

## **Title: Teaching a Lesson in Bioethics in a Biotechnology Class**

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“One can be no better a teacher than one is a learner at any point in one’s life.” Paul Saltman

**Abstract:** Students are becoming more and more aware of the increasing number of bioethical issues that face our nation and the world every day. Topics such as whether cloning, stem-cell research, and genetically modified organisms should be allowed further advancement in research or in practice will, no doubt, come up at some point in the teaching of a biotechnology course. As students start to understand the science as well as the techniques being used in these fields, we also need to prepare them to understand the ethical dilemma faced by researchers and politicians as they struggle to agree on the ethical standards that societies must obey. This lesson is a first year attempt to teach a brief history of ethics and promote civil discussion of some ethical issues among first year biotechnology students. Students will have a chance to reflect on their own preconceived notions of what is ethical as well as to share and discuss their ideas with their classmates.

**Rationale:** As my Biotechnology students and I discussed the first PowerPoint of the year, “What is Biotechnology and what can it be used for?”, questions immediately arose from the students regarding certain ethical issues. The students were animated and very anxious to share their opinions on topics such as cloning and stem cell research. I recalled the presentation by Ray Moseley, Ph.D. and his comment that that there was a “difference between rational opinions and rationalizing opinions”. I quickly realized that my students not only needed some introductory education to ethics, but would welcome it.

**Goals:** The National Institute of Health (NIH) and the National Science Teachers Association (NSTA) states four possible goals for teaching bioethics in a classroom; 1) to advance science understanding, (2) to prepare students to make informed, thoughtful choices, (3) to enhance respectful dialogue among those with diverse views, and 4) to cultivate critical-reasoning skills. These goals can be viewed in the webinar located on the NSTA’s Learning Center website. I believe that all of these goals must be kept in mind as the main objectives for teaching ethics.

**Action Research Intervention:** The lesson will involve two modules. The first module is a lecture/ discussion based on a PowerPoint (attached). The PowerPoint will include a brief overview of some of the more renowned historical cases of ethical misconduct and the evolution of our current national policies on human research. The lesson also includes a discussion of vocabulary and some ground rules for discussing ethical issue in class. The second module involves breaking the students into groups and allowing them to discuss two separate biotechnical ethical questions. The first question is whether or not a country or nation should financially benefit from bacteria that can be found only in within their boundaries. The specific example used is that of an enzyme extracted from an extremophile in Lake Nakuru, Kenya in the

1980's. The enzyme was sold to Genencor International, a company with close ties to Proctor & Gamble. The students will read, "Who Benefits from African Research?" by Christine Gichure. (This article can be read online at the website listed in Literature Cited below). The second question is whether or not individuals should financially benefit from medical research that used their DNA or cells. The specific example will be that of HeLa cells which were extracted from a tumor in a woman by the name of Henrietta Lacks in 1951. The students will read Rupert Cornwells' article "The Incredible Story of the Most Important Woman in the History of Modern Medicine." (This article can also be read at the website listed in the Literature Cited below.) The students will write a brief paragraph describing their opinions before their discussion and then again after their discussions. The entire two modules should be completed within a two week time period.

**Day One:** The first day students will be given a pretest and survey. The class can discuss the terms/values in the value exercise to determine which words/values have a place in a discussion regarding ethics.

**Days Two and Three:** The second and third day will be spent on a PowerPoint defining terms, protocol on discussion vs. debate, and a discussion of the Institutional Review Board's formation and consensus regarding human subjects in research. The PowerPoint will not be presented solely as a lecture, but rather as a talking point for interactive class discussion.

**Days Four and Five:** Students will answer the following question in a paragraph before the lesson begins; "If you found a bacteria, that was not known to exist before, in the Little Econlockhatchee River and found a valuable industrial use for it, do you think that the state of Florida should benefit financially from your research? Why or why not?". The students will then read the article "Who Benefits from African Research" from the website. After reading the article the students will be assigned to groups where they will be allowed to discuss their views. Once each group has discussed their views we will reconvene as a class and wrap up the discussion. At the conclusion the students will write a paragraph describing whether or not they would change their original answer to the "Little Econ" question and what, if anything, made them change their mind.

**Days Six and Seven:** Students will answer the following question in a paragraph before the lesson begins; "Assume that while you were under the care of a physician for a type of skin cancer a doctor, without your knowledge, took a sample of your cancer cells. Research using these cells resulted in the discovery of a cure for this specific type of skin cancer. Do you feel you should be financially compensated for the use of your cells? Why or why not? ". The students will then read the article "The Incredible Story of the Most Important Woman in the History of Modern Medicine" from the website listed. After reading the article the students will be assigned to groups where they will be allowed to discuss their views. Once each group has discussed their views we will reconvene as a class and wrap up the discussion. At the conclusion the students will write a paragraph describing whether or not they would change their original answer to the "Skin Cancer" question and what, if anything made them change their mind.

**Day Eight:** Review & Conclusions

**Day Nine:** Post Survey and Post-test

**Connections to Bench to Bedside Summer Institute:** I found Dr. Moseley's presentation on Bioethics to be extremely thought-provoking. Before his presentation, I truly thought I had a good handle on what the subject of ethics involved. I quickly found out otherwise. As we listened to caring and thoughtful presenters like Dr. David Weinstein who uses Maltese dogs in his research to find a cure for Glycogen Storage Disease to Dr. Barry Byrne discuss the "Critical role of Preclinical Models in Molecular Medicine" I realized that ethics was not something that could be avoided. People who think "all" animal testing is wrong don't realize how much their own quality of life is a result of animal testing. Nor do they realize the sacrifice that another type of animal, humans, have made for the benefit of us all. Whether in clinical trials or in the long hours of education and research, the cumulative effect of individual human sacrifices is immeasurable.

**Data Collection and Analysis:** There will be three types of data collected from this research. The first will be the pre- and post-test of ten multiple choice questions. This is a criterion-referenced test rather than an opinion test. This will be the easiest to evaluate. I will use the mean, median, and standard deviation to evaluate the learning gains made by the students as a class.

The second piece of data collected will be the pre- and post-survey. This will be used to see how students view the term "ethics" with respect to other nearly synonymous terms and if their opinions changed over the course of the lesson. For this survey the median scores of a 4-point Likert scale test will be used to determine shifts in attitude.

The last piece of data collected will be the reflective paragraphs written by the students before and after their specific ethical situation group discussions. These writings will allow me to be reflective in my own analysis of the lesson and perhaps notice any gaps in what I should be teaching.

### **Literature Cited:**

Cornwell, R., (2010, Feb 7). The Incredible Story of the Most Important Woman in the History of Modern Medicine. *The Independent*.

<<http://www.independent.co.uk/opinion/commentators/ruPERT-cornwell/ruPERT-cornwell-the-incredible-story-of-the-most-important-woman-in-the-history-of-modern-medicine-1891388.html>>

"Dealing with Charged Topics in the Classroom," audio [podcast] from a fall 2005 Berkeley Topics on Teaching event. Professors Mark Brilliant, History, Kristin Luker, Sociology, and Rich Muller, Physics discuss their approach to teaching and dealing with what can be difficult topics.

Gichure, C.W., (2005) *Who Benefits from African Research?*

<<http://www.ethicalbusiness.nd.edu/pdf/african%20research%20benefits.pdf>>

Mills, G. E., (2011). *Action Research: A Guide for the Teacher Researcher* (4<sup>th</sup> ed.). Pearson Education, Inc.

Poe, R.E., 2000. Hitting a Nerve: When Touchy Subjects Come Up in Class. *Association for Psychological Science*, 13 (9).

Valesquez, M., and C. Andre, and T. Shanks, and M. Meyer, and S.J. (1987). Can Ethics Be Taught?. *Issues in Ethics*, 1 (1).

apter 2: What is Ethics? (Section I- A Guide To Teaching the Ethical Dimensions of Science)" Online Ethics Center for Engineering 7/11/2006 National Academy of Engineering Accessed: Monday, September 06, 2010

<[www.onlineethics.org/Education/precollege/scienceclass/sectone/chapt2.aspx](http://www.onlineethics.org/Education/precollege/scienceclass/sectone/chapt2.aspx)>

**Budget and Budget Justification:** There are no costs associated with this lesson other than possibly printing off class sets of the situational examples or other articles for students to read. The pre- and post-tests as well as the surveys will be done on the computers in the computer lab through Blackboard.

**Permissions:** I should not need permission from parents or students for this research, however, I will make my Assistant Principal and Principal aware of my research plans.

Pre –Survey / Post-Survey

Identify each word or phrase below as being highly relevant to an ethical discussion on whether or not we should allow human cloning or not at all relevant to the discussion. Put an “x” in the box you feel most closely identifies with your assessment.

		1 – highly relevant	2 – somewhat relevant	3 – slightly relevant	4 – not at all relevant
1.	Morality				
2.	Theistic Values				
3.	Personal Opinion				
4.	Legal Precedence				
5.	Societal Tradition				
6.	Democratic Majority				
7.	Logic				
8.	Fairness				
9.	Facts				
10.	Purpose/Intent				

Bioethics

Pre-test/Post-test

1. Which of the following is not a characteristic of an “ethical” value?
  - a. Humane
  - b. Legal
  - c. Good
  - d. Right
  
2. Which of the following is not one of the three vulnerable research subjects as established by the “Common Rule”?
  - a. Pregnant Women
  - b. Prisoners
  - c. Children
  - d. The Elderly
  
3. The National Research Act of 1974 was passed as a result from the publicity of the
  - a. Nazi Medical War Crimes
  - b. Willowbrook Hepatitis Studies
  - c. Tuskegee Syphilis Experiments
  - d. San Antonio Contraceptive Studies
  
4. Which of the following was not one of the three key points added to the Helsinki Declaration?
  - a. Established specific requirements for informed consent

- b. The interest of the subject has higher priority than society
  - c. Every subject should get the best known treatment
  - d. Independent reviews of all human subject research are required
5. Thalidomide is a drug that was used for/as
- a. Treating syphilis
  - b. Treating morning sickness
  - c. Treating baldness
  - d. Birth Control
6. The Nuremberg Code or the International Code of Research Ethics includes all of the following requirements for experiments except:
- a. All drugs used for experimentation must have FDA approval
  - b. Voluntary and informed consent
  - c. Experiments must be scientifically necessary
  - d. The right to withdraw without penalty
7. Which of the following is not one of the four bioethical principals?
- a. Autonomy
  - b. Non-maleficence
  - c. Integrity
  - d. Justice
8. HeLa cells are a specific cell line that
- a. Have been growing in labs since 1951 and are considered immortal
  - b. Were used in the Nazi Medical War Crimes in 1936
  - c. Are grown from rat ovaries and used for fertility research
  - d. Were used to “treat” syphilis patients in 1940
9. “I will remember that there is art to medicine as well as science, and that warmth, sympathy, and understanding may outweigh the surgeon's knife or the chemist's drug.” is part of
- a. The Hippocratic Oath
  - b. The Common Rule
  - c. The Belmont Report
  - d. The Helsinki Declaration
10. Which of the following an incorrect way to frame an ethical question?
- a. Is it wrong to murder a two month old fetus?
  - b. Should a three month old fetus be considered a child?
  - c. At what stage in a pregnancy should abortions no longer be allowed?
  - d. Does a three month old fetus have a developed nervous system?