PSEUDOGENE SUITE
Lesson A: WHY DO WE NEED VITAMIN C IN OUR DIET?
or...Why do we carry old inactive genes in our genome?

adapted for ENSIweb by L. Flammer

SYNOPSIS:
Students compare the DNA sequence data for a portion of the rat GULO gene (which helps make vitamin C) to the corresponding sequence in the inactive human GULO gene by translating the sequences and by aligning them. This lays ground work for exploring pseudogenes and the significance of these DNA sequences in recognizing shared common ancestry vs the notion of "intelligent design" (Lesson B).

MAIN CONCEPT:
Mutation may create an inactive version of a gene (an inactive allele), and, over generations, the active gene (allele) may be lost from the species, leaving only the inactive gene (allele).

ASSOCIATED CONCEPTS:
1. Unlike most mammals, humans cannot synthesize Vitamin C and must ingest it.
2. Remnants of once functional genes can be found in the abandoned "junk" segments of an organism's DNA.
3. A single-base deletion in a DNA coding sequence shifts the reading frame.
4. A frameshift mutation may lead to premature chain termination by creating a stop codon.
5. A frameshift mutation may alter the sequence of amino acids from that point on in the chain.
6. Enzyme function is likely to be lost if the protein chain is greatly shortened or its amino acid sequence is dramatically changed.

ASSESSIBLE OBJECTIVES:
1. Predict the likely effects of a frameshift mutation on the amino acid sequence of an enzyme and on enzyme function.
2. Propose a scenario to explain the occurrence in one species of an inactive DNA sequence similar to that of an active gene in another species.

MATERIALS
Student Handouts (3 sheets: Background, Worksheet and Genetic Code Chart)
Key to Worksheet (for teacher)

TIME:
45 minutes

TEACHING STRATEGY:
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 be the first lesson (A) in this suite of three lessons, to be followed by Lesson B: "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 (not stapled) for every student or pair of students.

PROCEDURES:
Students may work alone, or preferably in pairs.
1. Either present the background information on scurvy and vitamin C, or pass out the Student Handout and have students read the Background information.
2. Explain to students that comparing the entire sequences for the functional rat GULO gene and the inactive human GULO gene is not practical in our time frame, so they will compare only a sample portion of the two sequences.
3. Students use a Genetic Code Chart to translate the partial rat sequence and the corresponding human sequence given in the Worksheet. You might need to demonstrate this process.