

Name: _____ Class: _____

Scientists Clone Human Embryos To Make Stem Cells

By Rob Stein and Michaela Doucleff
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Scientists have long been interested in harnessing the power of stem cells, which are undifferentiated, self-replicating cells that are capable of becoming differentiated cells within an organism. Pluripotent stem cells, which include embryonic stem cells, are capable of giving rise to any cell in an organism. Scientists believe that learning more about stem cells will allow them to develop treatments and potential cures for a variety of diseases. However, many object to the use of embryos for scientific purposes. In 2001, U.S. President George W. Bush signed an executive order restricting federal funding for research on stem cells obtained from human embryos; in 2009, U.S. President Barack Obama overturned the ban. As you read, take notes on the different viewpoints expressed on the subject of stem cell research.

- [1] Scientists say they have, for the first time, cloned¹ human embryos capable of producing embryonic stem cells. ;

The accomplishment is a long-sought step toward harnessing² the potential power of embryonic stem cells to treat many human diseases.³ But the work also raises a host of ethical⁴ concerns.

"This is a huge scientific advance," said Dr. George Daley, a Harvard stem cell scientist who wasn't involved in the work. "But it's going to, I think, raise the specter⁵ of controversy again."

The controversy arises from several factors. The experiments involve creating and then destroying human embryos for research purposes, which some find morally repugnant.⁶ The scientists also used cloning techniques, which raise concerns that the research could lead to the cloning of people.

- [5] Ever since human embryonic stem cells were discovered, scientists have had high hopes for them because the cells can morph into any kind of cell in the body. That ability means, in theory, that they could be used eventually to treat all sorts of illnesses, including diabetes, Alzheimer's, Parkinson's and spinal cord injuries.



"Stem Cell Research" by The U.S. Food and Drug Administration is in the public domain.

1. Cloning is the process of asexually producing a genetically identical copy of an organism or cell from a single ancestor.
2. **Harness (verb):** to gain control for a particular use

So for years, scientists have been trying to use cloning techniques to make embryonic stem cells that are essentially a genetic match for patients. The idea is that such a close match would prevent their bodies from rejecting the cells.

"It's been a holy grail⁷ that we've been after for years," says Dr. John Gearhart, a stem cell pioneer at the University of Pennsylvania.

But every previous attempt ended in failure or fraud, leading many scientists to wonder if the goal might be impossible to reach.

However, Shoukhrat Mitalipov of the Oregon Health & Science University and his colleagues never gave up. They succeeded in mice and monkeys. And in this week's issue of the journal *Cell*, Mitalipov's team reports they finally did it in humans.

[10] "I'm very excited," Mitalipov says. "It's a very significant advance."

The researchers first recruited women who were willing to provide eggs for the research. Next, they removed most of the DNA⁸ from each egg and replaced the genetic material with DNA from other peoples' skin cells.

Then, after a long search, they finally found the best way to stimulate⁹ each egg so that it would develop into an embryo without the need to be fertilized with sperm. The key turned out to be a combination of chemicals and an electric pulse.

"We had to find the perfect combination," Mitalipov says. As it turned out, that perfect combination included something surprising: caffeine.

"The Starbucks experiment, I guess," quipped¹⁰ Daley. "This little change in the cocktail was what really allowed the experiment to really ultimately succeed."

[15] That ingredient, plus other tweaks in the process, including using fresh eggs and determining the optimal¹¹ stage of each egg's development, Mitalipov says.

The researchers showed that the resulting embryos could develop to a stage where they could produce healthy stem cells containing the genes from the skin cells. They even showed that the stem cells could be turned into other types of cells, including heart cells that in a laboratory dish could pulse like a beating heart.

The work drew immediate criticism because of ethical concerns.

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3. Stem cells are extensively studied for their regenerative potential, which many scientists believe holds the key to personalized medicine.
 4. **Ethical (adjective):** pertaining to right and wrong in conduct
 5. **Specter (noun):** something widely feared as a possible unpleasant or dangerous occurrence
 6. **Repugnant (adjective):** extremely distasteful; unacceptable
 7. A Holy Grail is a thing that is earnestly and intensely pursued or sought after.
 8. DNA is a self-replicating material present in nearly all living organisms as genetic information and instructions.
 9. **Stimulate (verb):** to initiate action
 10. **Quip (verb):** to make a witty or clever statement
 11. **Optimal (adjective):** best or most favorite

First of all, the Oregon researchers compensated¹² women financially to donate eggs for the experiments — something many in the field have considered ethically questionable.

But beyond that, the creation and destruction of a human embryo is morally repugnant to people who believe an embryo has the same moral standing as a human being.

- [20] “This is a case in which one is deliberately setting out to create a human being for the sole purpose of destroying that human being,” says Dr. Daniel Sulmasy, a professor of medicine and a bioethicist at the University of Chicago. “I’m of the school that thinks that that’s morally wrong no matter how much good could come of it.”

Moreover, Mitalipov used the same method that researchers used previously to clone Dolly the sheep.¹³ That approach raises the possibility that scientists could try to clone a human being.

“This raises serious problems because it is the first actual human cloning,” Sulmasy says. “We already know there are people out there who are itching to be able to be the first to bring a cloned human being to birth. And I think it’s going to happen.”

But Mitalipov dismisses those concerns. He says the embryos he created aren’t the equivalent¹⁴ of a human being because they weren’t fertilized naturally. And his experiments with monkeys indicate that it’s unlikely that they could ever develop into a healthy baby.

“The procedures we developed actually are very efficient to make stem cells, but it’s unlikely that this will be very useful for kind[s] of reproductive cloning,” Mitalipov says.

- [25] Other researchers agree with him and argue that the possible benefits of the research outweigh the concerns. “Where you can improve [a patient’s] quality of life tremendously through this kind of technology, I personally believe that it is ethical to use material like this,” Gearhart says.

The scientists acknowledge that it will be years before anyone knows whether this step will actually result in treatments that might help patients. In the meantime, it’s clear that the intense debate over embryonic stem cells is far from over.

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12. **Compensate (verb):** to pay (someone) for a good or service, especially as payment for something lost or damaged
13. Dolly (1996-2003) was a female sheep and the first mammal ever created through cloning of an adult somatic (non-embryonic or stem) cell. She was created via cloning in 1996 in Scotland.
14. **Equivalent (adjective):** having the same value, use, or meaning

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: Which of the following best summarizes this article? [RI.2]
 - A. A group of scientists recently generated embryonic stem cells through cloning, which may help cure many diseases, though the process raises serious ethical concerns.
 - B. Stem cell research has long been hindered by controversy and repeated attempts to publish falsified data and experiments.
 - C. The most powerful criticism of stem cell research revolves around the fact that it necessarily and universally involves destroying human embryos.
 - D. Several scientists have already begun attempting to generate living human clones, and the generation of embryonic stem cells provides a vital stepping-stone to their efforts.

2. PART B: Which TWO phrases from the text best support the answer to Part A? [RI.1]
 - A. "But every previous attempt ended in failure or fraud, leading many scientists to wonder if the goal might be impossible to reach." (Paragraph 8)
 - B. "The researchers showed that the resulting embryos could develop to a stage where they could produce healthy stem cells containing the genes from the skin cells" (Paragraph 16)
 - C. "The work drew immediate criticism because of ethical concerns." (Paragraph 17)
 - D. "But beyond that, the creation and destruction of a human embryo is morally repugnant to people who believe an embryo has the same moral standing as a human being." (Paragraph 19)
 - E. "'This raises serious problems because it is the first actual human cloning,' Sulmasy says." (Paragraph 22)
 - F. "We already know there are people out there who are itching to be able to be the first to bring a cloned human being to birth. And I think it's going to happen." (Paragraph 22)

3. How does Paragraph 25 contribute to the development of the ideas presented in the article? [RI.5]
 - A. It demonstrates that the use of human embryos represents a very small sub-section of stem cell research.
 - B. It proves that stem cell therapies are not worth objecting to since we are still so far from being able to use them in human patients.
 - C. It shows that many researchers are unfairly dismissive of legitimate ethical concerns.
 - D. It advances the idea that the potential pros of stem cell research outweigh the cons.

4. Which statement from the text best illustrates the relationship between scientific advancement and corresponding public controversies? [RI.3]
- A. “The accomplishment is a long-sought step toward harnessing the potential power of embryonic stem cells” (Paragraph 2)
 - B. “This is a huge scientific advance,” said Dr. George Daley, a Harvard stem cell scientist who wasn’t involved in the work. “But it’s going to, I think, raise the specter of controversy again.” (Paragraph 3)
 - C. “But every previous attempt ended in failure or fraud, leading many scientists to wonder if the goal might be impossible to reach.” (Paragraph 8)
 - D. “First of all, the Oregon researchers compensated women financially to donate eggs for the experiments — something many in the field have considered ethically questionable.” (Paragraph 18)
5. What is the author’s main purpose in writing this article? Cite evidence from the text in your response. [RI.6]

Discussion Questions

Directions: Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.

1. Does the idea of human beings genetically modifying other organisms concern you? What might be some pros and cons of developing cloning technology?
2. The article depicts a struggle between physicians and scientists hoping to cure ailing patients whose bodies naturally reject foreign infusions and transplants. In the context of this article, who is in control: man or nature? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.
3. While scientific progress excites many, plenty of people are fearful about possible negative effects of such advancements. In the context of this article, what should the future look like? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.