University of Florida Center for Precollegiate Education and Training

2010 -2011 Biomedical Exploration: Bench to Bedside Action Research Proposal:

- **Title :**

'An Unknown Protein, Oh No!'; A Quest for a Rainforest Medicine, Biotechnology Exposure in a Biology I Class

- **Name and correspondence information for PI**

Lois Walsh
Deane Bozeman School
13410 Highway 77
Panama City, FL

- **Abstract :**

Man's knowledge of the human genomes actions and applications is impacting our lives. This is a very young science and dynamic science. I do not feel this area of science is adequately included in the standard high school textbook or very well understood by students. I propose to increase the awareness of biotechnology to my Biology I students by having them investigate a simulated problem scenario of biotechnology. The experience should also increase their knowledge of biotechnology and its applications.

In the scenario students will work in a laboratory that has material collected from the rainforest, in a quest to find a new medicine, a working protein, in a plant. The students will find a protein of interest, clone the gene for the protein, and then review the process of bringing that protein to the bedside or market place. The monitoring of students will be a 'prior knowledge and post knowledge questionnaire' of biotechnology and a self report of their increase of biotechnology awareness and knowledge.

- **Rationale:**

The school is in a rural setting with a majority qualifying as economically disadvantaged. The biology students are predominately eleventh graders. From my previous teachings I find this group is not aware of biotechnology applications. For example, they are mystified by the knowledge insulin used by diabetics is produced by yeast or their breakfast cereal has genetically modified foods in it McHughen (2000).

The general public does not have a thorough understanding of biotechnology either, even though it has a significant impact on our lives. Biotechnology issues are often in the news with a media slant to create controversy or attention. Important details and basic information is often missing. Students need to know, be informed. Without knowing, the students develop misconcepts and make false assumptions. There is a complexity to biotechnology that may not draw the interest of an average high school student as identified by Munn, Skinner, Conn, Horsma, and Gregory (1999). So I would like to create intrigue and increase the level of awareness and understanding of biotechnology in my Biology I students. I now have a creative way to do that with my newfound knowledge from

this professional development. This identification of a difficult concept and inquiry approach is supported by Bonner, Lotter & Harwood's work (2004).

This research project will investigate, "If students participate in a simulated problem scenario in biotechnology will it increase awareness and understanding of biotechnology and its applications?"

I will expose Biology I students to biotechnology; give them a problem based laboratory experience unique to this area of science and assist them in connecting current and future events of biotechnology.

- **Description of teaching unit or module(s), including expected outcomes/Action research intervention:**

In the scenario students will work in a laboratory that has material collected from the rainforest in a quest to find a new medicine, a working protein, in a plant. The students will find a protein of interest, clone the gene for the protein in the laboratory, and then review the process of bringing that protein to the bedside or market place. Students will perform three laboratory experiments involving gene transformation, the electrophoresis, and column chromatography. These lab activities are followed by simulated activities to bring this new found drug to market covering, FDA regulations, animal testing, and ethical issues.

With a one hour and fifty five minute block schedule this scenario will take five class sessions to complete and will follow gene expression in the first half of the course. Students' prior awareness of biotechnology will be assessed, followed by a class discussion. Students will be introduced to the scenario and practice biotechnology lab skills. In the lab students will inoculate bacteria with the genes of interest, isolate the proteins with column chromatography and use electrophoresis to identify it in the lab. Then students will form research teams to simulate the translational research to get FDA approval to test on animals. Students will be assessed on their post knowledge awareness of biotechnology with the same assessment as the prior knowledge and they will self rate themselves on their awareness and understanding of biotechnology, with a Likert scale. A traditional content knowledge assessment will also be administered.

From this scenario students will have a better understand of the use of biotechnology in the lab and its applications, and gain relevant vocabulary. Students will be more aware of biotechnology, and be able to site or recognize examples of lab technique and applications of biotechnology.

- **Bench to Bedside summer institute elements specifically included (UF connections**):

Gene transformation, pGLO SDS-PAGE and gel electrophoresis labs

- **Data collection and analysis:**

The data I collect will be in three components: A prior and post knowledge questionnaire, an self rating of knowledge and attitude (Likert scale), and biotechnology content knowledge assessment score. From these data I will be able to compare what students knew before and after the scenario, how they feel about their knowledge in biotechnology, how they feel about their experience. Lastly, to confirm knowledge gain, the standard content assessment will be compared to another content knowledge assessment taken within the Biology I curriculum. Statistics can be applied to the data. And I, of course, will apply any insight of

their learning experience to this research project in my observations and analysis of the project.

- **Literature cited:**

Bednarski, M. (2003) *Assessing Performance Tasks*. The Science Teacher 70(4): 34 -37.
Harwood, W. , J.J. Bonner, C. Lotter (2004) *One Bottleneck at a Time*. The Science Teacher, 71(10): 26-29.
McHughen, A. (2000) *Pandora's Picnic Basket The potential and hazards of genetically modified foods.* New York: Oxford University Press.
Munn, M. , P. Skinner, L. Conn, H. Horsma, P. Gregory (1999) *The involvement of Genome Researchers in High School Science Education*. Genome Research, 9 , 597 -607.

- **Budget and budget justification**

Quantity	Item	Cost
1	**UF CPET Loaner DNA Biotechnology Kit**	**Summer workshop & proposal**
1	**pGLO Bacterial Transformation Kit, #166-0003EDU BioRad**	**89.00**
1	**pGLO Kits SDS-PAGE Extention, #166-0013EDU BioRad**	**85.00**
1	**Secrets of the Rainforest Kit, #166-0006EDU BioRad**	**146.00**
	Shipping @ 10%	**32.00**
		352.00

- **Permission**
  Bay District Schools Consent form and classroom laboratory safety contract

'An Unknown Protein, Oh No!'; A Quest in Biotechnology **Name-_____**

Prior knowledge assessment

1. **List ten examples of biotechnology today.**

2. **Name a biotechnology laboratory procedure**
   Or
   Describe what biotechnology would look like in a laboratory.

3. **List five examples of possible future uses of biotechnology.**

4. **Can you recognize Biotechnology?**
   Circle biotechnology items; underline possible biotechnology and ~~draw a line through~~ items that are not biotechnology.

Plasmid	**gene therapy**	**PCR**	**ELISA**	**Protein crystalliazation**
Transformation	**DNA**	**activators**	**primers**	**promoters**
Sticky ends	**electrophorsesis**	**microarrays**	**buffers**	**Gel**
chromatography	**virus**	**RNA**	**miropipets**	**nucleic acid**
enzyme	**bacteria**	**reagents**	**centrifuge**	

Lesson Plan for 2010 – 2011 Biomedical Exploration: Bench to Bedside
University of Florida Center for Precollegiate Education and Training
'An Unknown Protein, Oh No!'; A Quest for a Rainforest Medicine

High School Biology I FL Standards: SC.912.L.16.3, 16.9,16.12,18.1,18.11 and SC.012.N 1.3

Goals: Students will have an increased awareness of biotechnology. They will have experience with its laboratory components and applications to a problem. From the experience they will be able to recognize biotechnology.

Time and Sequence: Estimated 6 class periods.

Sequence/sources:

1- Introduction to the problem of a quest for a new rainforest medicine and the lab challenge to isolate and identify a protein from the samples. See BioRad's 'Secrets of the Rainforest Kit'

2- Introduction and practice of biotechnology lab skills. UF's Designer Plates/practice pipetting

3- pGLO SDS-PAGE Lab. UF's Protocols & BioRad's lab directions

4- Gelelectrophoresis lab. UF's Protocols & BioRad's lab directions

5- Team research proposals for the tranlational research study for FDA approval of an animal study. Internet: UF, FDA, examples. . . .

6- Analysis of proposals and overall scenario. Self reflection: summary, positives, negatives, significants.

Materials/Resources:

BioRad's Secrets of the Rainforest Kit #166-0006EDU

UF CPET Loaner Locker with equipment & supplies [- pipetting station – gel electrophoresis – protein electrophoresis] w/gene cloning protocols, designer plate cards,

Computer and internet access at home or school for research and translational research proposals

Assessment:

-Pre and post test knowledge of biotechnology.

- Rubric for lab reports

-Rubric for research proposals

-Overall Scenario and Self reflection, written.