

Title: Survey of Emerging Pathogens in Florida: Connecting Students to their Environment

Principle Investigator:

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Abstract

The purpose of the action plan is to embed biotechnology throughout a school year. The Florida Department of Education recognizes a course called Biology Technology; this course is a level 2 Biology 1 equivalent. This means that students that complete the Biology Technology course will be mandated to sit for the Florida Biology End of Course exam.

The seven modules are designed to be implanted in the Biology Technology course, allowing the student to explore the field of Biotechnology with the purview of issues and topics current in Florida. Concurrent with expanding students' knowledge of biotechnology issues is the intent to teach students foundational skills used in various career within different biotechnology fields. The end goal being: to educate students about the impact of biotechnology within their surroundings. The scope of this proposal is ambitious, funding is an issue, and alignment with state standards is complex. The modules are sequenced from most feasible to least feasible.

Rational

There are a growing number of biotechnological careers that are coming to maturity in Florida. This is a direct result of Gov. Jeb Bush's initiative to diversify Florida's industry. Lacking currently, are students trained and educated in basic biotechnology techniques, biotechnology issues/topics, and careers open to students within the field. Students hunger for hands on directly transferable skills, skills that they can take directly into the work force and beyond.

The goals of this research will be:

- Educate students in emerging pathogens in Florida and globally
- Educate students in the variety of pathogens that can affect animal and plant systems
- Teach students biotechnology lab skills (gel electrophoresis, DNA extraction, PCR, ELISA)
- Acquaint students with further advanced biotechnology skills (SDS Page, Protein Mass Spectrometry)
- Equip students with the skills to seek out and evaluate valid sources of information for personal use

Description of Teaching Modules, Including Expected Outcomes

Pre Modules: Biotechnology Pretest

Module 1: Mutants Among Us - Intro to Biotechnology

Before the Lesson: Students will know what DNA is and how it used in the body at a basic level, i.e. DNA is common to all living things, DNA codes for proteins, proteins carry out a variety of tasks.

- Setup: Pretest designed by Dr. Troy Sadler concerning student's media savvy.
- Activity1: Virus Quest curriculum as designed by Troy Sadler et al.
- Assessment: Written Lab reports will demonstrate student proficiency in completing a DNA extraction. Daily activities will provide ongoing formative assessments. Posttest designed by Dr. Troy Sadler concerning student's media savvy

Module 2 – Cholera, You So Crazy! - Human Impact and Disease

Before the Lesson: Students will know the relationship between vectors and pathogens. Students will know that it only takes small amount of pathogen to infect an organism. Students also understand that humans cause massive changes to their environment.

- Setup: Students will complete a guided note (Cornell Format) worksheet, while attending a lecture on V. cholera.
- Activity 1: Students will complete the activity: A Medical Mystery of Epidemic Proportions as created Science Take Out and modified by Ms. Drew Joseph
- Activity 2: Students will engage in a Socratic seminar about the challenges of the cholera outbreak in Haiti.
- Activity 3: Students will create posters detailing the dangers of Vibrios in seafood, as it pertains to the seafood industry in Florida.
- Assessment: Post Test.

Module 3 – Hey Brah, your salad is sick! - Vectors and Pathogens

Before the Lesson: Students will know that pathogens can be passed from organism to organism. Students will know that DNA, RNA, and proteins are related. Students will know that disease can be caused by DNA, RNA, or proteins.

- Setup: Students will read articles about E. coli outbreaks. Students will think-pair-share a KWL about E. Coli
- Activity1: Students will complete a guided note (Cornell Format) worksheet, while attending a lecture on E. Coli.
- Activity 2: Students will increase their familiarity and accuracy of micropipetting by completing the micropipette locker (available form ICORE)
- Activity 3: After watching a video on gel electrophoresis, student will create, in groups, flow charts on correct gel electrophoresis technique. Flow charts will be posted at each lab station prior to actually running gels.
- Activity 4: Students will run DNA gel electrophoresis to determine if possible patients are infected with E. Coli.
- Assessment: Students will complete a mini research project on possible vectors for both pathogenic and non-pathogenic E. coli, and how scientists can test for the presence of E. Coli.

Module 4 – Killer Peanuts and Toxic Pets - Food Science

Before the Lesson: Students will know how the body's immune system works. Specifically they should be aware of how adaptive response works. Students will be given a pretest on their knowledge of allergies and ELISA technique

- Setup: Students will watch video clips and take notes (Cornell Style) on allergies, in small groups, and then they will jigsaw this information looking for commonalities.
- Activity1: Students will complete the ELISA simulation as created by Dr. Charles Lawrence.
- Activity 2: Students will research and present other pathogens ELISA is used for as well as the advantages and disadvantages of ELISA

- Assessment: Students will be given a posttest on their knowledge of allergies and ELISA technique

Module 5 – Dengue, You give me fever! - Animal Vectors:

Before the Lesson: Students will know the relationship between vectors and pathogens. Students will know that it only takes small amount of pathogen to infect an organism.

- Setup: Students will complete a web quest researching the background of dengue fever and the recent outbreaks in Florida
- Activity1: Students will attend a lecture by Dr. Roxanne Connelly, take notes, and ask questions to deepen their knowledge of dengue fever and its vectors
- Activity 2: Students will read articles concerning dengue history, treatments, and preventions. Then using all available notes they will participate in a Socratic seminar about Dengue fever.
- Activity 3: Students will be placed in ability mixed groups to create an awareness campaign about dengue fever.
- Assessment: Participation in Socratic seminar, successful completion of awareness campaign.

Module 6 – Cat: A Man’s Best Friend - Species Specificity

Before the Lesson: Students should the relationship between DNA and RNA. Students will know the life cycle of viruses.

- Setup: Students will be given a pretest on HIV. Students will complete a web quest concerning the pathogenesis of HIV.
- Activity1: Students will complete an ELISA looking for HIV-1 in possible infected patients.
- Activity 2: Students will jigsaw information on SIV/HIV/FIV
- Activity 3: Students will complete a guided note (Cornell Format) worksheet, while attending a lecture on FIV.
- Assessment: Students will be given a posttest on HIV.

Module 7 – The Good Tomato, The Bad Tobacco, and the Ugly Thrip - Plant Viruses

Before the Lesson: Students should be comfortable that virus and bacteria are pathogens and how they can be transmitted by vectors.

- Setup: Students will research agribusiness in Florida to explore possible local career options.
- Activity1: Field Trip to AgriStarts in Apopka to investigate what biotech is done on site and what level of education is needed for employment. Randy Strode, owner.
- Activity 2: Students will learn about the challenges facing citrus growers by completing a PCR analysis of citrus greening.
- Activity 3: Students will complete a guided note (Cornell Format) worksheet, while attending a lecture on TSWV.
- Activity 4: Students will complete a ELISA dipstick test to confirm the presence of TSWV in various plants from the area.
- Assessment: Biotechnology Posttest.

References

- Sadler T, et al. 2011 Virus Quest. University of Florida College of Education.
- Johnson, J. 2011 Molecular Biology of V. cholera [lecture]. University of Florida College for Pre-collegiate Education and Training Summer Institute
- Yamamoto, J. 2011 Feline HIV Research [lecture]. University of Florida College of Veterinary Medicine.

Gabriel, D. 2011. Transgenic Citrus with Immunity to Citrus Greening [lecture]. University of Florida College for Pre-collegiate Education and Training Summer Institute.
 Joseph, D. 2011. A Medical Mystery of Epidemic Proportions [simulation]. University of Florida College for Pre-collegiate Education and Training Summer Institute.

Budget with Justification

Virus Quest	Materials as proscribed by the Virus Quest curriculum	Provided from University of Florida
Pipetting Stations	9 P-20 pipets 9 P-200 pipets 1 P-1000 pipet Pipet tips	loan from CPET
Introduction to Gel Electrophoresis	8 horizontal gel boxes 2 power supplies 8 casting trays and combs	loan from CPET
ELISA Simulation	Food Allergy Assay	loan from CPET
A Medical Mystery of Epidemic Proportions	cat #STO-116	15 kits x \$12.60 + \$12.00 S/H = \$201.00
Advanced Gel Electrophoresis	8 E-Gel units 1 Safe Imager 2 Power strips	loan from CPET
Thermal Cyclor	Thermal cyclor	loan from CPET

Module 2: Cholera, You So Crazy! - Human Impact and Disease

KEY QUESTION(S): How does close proximity among humans create conditions conducive to bacterial transmission?

SCIENCE SUBJECT: Biology, Biotechnology

GRADE AND ABILITY LEVEL: Honors Level 10th and 11th students.

STUDENT LEARNING OBJECTIVES WITH STANDARDS:

1. Students will evaluate examples and/or explain the possible impact of biotechnology on the individual, society, and/or the environment.
2. Students will predict how the actions of humans may impact environmental systems and/or affect sustainability.
3. Students will identify and/or explain the basic functions of the human immune system, including specific and nonspecific immune responses.
4. Students will describe how the human immune system responds to vaccines and/or antibiotics.
5. Students will explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspective of both individual and public health.
 - HE.912.C.1.3 Evaluate how environment and personal health are interrelated.
 - HE.912.C.1.8 Analyze strategies for prevention, detection, and treatment of communicable and chronic diseases.
 - SC.912.L.14.6 Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.
 - SC.912.L.14.52 Explain the basic functions of the human immune system, including specific and nonspecific immune response, vaccines, and antibiotics.
 - SC.912.L.16.10 Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.

MATERIALS:

1. A Medical Mystery of Epidemic Proportions kit – One/Three Students
2. Articles to research cholera: 1 Set Per/ Three Students (see reference section)
3. Articles to research *Vibrio vulnificus*: 1 Set Per/ Three Students (see reference section)

PROCEDURE AND DISCUSSION QUESTIONS WITH TIME ESTIMATES:

Day One: Students will attend a lecture detailing the history of cholera, its pathology, and current impact, specifically in Haiti. During this lecture students will take notes, and construct a concept map about the various topics related to cholera.

Day Two and Three: Students will complete the A Medical Mystery of Epidemic Proportions simulation as outlined in the simulation directions.

Day Four: Students will jigsaw articles pertaining to cholera and the cholera outbreak in Haiti. To jigsaw this assignment, assign three students to each lab table. Each lab table will get multiple of the same article. (three students = three of the same articles) Students are now in their “expert” groups. Independently, in their expert groups they will read the article and summarize the article into five succinct points. (20 min) Then they will debate, still in expert groups, what are the top 10 points for their article. (10 min). Then they will return to their home group and share their knowledge with their cohort. (20 min)

Day Five: Students will participate in a Socratic Seminar about the outbreak of cholera in Haiti and possible aid and treatments that could be provided the Haitian people.

Day Six and Seven: Students will research, online, the effect of *Vibrio vulnificus* on the oyster industry in Pensacola, Florida. In groups of three, students will create an awareness poster, focusing on either consumer safety or industry safety.

ASSESSMENT SUGGESTIONS:

Day One – Credit will be given if the student completes their notes in Cornell format and creates a concept map (Thinking Map, Mind Map, etc) that illustrates the connections made within the presentations.

Day Two and Three - Groups and individuals will be informally assessed through a series of higher order questions. Formally students will transfer and transform the information discovered during the simulation into the Oak Ridge HS official lab format. (see attached resource)

Day Four and Five - Students will be assessed for their participation in a Socratic Seminar . Assessment will be rubric based. (see attached resource)

Day Six and Seven – Student groups will be assessed on their creation of a *V. vulnificus* awareness poster. Grading will be done by rubric. (see attached resource)

RESOURCES/REFERENCES:

1. Per group of 3 students A Medical Mystery of Epidemic Proportions as created Science Take Out:
<http://shop.sciencetakeout.com/products.php?id=31>
2. Articles to research cholera: 1 set per group of three
 - <http://www.miamiherald.com/2010/10/22/1885299/cholera-in-haiti-blamed-in-deaths.html>

- http://www.msnbc.msn.com/id/39787756/ns/health-infectious_diseases/t/cholera-cases-found-haiti-capital/#.TmbbGl1vDLw
- http://www.cdc.gov/haiticholera/clinicalmanagement/pdf/clinicalmanagement_brochure.pdf
- http://www.cdc.gov/haiticholera/pdf/ctc_pocketguide_en.pdf
- <http://www.cdc.gov/haiticholera/preventionandcontrol.htm>
- http://www.cdc.gov/haiticholera/five_messages.htm
- <http://www.bbc.co.uk/news/health-12744929>
- <http://www.nytimes.com/2011/09/07/opinion/haitis-needless-cholera-deaths.html>
- <http://www.miamiherald.com/2011/09/05/2392036/cholera-still-devastating-for.html>

3. Articles to research seafood borne Vibrio:

- <http://textbookofbacteriology.net/V.vulnificus.html>
- http://www.issc.org/client_resources/Education/VvFactSheet.pdf
- <http://www.epi.state.nc.us/epi/gcdc/vibrio.html>
- <http://www.epi.state.nc.us/epi/gcdc/vibadvice.html>
- <http://safeoysters.org/medical/modesofinfection.html>

Socratic Seminar Rubric

	Text Preparation	Engagement	Use of Text;	Conduct	Listening	Insight and Reasoning	Openness
5	Remarks and written work reveal a critical reading of text with annotations, vocabulary and at least four critical, discussable questions connected to the text.	Demonstrates thoughtful and active participation throughout seminar. Consistently stays on task. Body language is active. Consistently makes eye contact.	Initiates specific references to text to support and defend ideas without external prompting.	Contributes to the success of the group and makes invitations by name to include and support all participants. Is consistently nonjudgmental and respectful.	Listens unusually well. Frequently responds using names. Comments indicate accurate and perceptive listening and connect directly to what has been said.	Questions and comments are insightful, logical and contribute to deeper construction of meaning. Presents new ideas and makes connections to previous/outside topics or dialogues.	Accepts points of view other than own and uses them to expand own ideas and discover new meaning about concepts.
4	Remarks and written work reveal text was read—ideas are relevant. Annotations are present and three or four critical, text-based questions are present.	Demonstrates active participation throughout seminar. Stays on task. Body language is active. Often makes eye contact.	Makes specific references to text to support ideas. Uses text effectively when challenged to do so.	Demonstrates respect and enthusiasm attempting to include and support all participants. Makes invitations to participants.	Listens and is able to respond to ideas and questions from others with little digression. May sometimes use names in responses.	Questions and comments are apt, logical, and relevant but do not necessarily offer significantly new insights or ideas.	Accepts points of view of others and attempts to use them to expand own ideas but may reflect set thinking.
3	Remarks and written work reveal text was read, but ideas may be irrelevant or annotations may be scant with only three or fewer questions present.	Demonstrates active participation through most of seminar. Stays on task most of the time. Body language and eye contact show some	Occasionally makes references to text to support and defend ideas but may have to be challenged to do so.	Demonstrates general respect for the group but is not always supportive and inclusive. May at times be judgmental or impatient of others.	Generally listens but is not always attentive as evident in some unconnected responses. Frequently focuses on same people.	Questions and comments are apt and logical but do not move the group forward to a deeper understanding. Some ideas may be off topic.	Acknowledges other points of view but may try to argue or refute them. Points reflect a lack of flexibility.

		engagement.					
2	Remarks and written work reveal cursory reading of the text. Few questions present or questions lack substance for discussion.	Participates in seminar although may be off task. Occasionally carries on side conversations. May be disengaged or lack eye contact.	Makes few references to text and is unable to defend origin of ideas when challenged to do so.	Speech and manner suggest a lack of support and/or respect. Lacks awareness of group dynamics by conversing with same people most of the time.	Comments are relevant to topic but lack connection to what has been said by others.	Questions and comments reveal personal reactions but lack logic and/or insight.	Argues with other points of view and is reluctant to acknowledge them as possible or relevant.
1	Remarks and written work suggest the text was not carefully read. Questions lack substance for discussion.	Is a passive observer of seminar or is off task. Side conversations are frequent.	Makes no references to text to support and defend ideas. Ideas appear “off the cuff.”	Makes no attempt to be inclusive. Uses disrespectful language. Centers dialogue on self or specific classmates.	Does not listen adequately; therefore, comments are random and may be irrelevant.	Questions and comments are illogical, difficult to follow and offer no benefit to the group.	Does not acknowledge or accept other points of view. Engages in debate over dialogue.

Adapted from Matt Copeland’s *Socratic Circles: Fostering Critical and Creative Thinking in Middle and High School*.

Awareness Poster



	4 (N/A)	3 (N/A)	2 (N/A)	1 (N/A)
Graphics/Originality	<p>4 Several of the graphics used on the poster reflect an exceptional degree of student creativity in their creation and/or display.</p>	<p>3 One or two of the graphics used on the poster reflect student creativity in their creation and/or display.</p>	<p>2 The graphics are made by the student, but are based on the designs or ideas of others.</p>	<p>1 No graphics made by the student are included.</p>
Content/Accuracy	<p>4 Many facts are displayed on the poster.</p>	<p>3 Some facts are displayed on the poster.</p>	<p>2 Only a couple of facts are displayed on the poster.</p>	<p>1 No facts are displayed on the poster.</p>
Attractiveness	<p>4 The poster is exceptionally attractive, in terms of design, layout, and neatness.</p>	<p>3 The poster is attractive in terms of design, layout, and neatness.</p>	<p>2 The poster is acceptably attractive though it may be a bit messy.</p>	<p>1 The poster is distractingly messy or very poorly designed. It is not attractive.</p>
Title	<p>4 Title can be read from 6 feet away and is quite creative in describing the content.</p>	<p>3 Title can be read from 6 feet away and describes content well.</p>	<p>2 Title can be read from 4 feet away and describes the content well.</p>	<p>1 The title is too small and/or does not describe the content of the poster well.</p>
Conventions:Spelling/Grammar	<p>4 Conventions (Spelling, capitalization, and grammar) are correct throughout the poster.</p>	<p>3 There are a couple of errors in the conventions (spelling, capitalization, and grammar) throughout the poster.</p>	<p>2 There are many errors in the conventions (spelling, capitalization, and grammar) throughout the poster.</p>	<p>1 There are lots of errors in the conventions (spelling, capitalization, and grammar) of the poster.</p>