PSEUDOGENE SUITE

# Lesson C: EXPLORING PRIMATE PSEUDOGENES WITH BIOLOGY WORKSHOP

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adapted for ENSIweb by L. Flammer
Macroevolution

A. SYNOPSIS:

Students use Biology Workbench to explore DNA sequence data for the GULOP gene in humans, chimpanzees, orangutans, and crab-eating macaques and the beta globin gene and its pseduogene in humans, gorillas, and chimpanzees.

B. MAIN CONCEPT:

Many features of modern organisms reflect the structure of their ancestors in ways that are not adaptive.

C. ASSOCIATED CONCEPTS:

1. DNA sequences from different species can be compared by aligning them.
2. Software has been created to facilitate sequence comparisons.
3. Some sequence differences involve similar amino acids.
4. Existence of pseudogenes provides a record of evolutionary history, with relative timing and degrees of relationships.

D. ASSESSABLE OBJECTIVES: Having completed this activity, students should be able to

1. Use CLUSTALW to align two or more sequences.
2. Use BOXSHADE to color-code an alignment.

E. MATERIALS: (click to get PDF files for downloading)

computers with an Internet connection [may require Windows/PC systems].
Student Handout: :Lesson C: Exploring Primate Pseudogenes with Biology Workbench (Background, Procedures and Report Form).

F. TIME: 45 minutes

G. PREPARATION:

Excellent Teacher Background on Pseudogenes and Intergenic Analyses can be found online at:
http://bioinfo.mbb.yale.edu/genome/pseudogene/

1. This lesson assumes a basic understanding of enzyme structure/function and of gene expression (protein synthesis). It is intended to follow lessons **A** and **B** in this suite: **"Why Do We Need Vitamin C In Our Diet?"** and **"What Can Pseudogenes Tell Us About Common Ancestry?"**
2. This lesson would fit nicely near the end of an introductory unit on DNA structure and function., or, in concert with the other two lessons in this suite, it would be appropriate in a unit on evolution, or classification and biological relationships.
3. Prepare enough copies of the Student Handout for every student or pair of students. Have extra Report Forms.
4. You should DO the exercise online, following the instructions on the Student Handout BEFORE doing this lesson in class. You might want to place the two URLs needed in the "Favorites" or "Bookmarks" list on each student computer, for their convenience.

H. PROCEDURES:

1. Have students work in pairs (even if there are enough computers for them to work alone.)
2. Briefly introduce the background information.
3. Pass out the Stuudent Handout and Report Forms.
4. Have students work through the exercise being careful to follow the steps as written.
5. Students are to hand in their Report Forms completed for you to look over.

I. DISCUSSION:

Lead a discussion in which teams share their observations and conclusions.

J. ASSESSMENT & EVALUATION:

1. Check student Report Forms for clarity, logic, etc.
2. Assign a particular comparison for which a plot is to be turned in.

K. EXTENSIONS & VARIATIONS:

1. This lesson was meant to follow the **lessons A** and **B: "Why Do We Need Vitamin C in Our Diet?"** and **"What Can Pseudogenes Tell Us About Common Ancestry?",** but could be used alone if students were given some of the background information from these lessons.
2. The procedures learned in this lesson could be used to explore other data sets available in the DataSets account on Biology Workbench. (See Preparation for how to access these.)
3. Students may notice that Workbench can be used to draw rooted and unrooted trees from alignments. The unrooted trees are easier to interpret, so if you decide to have them draw trees, we recommend their using DRAWTREE rather than DRAWGRAM. Even so, the tree produced is technically a "gene tree" (based on a single gene) and may conflict with accepted phylogenies. This is the reason we chose not to include tree drawing in this lesson.

L. ATTRIBUTIONS:

This activity was developed by Mary Ball and Steve Karr of Carson-Newman College for use in a high school biology course or a college-level introductory biology course. References used as a source of information, ideas, and sequences can be found on Lessons A and B of this suite. (The actual articles were not consulted. The abstracts and data were accessed through PubMed.) The sequences were edited to give the common names of the animals.

Revised 7/18/03