. The teacher uses a sorting activity to help students see how "classification systems" work, including **dichotomous** keys.

2. The teacher reviews the concept of diversity and **biodiversity** using a PPT (or Video, if preferred) on exotic animals. Students make comments to clarify understanding, complete a table to identify the physical attributes and basic traits of sample species

3. The teacher shares an anecdote about the 8:00 and the 9:00 cock-roaches.

4. The teacher displays a 4-panel cartoon of Family Trees (containing errors); students can work alone or in 2s or 3s to study each panel; they explain what is "not right" in each case and why; students summarize the essential points of each cartoon. See **FOOTNOTES** for detail of this activity.

5. The teacher helps students establish both academic and personal goals for this Unit; the students record these in their Notebooks. e.g.,

Sample Personal Goals	Sample Academic Goals
a. Write daily assignments in notebook (planner) b. Follow classroom rules 3 of 5 days (60%) c. Come to class prepared (materials, supplies) 80%	a. Bring to class an example from real-life of something being studied in our Unit b. Explain learning goals each day to a peer

6. The teacher previews the Authentic Assessments for the end of the Unit.

TEACHER NOTES

bold text = featured vocabulary

TEACHING-LEARNING

1. **Science Vocabulary Strategy**

   Teacher

   a. post words in room on chart paper; allow to hang at least throughout the Unit
   b. deal with roots and affixes (if appropriate)
   c. use a diagram to illustrate the meaning of a term (e.g. alleles; density)
   d. relate each term to a similar word and/or a familiar like-word, and teach the opposite word (e.g., immigration . . . . migration . . . . emigration)
   e. in the course of teaching, define the word in context (never in isolation)
   f. throughout the Unit, frequently use the word

   Students

   g. use the words in (1) discussions, notes, diagrams; (2) investigations and write-ups; and (3) 2- and 4-point responses
   h. use the terms in Rubrics for the Authentic Assessments

dichotomous key	Linnaeus	molecular
biodiversity	Darwin	sequence data
kingdom	scientific names	morphology
phylum	*(Homo sapien)*	homologous
niche	cytochrome- C	cladogram

2. The teacher reviews classification "levels" (i.e., **kingdom, phylum**, **niche**, etc.) using the inverted pyramid diagram; students take notes and explain / predict why the organisms are gradually separated out by the criteria at each descending level of the diagram to finally become exclusive and given a species designation. **(IIIA1)** [**Lab Aids Classification Kit #505 on Classification] (RST.1)**

3. The teacher previews a reading on the historic view of classification systems, explaining when, where, and why it started, and where it is now. Focus will include **Linnaeus** and **Darwin**. Students are divided into small groups, and each is assigned a portion of the reading text; from the readings, each group devises a set of bullet points. The groups jigsaw to pull entire text together. DIFFERENTIATION OPTIONS: (1) may provide some groups "look-fors;" (2) some groups may predict where the classification system may go in the future. (**IIIA1) (RST.1)** (**RST.4)** (symbols and terms).

4. The teacher shows a segment of Carl Sagan *Cosmos* video *One Voice in a Cosmic Fugue* dealing with early life on planet earth and a timeline of evolution reflecting biodiversity. Students complete a Video-Guide. **(IIIA2)**

5. The teacher displays several pictures of unfamiliar creatures; students will use **dichotomous keys** to classify the creatures to the level of genus and species. Classifications will include scientific names such as ***Homo Sapien***. **(IIIA1, 2)**

6. The teacher provides a lecture or explanation (PPT) about molecular sequence data; students take notes using a graphic organizer designed to coincide with the lecture. In preparation for lab activity, teacher introduces **cytochrome-C** and its relationship to molecular sequence data**. (IIIA3)**

7. **Cytochrome-C LAB.** The teacher leads students through a lab on molecular evidence for evolutionary relationships in organisms; students work in 2s or 3s, and they will select 5 organisms to compare the amino acid sequence of cytochrome-C. Will include morphology**. (IIIA3)**

TEACHER NOTES

Teaching-Learning Activity #2

The teacher can remove the titles from all 4 panels and separate the parts. Groups can be given a panel to discuss what it illustrates. Class discussion should proceed in this order:

1. first, the lineal family tree; next, the branching tree; groups talk about what they see
2. then the teacher shows both of these together and ask students to compare the two. Next the teacher asks if these are just two ways for showing the same thing
3. the teacher asks for students' opinion about these first two panels: Is one better than the other? Which one and why? Is one right and the other wrong? Which one and why?

The teacher repeats these steps and questions with the other two panels. Students should see, when showing both pairs together, the similarity of the two "NOT" frames, and the similarity of the two "IS" frames.

TEACHING-LEARNING	TEACHER NOTES
8. The teacher shows a PowerPoint to introduce evidences for evolution: **homologous structures**, fossils, DNA, embryonic structures. Students take notes in an appropriate graphic organizer provided by the teacher. The teacher explains that structures in different species can be similar because of common ancestry. The teacher shows pictures of **homologous structures** of different organisms, including embryos; students determine **similarities**, relatedness, etc., and complete a note-sheet answering different **levels of questions. (IIIA2, 3)** outreach.mcb.harvard.edu/teachers/Summer06/LucyMcKone/Case... [PPT file] 9. **Cladogram LAB.** The teacher leads students through a lab in which they construct a **cladogram** that shows the common ancestry and degree of relationship in a group of organism. Students work in 2s or 3s to diagram the results using common characteristics; each group prepares a written explanation of three types of information that can be obtained from each **cladogram**. **(IIIA4)**	

TRADITIONAL ASSESSMENT	TEACHER NOTES
1. Unit Test that includes test items for standards **(IIIA1, 2, 3, 4)** (a) Multiple Choice items (b) 2- and 4-point Essays [see next page]	

TEACHER CLASSROOM ASSESSMENT	TEACHER NOTES
1. 2-point short-answer questions include 1. describe the relationships among vocabulary / terms 2. compare historical with modern classification systems 4-point extended response questions include 3. given background information, describe the process of using a cladogram and how it provides evidence leading to a conclusion 2. Compilation of notes, worksheets, lab write-ups	

AUTHENTIC ASSESSMENT	TEACHER NOTES
Each student will - - 1. Create a dichotomous key for a given set of pictures. **(IIIA1, 3, 4)** 2. Make predictions about the importance of newly discovered species.	

BIOLOGY Unit 5: CLASSIFICATION SYSTEMS (2-3 WEEKS)

MULTIPLE LEVELS OF QUESTIONS

Level I

1. [T-L 3.] What comprises a scientific name, including an example in your response?
2. [T-L 5.] What is the purpose or function for a *dichotomous key,* including an example?
3. [T-L 8.] What are *homologous structures,* including an example?
4. [T-L 9.] What does a *cladogram* show?

Level II

5. [T-L 2.] What is the relationship among the levels of the classification system (kingdom, phylum, class, order, family, genus, and species)?
6. [T-L 3.] What is the difference between the early classification system (by Linneaus, Darwin) and the system we now use?
7. [T-L 3.] How can a scientific name be used to show relationships among organisms?
8. [T-L 5.] How does a dichotomous key relate to the classification of organisms?
9. [T-L 5.] How would you use a dichotomous key to determine the relationship between two given animals (e.g., a turkey and a fox; a hawk and a chipmunk)?
10. [T- L 6-7.] How does molecular sequence data prove that organisms are related?
11. [T-L 8.] How do homologous structures indicate evolutionary relationships?
12. [T-L 9.] How would you analyze and interpret this cladogram in terms of how it shows (a) common ancestry and (b) evolutionary relationships?

Level III

13. [T-L 6-7.] Given the table of molecular sequences, determine where the major differences occur between/among organisms, and what do those data relate?
14. [T-L all.] If you were a scientist who has been asked to nominate a newly-discovered species from the "Top Ten" list as having the greatest impact on society, what criteria would you use?
15. [T-L all.] If you discovered a new organism that could not be classified because it showed no direct lineage to any other organisms, how would you develop a scientific name for it?
16. [T-L all.] What if a new organism, with a totally unfamiliar trait, were discovered; how could it be classified if the classification system does not recognize that specific trait?