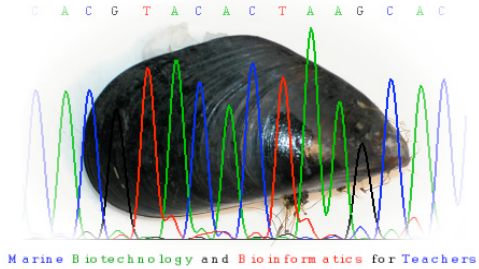

MARINE BIOTECHNOLOGY & BIOINFORMATICS FOR TEACHERS
MOSS LANDING MARINE LABS NSF ITEST GRANT
TEACHER LESSON PLAN FOR CLASSROOM USE

DNA AND HEREDITY: A MIDDLE SCHOOL CLASSROOM APPROACH

DNA and Heredity: A Middle School Classroom Approach

Designed by

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Background

*** This lesson is designed to introduce middle school students to the Role of DNA in Heredity and the various technologies that exist as a result of the discovery of DNA structure. Students will use biotechnology applications to view DNA strands and bands from Gel Electrophoresis and Bioinformatics to view common protein and nucleotide chains of similar and dissimilar species.

Description of Audience: This biotechnology/bioinformatics activity is designed for use by middle school students and English Language Learners. *****.

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

1. c. Students know the nucleus is the repository for genetic information in plant and animal cells.
2. Students know that a typical cell of any organism contains genetic instructions that specify its traits. Those traits may be modified by environmental influences.
7. a. Select and use appropriate tools and technology to perform tests, collect data, and display data.

National Standards: This biotechnology/bioinformatics activity fulfills the following National Science Standards:

STEM Connection. Careers that are tied to this activity include biologist, biochemist, bioengineering, geneticist, science educator, genetic counselor, medical doctor, medical nurse, forensic scientist, forensic medicine.

Technology Integration. Students learn to use data bases for comparing data and matching sequences, biotechnology for DNA extraction and use in gel electrophoresis, STEM websites for extension into careers, Web Quest for inquiry into genetic disorders, species philologies and bioengineering.

Goals(s):

Goal 1 is for students to experience the aspects of heredity and implications of the genetic code for life. ***
Goal 2 is for students to describe the process of DNA replication.
Goal 3 is for students to describe mutations and their results.
Goal 4 is for students to experience biotechnology and bioinformatics.

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?):

- *** Objective 1: Students will be able to demonstrate electronically using Power Point/web pages or with creative models the components of the genetic code. ***
- *** Objective 2: Students will be able to compare different sequences using Bioinformatics and Clustal technology.
- **Objective 3: Students will be introduced to STEM careers via investigation, speakers/and or interviews using Bioinformatics or live communication.

Purpose/Rationale

Why am I teaching this lesson this way?
Students at the middle school level need to experience "hands-on" learning for "buy-in". Any and all activities that allow them to manipulate materials whether real or virtual give them a sense of ownership.
The technological presentations, whether book or computer based will introduce heredity and DNA and then specific lesson will allow students to "handle" DNA extraction, processing and comparing.
The relevance is that the California State Standards dictate middle school competence in the understanding of living cells, the nucleus, mitochondria and their functions and the implications of DNA coding that have huge effects upon daily life.
Standards one,

Materials/Resources

Textbook: CPO Focus on Life Science, paper and pencil manipulative, Computer models, beads (or appropriate material to build physical models of DNA and replication processes.)

Prior Teacher Preparation

What did you have to do to get ready for this lesson? Complete research on data bases, web sites for web quest: purchase all materials for DNA extraction, gel electrophoresis: organize student materials both physical and virtual/web (computers).

3-Step Procedure

#1 Introduction

1. Intro "prior knowledge" activity using student collaborative groups.
2. Have students carry out "First person interviews" with parents/adults regarding science careers, content words and questions, like "What is DNA?"
3. Debrief session (prior knowledge) activity and First person Interviews. Collate information in an obvious place in classroom for all students to review.
4 Show Genetic video. Get feedback; dispel misconceptions about DNA after reading text.
5. Build DNA naming parts using a key – color coded by computer/PPT presentations.
6. Use web sites for DNA replication animations and DNA extraction.
7. Review the Scientific Method, journal keeping and explain parameters for lesson.

#2 Exploration

1. Students will extract DNA from fruit or cheek cells, whatever we can arrange and then put the working stocks into gels for learning how to read bands.
(Detail will come later for this process.)
2. Questions: Where does DNA come from? Where is DNA located in the cell? Is the nucleus the only organelle where DNA is located? What are the differences between nuclear DNA and mitochondrial DNA?
3. Students will maintain lab journals for all laboratory investigations.
4. Students will predict all sequencing and results using proper hypothesis language with gels and with other species after web explorations on Clustal.
5. Student gels and Clustal results will be recorded and shared appropriately.

#3 Application

- Students will make predictions about DNA studies, forensics, mutations, gene therapy and evolutionary implications based upon results.
- Students will be instructed to make extended studies into web portals and sites for relevance.
- Students will be directed to find careers that use biotechnology as used in class and to demonstrate in an oral report PPT or web page that the lesson is connected to current and future careers.

Assessment

- Students will be required to keep accurate journals for assessment.
- Every student will have a physical or virtual end product to illustrate their understanding of the standards.

Please include several copies of students' work, ideas, journals, and completed lab sheets. Include copies of any text pages you used as well as any handouts, lab sheets, and workbook pages.

Teachers' Self Evaluation

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?