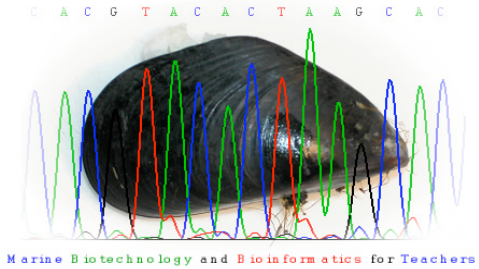

MARINE BIOTECHNOLOGY & BIOINFORMATICS FOR TEACHERS
MOSS LANDING MARINE LABS NSF ITEST GRANT
TEACHER LESSON PLAN FOR CLASSROOM USE

TELLTALE MOLECULES

Title of Lesson: Telltale molecules

Designed by

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Background

*** This activity is designed to replace a very boring worksheet in the new Prentice Hall Life science text book. The context is Chapter 7 Changes Over Time, section 3 is about evolution of species and the worksheet on p.247 shows the sequence of amino acids for cytochrome c in various animals. The textbook assignment is to look at the picture and draw conclusions about how animals are related. This lesson modifies that assignment and uses tools of bioinformatics to take amino acid sequences and using ClustalW compare them with a computer and draw the phylogenetic tree.

Description of Audience: This bioinformatics activity is designed for use by seventh grade students.

State Standards: This bioinformatics activity fulfills the following State of California Science Standards:

- 7.3a
- 7.7b

STEM Connection. A biologist might do something like this I suppose if they discovered a new species.

Technology Integration. This makes good use of computers and a powerful piece of bioinformatics software ClustalW

Goals(s):

The goal of this lesson is to (List overall goals. What do YOU, as the teacher, set up for students to learn?):

- ***how similarities in proteins in animals reveal their relatedness***
- ***try out software of real scientists (big deal for sevies) ***

Learning Objective(s)

Upon completion of this lesson, students will be able to (Include process skills but be specific. What will the STUDENTS be able to do/demonstrate as a result of this lesson?):

- *** understand how scientists can tell how related organisms are***
- *** be able to look at sequences of other proteins or even DNA and draw conclusions about how closely the organisms are related***

Purpose/Rationale

***I am teaching the lesson this way because it will be a lot more fun for the kids to have a much more interactive lesson on evolution. The worksheet is really dull. For state standards see above

Materials/Resources

In order to complete this lesson, the following materials are needed:

- Prentice Hall textbooks
- Computer cart (28 laptops)

Prior Teacher Preparation

What did you have to do to get ready for this lesson?

- You will need the sequences which can be retrieved from NCBI entering the organism genus with [orgn] and the name of the protein with quotes around it. I was planning on cytochrome c because that's what they had for the worksheet but I might fiddle around and see if there are other proteins to compare with.

3-Step Procedure

#1 Introduction

- Brainstorm what students think about how closely certain organisms are related. Then think about the kinds of evidence scientists could use to decide how closely organisms are related.
- Review questions from previous sections on Darwin's theory, evidence of evolution, and evolution of species
- Discuss the Pandas, Bears, and Raccoons figure 14 p245 (shows a phylogenetic tree)
- Note expectation of saving the N-T tree w/branch length picture, pasting it on an electronic form and answering questions working in pairs

#2 Exploration

- Students will be given a folder on their laptops with sequences from several animals
- Students will be asked what determines the sequence of amino acids in the protein of a particular animal, what might cause changes in the sequence of amino acids and how that might effect the animal, and lastly figure out how they can take that data to figure out relationships between animals
- Students predict which animals are most closely related and why. Then students predict which animals are most distantly related and why
- Students figure out they will need software to speed up the comparison
- Students use ClustalW to make the comparison and generate the tree

#3 Applications

- Students apply what they learned in the chapter and from looking at the tree to figure out the answers to the questions
- Students consider other possible uses for a tool like ClustalW

Assessment

- Students review answers in class
- Students print their tree with questions and answers and paste it in their lab note book
- Chapter test will have questions specific to this activity

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Teachers' Self Evaluation

Can't be done at this time
Reflect on strengths and weaknesses of the lesson as taught.

- Describe individual student responses to techniques used. How did they react?
- Discuss student "thinking" and ideas.
- Include samples of students answers on lab sheet or journal entry (photocopy is fine).
- Ask students for a brief evaluation of lesson. Include their responses.
- Discuss fulfilled and unfulfilled expectations. Any surprises?
- In retrospect, how would you modify this lesson?