

The Cloning Conflict — Parkinson's Disease

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

Teaching materials developed by VCU Life Sciences

V i r g i n i a C o m m o n w e a l t h U n i v e r s i t y

Classroom Tested Lesson

Video Description

"Secrets of the Sequence," Show 109, Episode 1

"The Cloning Conflict-Parkinson's Disease" – approximately – 11 minutes viewing time

Ole Isakson has cured Parkinson's with stem cells – in mice. But to translate that success to humans he needs to do a lot more research with human embryonic stem cells. To what extent does the present climate dampen research, and how does that impact patients, physically and emotionally?

Ward Television

Producer: Paul Gasek

Featuring: Dr. David Standaert, Neurology at Massachusetts General Hospital, Dr. Ole Isakson, Neuroscience at McLean Hospital

Lesson Author; Reviewers: Ellen Lamb; Catherine Dahl, Dick Rezba, Kieron Torres

Trial Testing Teachers: Regina Ahmann

National and State Science Standards of Learning

National Science Education Standards Connection

Content Standard C: Life Science

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

- The Cell

Content Standard F: Science in Personal and Social Perspectives.

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

- Personal and community health
- Science and technology in local, national and global challenges

Selected State Science Standards Connections

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

- a) cell growth and division
- c) cell specialization
- f) the structure, function, and replication of nucleic acids (DNA and RNA);

- i) exploration of the impact of DNA technologies.

Delaware

Grades 9-12

By the end of the twelfth grade students should know that:

Reproduction and Development

1. Embryological development in plants and animals involves a series of orderly changes in which cells divide and differentiate. Development is controlled by genes whose expression is influenced by many internal and external factors.

Overview

Although other video segments in this *Secrets of the Sequence* series also contain information on research that uses “cloning” techniques, this segment carefully explains the differences between two types of cloning and highlights the controversy surrounding their use by research scientists. The two cloning techniques are reproductive cloning and therapeutic cloning. At the present time reproductive cloning, which results in the identical duplication of an organism, continues with plants and animals but not with humans. In contrast, researchers see enormous potential for therapeutic cloning for humans, where new cells and tissues are grown from human embryonic stem cells to replace diseased human cells and tissues. The replacement or regeneration of cells could be used in the treatment of multiple diseases - such as Parkinson’s, which is featured in this video segment.

However, even therapeutic cloning, which involves the use of embryonic stem cells, raises ethical issues because human embryos are destroyed when the stem cells are removed. Current federal regulations prohibit funding research that involves the destruction of embryos for stem cells and only permits the use of embryonic stem cells from already existing stem cell lines. Because limiting research to existing stem cell lines dramatically reduces scientists’ options in pursuing new therapeutic treatments, the controversy continues. Furthermore, it has been reported that some of these stem cell lines may even be contaminated. One solution put forth is to use surplus embryos from fertility clinics that would typically be destroyed anyway.

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

The Human Genome Project was begun in 1988 by scientists from 13 nations as a worldwide effort to understand the sequencing of the entire DNA in the human body. What is one potential scientific benefit of this research?

- A. It will help to explain human cultural differences.
- B. It will create communication between research centers
- C. It will help find the genes responsible for many diseases *
- D. It helps to classify man most accurately in the animal kingdom

Source: Virginia Spring 2003 End of Course Biology

Video Preparation

Preview the video and make note of the locations at which you will later pause the video for discussion.

Before Viewing

Ask students the following questions:

1. "How would you define the term 'cloning'?"

The exact genetic duplication of an animal, plant, or human.

2. "There are two types of cloning. Do you know what these two types are called and what they mean?"

Reproductive cloning and therapeutic cloning. Reproductive cloning is the laboratory production of organisms that are identical genetic copies of another organism (animal, plant, or potentially a human being). Although plants and animals have been cloned, there is no evidence that a human has been cloned.

The intent of therapeutic cloning is not to make a copy of an organism, but rather to grow healthy replacement cells and tissues for those cells and tissues that are diseased in organisms, including humans

3. "What are stem cells?"

Stem cells are cells from which all other cells grow. They are present in a developing embryo as well as a grown individual.

4. "What are embryonic stem cells?"

Embryonic stem cells are cells extracted from a 4-day old fertilized egg called a blastocyst.

5. Inform students about the activity or both activities that they will do following the lesson so they know what is expected of them. For example, the sources of information they will need to prepare for Activity 2 will be the video and the class discussion so they will need to take notes about the two different kinds of cloning. You may need to re-play portions of the video if students need to review.

During Viewing

START the video.

PAUSE the video (4.35 minutes into the video) after the computer and the narrator explain reproductive cloning and therapeutic cloning.

Review the steps involved in both reproductive cloning and therapeutic cloning. Write these steps on the board or on an overhead.

Reproductive Cloning

- Remove the nucleus from an organism's cell, such as a skin cell that contains all the genetic makeup of that organism.
- Extract embryonic stem cells from a 4-day old blastocyst (which destroys the embryo).
- Extract the nucleus from one of these embryonic stem cells.
- Implant the nucleus of organism's skin cell into the embryonic stem cell.
- Allow embryonic stem cell with the identical genetic makeup as the original individual organism to grow into a duplicate organism or "clone".

Note: Stress that the cloned organism will not be the same age as the original. The clone will still have to develop as an embryo, fetus, and then as a baby organism.

Therapeutic Cloning

- Extract embryonic stem cells from a 4 day old blastocyst (which destroys the embryo).
- Allow these cells to differentiate into the cells or tissue needed to replace diseased cells or tissue in a patient, such as may be possible with Parkinson's disease.

Note: Replacement cells and tissues grown from stem cells from a donor embryo sometimes result in rejection by the patient's body because the DNA in the replacement tissue is different from the patients' genetic makeup. Researchers are now experimenting with removing the nucleus from the embryonic stem cells (as is done in reproductive cloning) and replacing it with the nucleus of a cell from the patient so that the healthy replacement cells or tissues will exactly match the patient's genetic code.

RESUME the video and play to the end.

After Viewing

Ask students the following questions:

1. In the video President Bush raised two major concerns if all forms of cloning were legal. "What were those concerns?"
 - i). *Babies could be engineered to custom specifications*
 - ii) *Cloned individuals could be grown for spare body parts*
2. "Was President Bush referring to 'reproductive cloning' or 'therapeutic cloning' when he raised these concerns? He was likely referring to reproductive cloning because therapeutic cloning is about cloning replacement cells and tissues, not entire organisms.
3. Review statements made by President Bush and Reverend Abernathy in the video.

In the early part of the video, President Bush states that "no human life should be exploited or extinguished for the benefit of another" and therefore he has ruled against allowing new stem cell lines to be developed because they would result from the destruction of 4-day old embryos (blastocysts). Later in the video, Reverend Abernathy, a patient with Parkinson's disease, said, "Sign me up", when the possibility of receiving stem-cell therapy was proposed. Rev. Abernathy talked about using fertilized eggs from fertility clinics as a source of embryonic stem cells. He felt that this was not an ethical problem because surplus fertilized eggs from fertility clinics are typically discarded and destroyed.

Ask: "What are the pros and cons of using embryonic stem cells in disease research?"

Some responses could include the following:

- *Potential humans are destroyed.*
 - *Diseases could be cured from this research.*
4. Ask: "Do you think having a disease or having a loved one with a disease such as Parkinson's influences how a person feels about using embryonic stem cells in disease research?"

Note: Because more than 1 million Americans are afflicted with Parkinson's disease, you may wish to pursue this topic further with your students. Consider a discussion based on the following:

- a. "What are the symptoms of Parkinson's?"

Symptoms include tremors, stiffness, slowness of movement, and trouble walking.
- b. "What might be the cause of Parkinson's?"

The cause is not known, but may include inherited genes, environmental toxins, or physical damage to the brain.

- c. Have students use library resources or a search engine on the Internet to learn more about this disease.

People in all walks of life suffer from this disease: government - Janet Reno, religion - Pope John Paul II, sports - Muhamed Ali, and entertainment - Michael J. Fox.

Teacher Notes for the Student Activity:

Activity 1: The Slippery Slope - Bioethics and Cloning

Activity 2: Cloning – what does it mean?

Choose one or both of the two activities

Note: The choice depends upon class time and whether you have already conducted Activity 1 as part of the *Secrets of the Sequence* video and lesson on "Bioethics- Drawing the Line".

Activity 1: The Slippery Slope - Bioethics and Cloning

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

Procedure:

- Have students read the student handout.
- Discuss how the roles can be selected and how the debate will be conducted in class.
- Alternately, instead of role playing, you may wish to ask students to choose two positions and write short essays describing both points of view.
- 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 must 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:

- A. Event X has occurred (or will or might occur).
- B. 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.nizcor.com

Teacher Notes Continued:

Activity 2: Cloning - What does it mean?

In this activity, students will work in pairs to create a poster explaining and differentiating between therapeutic cloning and reproductive cloning.

Materials Needed

Poster size sheets of paper
Markers
Pens

Procedure

1. Divide the class into pairs.
2. Remind students that the only scientific information needed for their poster was provided in the video and during class discussion. Their task is to present it as clearly and as attractively as possible.
3. Replay the video from 2 minutes to 4.35 minutes to review the types of cloning if needed.
4. Inform students that their posters will be put on display and, if you wish, you can select a panel of judges who will decide which poster provides the best explanation of the two types of cloning.
5. Tell students that because the issues involved are highly controversial, they should show you the graphics they plan to use on their poster before actually doing so.
6. Distribute the poster sheets, pens, and markers to each pair.

Student Handout: Activity 1

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 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. You will present the case of the role you have assumed to the 6 members of an 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 or specific 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. Remember that values are principles, standards, or qualities considered worthwhile or desirable.
 4. A concise statement of the viable or possible options and your rationalization or explanation 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 that of the role 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? What is the slippery slope of this dilemma?

Student Handout: Activity 2

Cloning - What does it mean?

In this activity you will work in pairs to create a poster explaining the difference between therapeutic cloning and reproductive cloning. When planning your poster, take note of the following points:

1. The only scientific information needed for your poster was provided in the video and during the class discussion; your task is to present the information as clearly and as attractively as possible.
2. Assume that these posters will be used to teach middle school students about cloning and therefore must be tasteful, easy to understand, and interesting.
3. Your posters will be put on display and your teacher may select a panel of judges to decide which poster best explains the two types of cloning.
4. Remember that the issues involved are highly controversial; choose your graphics with care and concern for how others may view them.
5. After you have chosen the graphics you plan to use, show them to your teacher *before* putting them on your poster.

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