

Diving into Biotechnology

Incorporating the Emerging Pathogens Program in High School Curricula

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ABSTRACT: In today's schools the focus is to send everyone to college. This process is leaving those students behind who might have an interest in Science but, feel that that world is shut off to them because they lack the academic skills needed to either attend or excel in a full academic climate. Providing a hands on version of science and how, with the use of technology, that they may see another aspect of Science never before presented to them. Participation in the scientific world is not only from the front line researcher but, now the need for researchers who actually run the tests and verify the information using the latest in technology not only let's this student see a skill set, but actually get hands on. This skill set is marketable as they leave school either as a career or as a move into a degree at a local college.

MISSION STATEMENT: The expenditure of \$200.00 will be used to provide instrumentation and disposables for the Biotechnology and Marine Science Program. Allowing students to get hands on in the aspect of Biotechnology and how it is used to provide critical research information for Marine Researchers. This activity will provide, in a classroom situation, a view of science that is not all lectures, reading and tests. Very few students, even those who have the mind set, see science as a career because of this previously mentioned point of view. Using the Biotechnology lockers provided by the Emerging Pathogen Program across a semester will enhance the scheduled material that we are discussing at the time. It will provide for those students who see science as a less than viable probability for a future career, as an exciting taste of the active side of science that allows them to actually put hands and mind on how the latest in technology is used.

We teach students who are not all college bound without showing them a side of science that can actually provide them with skills that can be translated very shortly after they graduate to money making applications or jobs that are not run of the mill McJobs. This actual hands on will entice students to actually stay up with the science curriculum and actively participate rather than fall behind for lack of interest or worse of all lack of a reason to pay attention. Many of these students also, especially in light of today's economy, will have to work their way through college. Many of the local Community Colleges are providing AA's in Biotechnology and they could within a reasonable amount of time either find full time employment, because they may be on their own, or part time employment as they attend school, or even better defray costs by actually working in a lab doing research at a local college. This means that we have allowed a student to see science as a career path from the bottom up rather than from the top down.

Description of Teaching unit or module(s), including expected outcomes.

LEARNING GOALS: As a result of participating in this program across a semester students will have the hands on knowledge on how technology actually plays a vital role in the aspect of achieving almost any goal in the world of science, even Marine Science. They will also be introduced to the latest technologies that are used across science to review the process of life down to the molecular level, and how these submicroscopic organisms are the key to all life.

PROCESS: Throughout the semester I have four sections that lend themselves to putting in lab activities that can incorporate the use of Biotechnology to enhance the curriculum at that point. These points are in Chapter 1: What is Marine Science, Chapter 5: A Survey of Life in the Sea, Chapter 10: The Ecology of the Sea, Chapter 15: The Interaction between Man and the Sea. In spreading the use of Biotechnology across several chapters I can provide interest that usually wanes to spring forth again and sustain the underserved student.

LESSON PLANS: The material we will be using will be introduced the week before as we enter the chapter. We will have a discussion about how scientists can verify information they feel are part of hypothesis. The next step I will provide the students with reading material or videos (depending upon the class) that shows the use of Biotechnology in solving a riddle that had puzzled researchers for a long time.

The day before use of the actual equipment or use of the simulations I will cover all the materials to be used and how to use them in detail, making sure that there is at least one or two that has the ability to make this successful in every group. I will also provide the rubric with the lab outline so that students understand that even though we will be having fun it will be for a grade. I will provide a handout on the use of each of the pieces of technology and a brief history of each so they can have an appreciation of how it has changed and how simple the procedure they will be doing has become. On the day of the actual lab I will have lab coats, gloves, and safety glasses for each student. The desks will be prepared with the necessary equipment and the work stations will be set up around the room. I will cover the activity with them one more time and leave it up on the screen for them to see as well. Then I will let lose the Dogs of War and hope for the best. Students will write up their observations in their lab books and the outcome of their procedure, the rubric will spell out what will be expected and how it will be graded.

OUTCOME: The expected outcome is that all students will get hands on with new technology, most they have not heard about before. It also let's those who normally shy away from the heady science activities, to step forward and take part in new and fun activity. This will stimulate their interest and provide a differing outlook on science and how it can actually be something that with minimal training could be a lead in to a career or attending a college and working an interesting job at least part time to pay for it. Overall the students learn that there is bench time in the lab to find out all those little facts that lead to big answers.

Expertise of the PI: Lorin Kessler has a BS in Marine Science from Florida International University and a Master's Degree from Novasoutheastern University. He worked at BeckmanCoulter for 25 years selling cutting edge laboratory research equipment. He sold everything from their general Hematology and Chemistry line through to Laser Based Flow Cytometers, which were used in the earliest stages of HIV discovery. He has also attended the Emerging Pathogen program put on by the UF ICORE team and has had experience using the Biotech equipment that will be used in the program. He has mad contact with local Bophirima companies to help with the activity as well as provide future locals where students may actually find work in their labs. Also, for the first program assistance from ICORE program will be forthcoming.

Literature Cited:

CENTER FOR MARINE BIOTECHNOLOGY & BIOMEDICINE, Scripps Institute of Marine Science, cmbb.ucsd.edu/

Marine molecular biology: An emerging field of biological sciences , Narsinh L. Thakur^a, Roopesh Jain^b, Filipe Natalio^c, Bojan Hamer^d, Archana N. Thakur^c and Werner E.G. Müller, doi:10.1016/j.biotechadv.2008.001

Marine Biotechnology and Bioinformatics for Teachers, Moss Landing Laboratories, <http://www.marinebiotech.net/>

The European Centre for Marine Biotechnology, The Scottish Association of Marine Science, <http://www.sams.ac.uk/commercial/ecmb>

Budget and Budget Justification: This program will take all of the \$200 dollars that is proposed for this grant proposal. It will take more to sustain over more than one semester and that will come from proposing this same grant to local Biopharma Companies and Lab Facilities at the local Colleges. The need to provide this type of training and expertise will be immeasurable in the future.

Lesson Plan Template Sample

Theme: Emerging Pathogens

Lesson Title	Diving Into Biotechnology
Grade Span	11/12 For all reading levels, regular, honors. Honors II
Content Emphasis (Mathematics or Science)	Marine Science
Targeted Benchmark(s)	Marine Science Curriculum Broward County, based upon “Life on an Ocean Planet”
Author(s)	Lorin Kessler
School	Cooper City High School
Lesson Preparation	
<p><u>Learning goals:</u> What will students be able to do as the result of this lesson? As a result of this lesson students will come to not only have hands on Biotechnology equipment but, understand that science is not all just reading books and notes. Research also uses technology that is very cool and interesting to use.</p>	
<p><u>Estimated time:</u> Please indicate whether this is a stand-alone lesson or a series of lessons. This will be a series of lessons that will take place over a semester. Each section should last two to three class periods. 1 for prep, 1 for actually working with the instruments, and 1 for final analysis. There would be four of these lab sections.</p>	

Materials/Resources: Please list any materials or resources related to this lesson. Pipettors, pipette tips, biodisposal bags, gloves, goggles, lab coats, tubes for samples, gels, electrophoresis unit, PCR, Thermal Accelerator, Primers, sample of expected material (DNA)

Teacher Preparation: What do you need to do to prepare for this lesson? Prepare and research Marine Pathogens that can be used to explore the use of available technologies with the goal of assisting Marines Researchers. Such applications as Coral Diseases or Sea Grass Blights are examples of pathogens that could be researched. Students will study and analyze samples (similar to the Peanut plant lab) to show what vectors are involved with the spread of these diseases.

Lesson Procedure and Evaluation

Exploration: Describe in detail the activity or investigation the students will be engaged in and how you will facilitate the inquiry process to lead to student-developed conclusions.

Students will begin by having a week to prepare (in groups) for presentations to the class on differing pathogens that are being either monitored or deeply studied by Oceanographers and more importantly the why behind the studies. Are these pathogens affecting the numbers of these organisms, are they affecting organisms that humans depend upon (fish, crustaceans, or markers in the oceans such as coral)

After the presentations and discussions on the subject of Pathogens in the ocean, the classes will cover detailed information on the history of the technologies they will be using. Many will not have had any knowledge of these technologies so this is a critical aspect of preparation for this section of the class schedule.

Application: Describe how students will be able to apply what they have learned to other situations.

As we move forward in the class from these basic ideas about Marine Science and how researchers use this knowledge to trace and verify species and organisms they are working with. The organisms we will talk about and even the environment they live in will now take on a more important role to the overall planet. As the student moves on to advanced science courses this new information will assure them of a level of knowledge

that is above the normal student. On the other hand students who are not planning to move on in advanced science will now have a deeper understanding of the mechanical aspect of science and have a greater appreciation of how they themselves could take part in these hands on part of science.

This aspect of the program is what I'm so excited about as we can bring more students along with us instead of blocking them out with the overall heady focus of science. This aspect allows them to see themselves as a part of science instead of sidelined player.

Assessment: Describe how student knowledge is being assessed at the appropriate cognitive level for the targeted benchmarks.

Students will test using open ended questions that will allow them to elaborate upon not only their cognitive knowledge but, personal experience at actually taking part in a scientific study where they are using the latest in technology. Students will be expected to use the language of science to answer the questions.

There will also be classical assessments of their bridged prior knowledge and how it fits into the bigger picture in relation to Marine Research.

Teacher Self-Reflection: Record your thoughts on the lesson and describe any modifications you would recommend based on the outcomes.

At the time of my submission of this lesson plan I have not yet implemented this program.