Bioethics: Drawing the Line

Secrets of the Sequence Video Series on the Life Sciences • Grades 9 — 12

Teaching materials developed by **VCU** Life Sciences

Virginia Commonwealth University

Classroom Tested Lesson

Video Description

"Secrets of the Sequence," Show 113, Episode 1

"Bioethics: Drawing the line" – approximately 12 minutes viewing time

Twenty-four years later, we still know little about all the results of the first step in human genetic manipulation, the creation of the first test-tube baby. While the President's advisory council debates what policies to recommend on issues of cloning and stem cell research, it's possible to purchase eggs off the Internet. Drug companies and other commercial enterprises are patenting genes and biological processes – even before knowledge is complete about how they work. Consumers are often desperate for the treatments promised by scientific and commercial hype that comes with genetic advances. Where do you draw the line between what's ethically acceptable and what's not?

Ward Television
Producer: Naomi Spinrad
Featuring: Arthur Caplan, Center for Bioethics at University of Pennsylvania School of Medicine, Dr. Leon Kass, Chairman of the President's Council on Bioethics, Christopher Reeve, Christopher Reeve Paralysis Foundation and Jerry Falwell, Falwell Ministries
Lesson Author; Reviewers: Ellen Lamb; Catherine Dahl, Dick Rezba, and Kieron Torres
Trial Testing Teachers: Beneta Brown, Lawrence Volk

National and State Science Standards of Learning

National Science Education Standards Connection

Content Standard F: Science in Personal and Social Perspectives

As a result of their activities in grades 9-12, all students should develop an understanding of

- personal and community health.
- science and technology in local, national and global challenges.

Content Standard G: History and the Nature of Science

As a result of their activities in grades 9-12, all students should develop an understanding of

- science as a human endeavor.
- nature of scientific knowledge.

Selected State Science Standards Connection

Use http://www.eduhound.com (click on "Standards by State") or a search engine to access additional state science standards.

Virginia

BIO.6 The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include

- Use, limitations, and misuse of genetic information.
- Exploration of the impact of DNA technologies.

Florida

Standard 3

The student understands that science, technology, and society are interwoven and interdependent. (SC.H.3.4)

2. knows that technological problems often create a demand for new scientific knowledge and that new technologies make it possible for scientists to extend their research in a way that advances science.
3. knows that scientists can bring information, insights, and analytical skills to matters of public concern and help people understand the possible causes and effects of events.
5. knows that the value of a technology may differ for different people and at different times.
6. knows that scientific knowledge is used by those who engage in design and technology to solve practical problems, taking human values and limitations into account.

Overview

In this lesson students are asked to grapple with the ethical dilemmas that have resulted from major scientific advances in gene research. Students will reflect on whether science is neutral, on who sets the moral boundaries of research as the stakes get higher, and how all this plays out in a free market system. The students will see how those boundaries are not clear, how the slippery slope is developing and the difficulties of where to "draw the line". In-vitro fertilization, somatic cell nuclear transfer, cloning, and gene diagnostics are addressed.

Testing: A sample related multiple choice item from State Standardized Exams

A woman has a gene that causes a visual disorder. To prevent the disorder from appearing in her children, the defective gene would have to be repaired in the mother's

1. nervous system
2. reproductive cells *
3. eye
4. uterus

Source: New York Sample Test Questions for the Living Environment Regents Examination Part A

Video Preparation

Preview the video and make note of the locations you will need later to pause the video for discussion.

Before Viewing

1. Review basic concepts of values, morals, and ethics before starting this lesson. See the general lesson: *Bioethics - Introduction to Ethics* available on the Web site, http://www.vcu.edu/lifesci/sosq to refresh your understanding of these concepts and for ideas for a preliminary ethics lesson for your students if desired.

2. Inform students about the video they are going to view and the role-playing activity that will follow. Establish basic classroom procedures for discussion (see the general lesson: *Bioethics - Introduction to Ethics* for suggestions)

3. Provide students with copies of Student Handout 1, Bioethics: Background and Definitions. Provide them time to read the handout. Discuss several of the terms and their meanings and encourage students to pay close attention to the video to learn more about these concepts.

4. On the board or as a handout, give students the following questions. Have them write their thoughts and opinions for one or more of the questions. Alternatively, discuss the questions as a class.

    - When does human life begin and end?
    - What is the status of an early human embryo? Is it a human person or a complex biological entity with potential for human life? Should we allow embryos and stem cells to be commodities?
    - Should techniques such as in vitro fertilization, stem cell research, therapeutic cloning and reproductive cloning be freely encouraged or greatly regulated and limited?
    - Who should answer these questions and decide whether to limit or use new biotechnologies?
    - Why do some people want to clone stem cells?
    - Should therapeutic cloning be used to treat Parkinson's or Alzheimer's disease?

During Viewing

1. START the video.

2. PAUSE the video (9.24 minutes into the video) when the narrator says, "but that same technology might be one day used to eliminate embryos that have characteristics that are simply just unwanted…" Be sure to pause the video before he says, "…freckles…great musician."

    Ask the following questions:

‘

    - "What might those characteristics be?"
    - "How far do you think people will go towards making the "perfect baby???"
    - "To what extent should individuals be free to make choices about their baby's characteristics?"

1. RESUME the video and play to the end.

After Viewing

1. The video segment ends with a statement that science is morally neutral, yet humans pursue science, and as humans, bring their own morals, values, and agendas to the study and pursuit of scientific knowledge.

    Ask: "Do you think scientists can remain morally neutral? How might the personal values of scientists affect the types of research they would choose to conduct?"

2. Choose <u>one</u> of the following questions to discuss:
    - If we as a country cannot agree on what our ethical boundaries should be in gene research, what hope do you see for agreement on some world values?
    - What do you think a parent of a child with a disability that is not fatal or painful would think about eliminating the gene defect for that disability?
    - How far should we go to pursue knowledge? And is there value of knowledge for knowledge's sake?

3. Conduct the Student Activity: The Slippery Slope: Bioethics and Cloning

Teacher Notes for the Student Activity: The Slippery Slope - Bioethics and Cloning

In this activity, students will role play various individuals involved in the dilemma posed by stem cell research.

Introduction:

Discuss the meaning of the slippery slope: The slippery slope (also known as the “The Camel's Nose”) is a fallacy in which a person asserts that some event will inevitably follow from another without any argument for the inevitability of the event in question. In most cases, there are a series of steps or gradations between one event and the one in question and no reason is given as to why the intervening steps or gradations will simply be bypassed. This argument has the following form:

- Event X has occurred (or will or might occur).
- Therefore event Y will inevitably happen.

This sort of reasoning is fallacious because there is no reason to believe that one event must inevitably follow from another without an argument for such a claim. This is especially clear in cases in which there are a significant number of steps or gradations between one event and another. Examples of slippery slope:

- "We have to stop the tuition increase! The next thing you know, they'll be charging $40,000 a semester!"
- "The US shouldn't get involved militarily in other countries. Once the government sends in a few troops, it will then send in thousands to die." (Source: www.nizcorcom)

Procedure:

1. Have students read Student Handout 2 and discuss how the roles can be selected and how the debate will be conducted in class.

2. Depending on the availability of time, have students use the library and the Internet to learn more about stem cell research and particularly the positions of various stakeholders.

3. Have each group select one of their group members to serve on the Ethics Review Board.

4. After each group has presented their position, provide time for the Review Board to decide which group presented the most convincing argument.

Student Handout 1: Bioethics - Background and Definitions

Somatic cell nuclear transfer (SCNT) is the process of removing the nucleus from an ovum and replacing it with the nucleus from another individual; this diploid ovum is then transferred to the uterus of a female in the same kind of procedure developed for *in vitro* fertilization, the technology that produced Dolly the sheep.

Therapeutic or research cloning are other terms used to describe somatic cell nuclear transfer (SCNT).

Reproductive cloning is the process of producing organisms as offspring via either SCNT or splitting embryos at a very early stage of development (making identical twins, triplets, etc.), and then allowing each new embryo to develop and be implanted. This latter technique has been used with domesticated animals such as prize cattle or horses for many years. *Reproductive cloning is most controversial when referring to human reproduction.* With regard to humans, reproductive cloning might be a viable (and controversial) option for a couple to produce a child when parents carry genes that would lead to a child with severe disability or disease. Before implanting a fertilized egg, defects could be corrected or engineered to produce specific traits.

Stem cells are precursor cells that have the potential to give rise to several different kinds of cells.

Totipotent is the first single cell of a forming embryo that can potentially give rise to any type of cell in the body. Its fate is not yet determined.

Determination: once determination has occurred and a cell has become fully differentiated, we do not yet know how to return it to a totipotent state. This determination appears to occur as a result of certain segments of DNA becoming permanently "turned off", but science has yet to unlock the secrets of how and exactly which segments of DNA must be controlled

Differentiate: as the embryo goes through various divisions and contains more and more cells, the cells begin to differentiate into specific types of cells, such as blood or nerve or muscle cells. Differentiation occurs in stages, and the fate of cells is first determined generally, then more specifically as more divisions occur. For example, once the fate of a particular cell is determined to be a blood cell at an early stage of development, the cell still retains the potential to become any of several types of blood cells, but not muscle or nerve cells.

Pluripotent: the cell is called pluripotent if its fate has already been determined at a preliminary stage of development but it still retains the potential to become more specifically determined, i.e. pluripotent suggests its several different potential fates. Another way to refer to this level of determination is to say that the cell has lost some of its plasticity.

Plasticity is the ability to become different types of cells. Curiously, most plant cells appear to retain their plasticity (that is, remain totipotent) throughout their lives. Only animal cells seem to have these determined limitations, and the extent of determination varies within the animal kingdom. For example, some sponges can regenerate completely from single cells; starfish can regenerate arms from the basal disk; some salamanders can regenerate their tails; even humans can usually regenerate the liver, as long as a certain critical amount of the liver remains intact! But we cannot usually regenerate nerves in the spinal cord, the brain, or most other parts of the nervous system.

Parthenogenesis: Recently, researchers have taken an unfertilized human ovum and induced it to recall its attached polar body, returning it to a diploid state. Further steps have triggered the ovum to begin to divide and develop in a process known as parthenogenesis.

Parthenode: Rather than forming a true embryo, the process of parthenogenesis results in the development of a parthenode, which will spontaneously abort after several divisions. Stem cells could be recovered prior to the destruction of the parthenode, however, making such techniques another possible source for stem cells for cloning.

Student Handout 2: The Slippery Slope - Bioethics and Cloning

In this activity you and your classmates will role play various individuals involved in the dilemma posed by stem cell research.

Scenario: A researcher-physician has applied for permission and a substantial grant to continue her stem cell studies. Her research focuses on using human totipotent stem cells in the brains of patients with Parkinson's disease, replacing damaged cells with new cells and thus reducing or eliminating the symptoms of this progressive and debilitating disorder.

A. You and the members of your class as small groups will take on the following roles or stakeholder positions:
   1. The researcher
   2. The funding agency
   3. The government
   4. Patients with Parkinson's disease and their families
   5. Representatives of a pro-life organization (who may take the position of the embryos to be used)
   6. Other (to be determined once the class brainstorms the issues)

B. Your group will present the case of the role you have assumed to the 6 members of the Ethics Review Board, which will consist of one student drawn from each of the 6 groups above. In presenting your case, you must be sure to include the following:
   1. A concise statement of the issue from your assumed perspective
   2. The scientific facts, with references, related to your argument
   3. The values at stake, from your perspective
   4. A concise statement of the viable options and your rationalization of those options, from your perspective

C. Once the Ethics Review Board has heard all arguments, there will be a brief rebuttal opportunity for each stakeholder.

D. Before the Ethics Review Board presents its conclusions, you will each write a short position paper stating your own personal position on this issue (not necessarily the position of the role you assumed above). Your position paper should include the values at stake and your reasoning for your position. How is your conclusion different from that of your assumed stakeholder role? Exactly what is the slippery slope of this dilemma?

E. The Ethics Review Board will decide which role was presented most convincingly.

Additional Resources

Because Web sites frequently change, some of these resources may no longer be available. Use a search engine and related key words to locate new Web sites.

Therapeutic cloning and stem cell research

http://www.bio.org/bioethics/tcloning.asp
http://www.religioustolerance.org/clo_ther.htm
http://www.doh.gov.uk/cegc/stemcellreport.htm#execsum
http://www.christopherreeve.org
http://www.genetics-and-society.org
http://www.laskerfoundation.org/news/weis/tcloning.html
http://www.agingresearch.org/clone_qa.cfm
http://www.chicagotribune.com/technology/local/chi-010706stem,0,1747596.story

In vitro fertilization

http://school.discovery.com/lessonplans/programs/invitro/
http://www.inciid.org/ivf.html
http://www.givf.com/

Parkinson disease

http://www.parkinson.org/
http://www.nlm.nih.gov/medlineplus/parkinsonsdisease.html
http://www.ninds.nih.gov/health_and_medical/disorders/parkinsons_disease.htm

Ethics and values

http://www.accessexcellence.org/21st/TE/BE/
http://www.accessexcellence.org/AE/AEPC/WWC/1992/bioethics_intro.html
http://onlineethics.org/edu/precol/classroom/
http://www.georgetown.edu/research/nrcbl/

Genomic Revolution

http://www.ornl.gov/sci/techresources/Human_Genome/education/education.shtmL
This Web site of the government-funded Human Genome Project has links about genomics, the history of the project, and more.

Secrets of the Sequence Videos and Lessons

This video and 49 others with their accompanying lessons are available *at no charge* from www.vcu.edu/lifesci/sosq