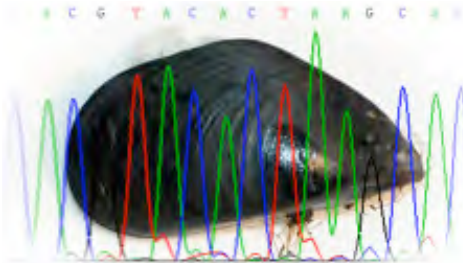


Marine Biotechnology and Bioinformatics



A program of ITEST (Information Technology Experiences for Students and Teachers) funded by the National Science Foundation

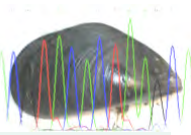


Which Marine Organisms Show Evidence of Evolutionary Relatedness?

AP Biology 11-12th Grade

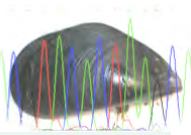
Susan Schylander

Sheepshead Bay High School, Brooklyn, NY



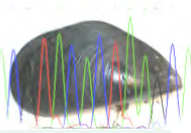
Background Context

- ▶ Biotechnology and Bioinformatics
- ▶ Challenging students to make connections between protein gel electrophoresis and evolution.
- ▶ Modeling of electrophoresis and bioinformatic techniques.



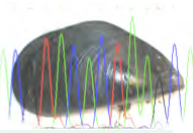
Instructional Goal

- ▶ To teach and model wet lab electrophoresis techniques
- ▶ To train students to use genetic databases to answer research questions
- ▶ To create experimental designs
- ▶ To obtain accurate evolutionary cladograms of related species



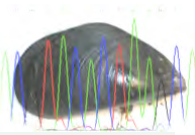
New York State Standards

- ▶ List the state educational standard(s) this lesson addresses
 - ▶▶ Standard 1: Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions. 1.1a,1b,1.2a, 1,2b,1.3a,1.3b,1.4a
 - ▶▶ Standard 2: Students will access, generate, process, and transfer information using appropriate technologies. 2.1,2.3,2.4
 - ▶▶ Standard 3: Analysis of results. 3.1a,3.3,3.4
 - ▶▶ Standard 4: Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment.1Living Things.1.2a, 2-Genetics, 3-Evolution 3.1a,3.1e,3.1k
 - ▶▶ Standard 6: Students will understand the relationships and common themes that connect mathematics, science, and technology and apply the themes to these and other areas of learning.Ecology 6.2a
 - ▶▶ <http://usny.nysed.gov/teachers/nyslearningstandards.html>



Instructional Objectives

- ▶ Familiarize students with Protein technology and Gel electrophoresis
- ▶ Introduce students to Bioinformatics activities



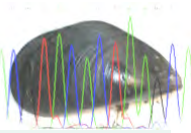
Instructional Objectives

Train students in
biology laboratory
techniques

[mlml lab 042.jpg](#)

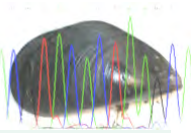
PPT of Wet Lab

Introduce students to
bioinformatics



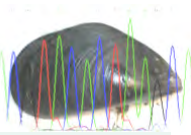
Materials and Resources 1/3

- ▶ Protein gel electrophoresis apparatus
- ▶ mini-vertical gel boxes
- ▶ power supplies and extra fuses
- ▶ micro pipettors (1 set of 2-20 μ l capacity) with loading tips
- ▶ 1 dry bath heater
- ▶ staining trays with lids
- ▶ Reagents and Gel Photography supplies
- ▶ 1 bottle w/ \sim 90mL. 10x Tris-Glycine-SDS running buffer (per 4 gels)
- ▶ 2 bottles of blue Tris-SDS solubilization buffer labeled " Laemmli "Buffer (per 4 gels)
- ▶ 2 bottles protein fixative stain (per 4 gels)
- ▶ 1 vial of high molecular weight markers per 4 gels
- ▶ different sea foods
- ▶ distilled water (1liter per gel)



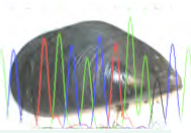
Materials and Resources 2/3

- ▶ precast polyacrylamide gels
- ▶ Polaroid camera
- ▶ light box
- ▶ Polaroid film type 667 from WARDS
- ▶ General Lab supplies
- ▶ 500 ml or 1 liter flask or beaker (one per gel box)
- ▶ 100 ml graduated cylinder
- ▶ 500 ml graduated cylinder
- ▶ 15 ml blue capped plastic tubes
- ▶ test tube racks
- ▶ funnel with cheesecloth (low tech) or centrifuge (high tech)
- ▶ labeling tape
- ▶ microcentrifuge tubes
- ▶ microcentrifuge racks
- ▶ 4 markers
- ▶ razor blades or scalpels
- ▶ cutting boards
- ▶ safety glasses
- ▶ transfer pipettes (5-6 per muscle sample)
- ▶ latex gloves



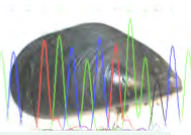
Materials and Resources 3/3

- ▶ Computer labs
- ▶ Handouts
- ▶ Websites:
 - ▶ http://www.marinebiotech.net/workshop/bioinformatics/Materials/Trees_Student.html
 - ▶ <http://www.ncbi.nlm.nih.gov/>



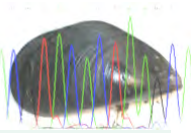
Instructional Strategies

- ▶ Formulation of a research question
- ▶ Extraction and preparation of muscle protein from 6 different animals: clam, scallop, shrimp, escargot, pork, octopus
- ▶ Gel electrophoresis of proteins
- ▶ Analysis of results
- ▶ Use of NCBI website to produce the cladogram of the above animals' myosin light chain smooth muscle sequences
- ▶ Comparison of wet and dry lab results



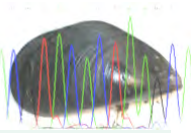
Assessment

- ▶ Lab reports for the wet lab and the computer lab
- ▶ Homework
- ▶ Experimental design
- ▶ Research report
- ▶ Extra work for challenged learners



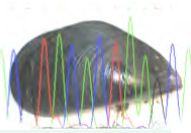
Learning Outcomes

- ▶ *"I never did this before"*
- ▶ *"I want to be a research biologist"*
- ▶ What is the anecdotal evidence of learning outcomes (stories, quotes, incidents that indicate learning happened outside the assessment)



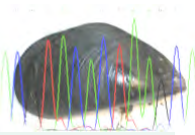
Lessons Learned

- ▶ Due to time constraints, we could not load the gels on the same day as the extraction.
- ▶ Our outcome was less than perfect.
- ▶ If I was able to, I would have done the entire electrophoresis as a day long lab.
- ▶ The extraction and the pipetting went well considering this was the first time for all.
- ▶ The tie-in with the computer lab brought out the connection between biotechnology and bioinformatics.



Contact

- ▶ For more information about this lesson, contact:
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 - ▶▶ Teacher, Grade 10-12
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Protein gel Electrophoresis

