WE ARE ALL MUTANTS

Designed by
Susan Schylander, susie07@aol.com
Shannon Wernette, shannon.wernette@mvla.net
Pennie Perkins, pantoof2003@yahoo.com
Neal Perry, nealperryaq@aol.com

Background
Investigating mutations helps to understand biodiversity and adaptation through natural selection in a changing world.

Description of Audience:
The audience consists of students with varying backgrounds in Life Sciences, entering 10th grade and are current participants in Upward Bound, HEP and RISE.

California State Standards

- Grades 4-6: Investigation & Experimentation
- Grade 7: 2e, 3a
- Grades 9-12:
  - 1b, 1d, 1h
  - 4a, 4b, 4c, 4d, 4e
  - 5a, 5b, 5c, 5d, 5e

National Standards (grade 6-12)

- Content Standards A: Science as Inquiry
- Content Standards C: Life Sciences
- Content Standards E: Science & Technology

STEM Connection: Biotechnitian, Marine Biologist, Bioinformatics Researcher, Genomics Technitian, Phycologist, Lab Technologist, and Naturalist.

Technology Integration: Paper Chromatography, Gel Electrophoresis, ORF paper activity, Mini-Web/Quest… Stem Activity, Research, Data Collection.

Goals(s):

- Goal 1: Mini Lava Lamps: Separation by density.
- Goal 2: Paper Chromatography: To separate marine photosynthetic proteins.
- Goal 3: Gel Electrophoresis: To separate DNA from several organisms to show it is mostly conserved.
- Goal 4: ORF: Modified open reading frame activity. Statistics, Cryptology, Problem Solving, Point and Inversion Mutations.
- Goal 5: STEM Web/Quest: Using computer technology, students will investigate various careers associated with science, technology, engineering, and math.

Learning Objective(s)

- Paper Chromatography: Students will be able to separate photosynthetic pigment from local seaweed species.
- Lava Lamp: Students will be able to visualize separation of liquids by density.
- Gel Electrophoresis: Students will be able identify different DNA molecular weights.
- Mystery Codon Bracelets: Builds on the idea of general conservation of genetic code illustrated in Gels and confirmed by students assigned specific nucleotide sequences (including start and stop codons). Students will translate the codons.
- ORF : Students will be able to identify variations in a DNA sequence as well as different types of mutations.
- STEM Web/Quest (http//: Students will be able to identify a number of careers associated with science, technology, engineering, and math.

Purpose/Rationale

Biodiversity in the natural world is a result of genetic mutations and natural selection over 3.2 billion years. Utilizing emerging technologies as well as STEM careers, students investigate molecular information of plants and animals from a marine ecosystem.
What is the significance, relevance, reason for teaching & learning this lesson?
What are the standards that are addressed in this lesson?***

Materials/Resources

- Vocabulary name tags
- Lettered beads
- Twine
- Vegetable oil
- Salt
- Water
- Coffee filters
- Scissors
- Plastic test tubes(7)
- Rubbing alcohol
- Various seaweed species
- Mortar & pestle
- 1.5ml tubes
- Toothpicks
- Food coloring
- DNA samples
- DNA marker
- Loading dye
- Gel rigs with tray
- UV box
- Camera
- .8% agarose
- Ethidium bromide
- TAE buffer
- P20 pipetters(5)

Prior Teacher Preparation

During a three week workshop on marine biotechnology and bioinformatics, group members brainstormed for a big picture or concept. Group members agreed on biodiversity through mutations and natural selection. With PBL in mind, teachers researched and aligned activities ranging from simple to complex with a mutation correlation. A list of materials and resources was created and allocated to Christie and Rick for immediate retrieval (see materials list).

3-Step Procedure

#1 Introduction

- *Make connections between prior knowledge and experiences with what is presented.*
- *Find out what students ideas are on this topic - uncover misconceptions!* Ask students to define mutation…give examples. Misconception: All mutations are negative. In the living world, changes in the genetic code result in numerous variations of species. As a result, there are positive, neutral, and negative mutations.
- *Review what was learned in prior lessons - then introduce content and vocabulary necessary for today's lesson.* Aliquot vocabulary name tags to each student. Give each student corresponding vocabulary worksheet.
- *Use teaching charts, video clips, books, presentation software, instructional software, articles, tapes, overhead projector, handouts, models, etc. to accent instruction.* Students will you utilize the computer lab to complete vocabulary worksheet. Show Youtube clip on paper chromatography.
- *Create and describe the structure for group learning (if applicable), whole class discussion, and individual work (journal, worksheet).* Students will be working independently, pairs, and groups of four.

#2 Exploration

- *Describe in detail the activity or investigation students will pursue with clear directions.*
  - Ask Me About…. (Vocabulary Name Tags & Worksheet). Students will be given Ask Me About…. name tags with vocabulary worksheet. Students will be allotted 25-30 minutes to complete worksheet. Teachers will monitor with a point system tally sheet on clipboards throughout the day. I.E. "Jonathan. Tell me about PCR." Or if a teacher sees a student engaged in dialogue with another student, points are given.
  - Salt Volcano: Mini Lava Lamps. Students will mix 6 ml of water with 6 ml of food colored oil from stock beakers into a screw cap 15 ml glass sample tube. They will shake the tubes and let the liquids separate liquids of different density to separate materials that dissolve in them
  - Paper Chromatography: Separate photosynthetic proteins based on size, apparent primary pigments accompanied by secondary accessory pigments.
  - Gel Electrophoresis
  - Complementary Base Pair Bracelets
  - ORF
  - STEM Web/Quest
- *Describe the path of inquiry or process of discovery to be followed - What questions will you ask? - LIST THEM!*
- *Prepare a lab sheet for students to record data, answer questions. This can be done in science journals.*
- *Students Predict / Explain. Then Explore and Discuss. Finally they Revise their explanations and theories.*
- *Conclude, share results, discuss, ask and answer questions, evaluate lesson, assess student understanding.*

#3 Application

- *How can the student apply what was learned today in his/her experience?*
- *How can the value of this lesson be made relevant in their lives?*
- *How can interest be extended?*
- *What is a good follow-up activity to reinforce concepts learned today?*
- *Provide relevant homework, class work, parent-involvement activity, research assignment…*
- *Career Connection. At this point write a paragraph describing careers in bioinformatics and biotechnology related to this activity. Describe how this activity contributes to students' understanding of science careers. You may also choose to list specific careers related to this activity.*

Assessment

- How do you know if they GOT IT?

- Design a worksheet, journal recording, test, quiz, or performance-based activity for students to demonstrate what they have learned.
- Have your Goals and Learning Objectives been met?
- How will you do to assist those who do not "get it"? Provide an alternative activity for a student with a special need.
- How might you extend the lesson, dig deeper, go beyond?

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.