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Stem-cell debate splits in two

The adult vs. embryonic controversy rages on

By Dan Vergano
USA TODAY

Within two weeks, stem cells will speed into Kathy Duffey's bloodstream and begin to rebuild her defective immune system.

Duffey, 38, from Prescott Valley, Ariz., knows exactly what she wants from this experimental treatment at medicine's frontier.

"In the best case, there will be no symptoms at all," she says. "To me, that's a cure."

For 20 years an inflammatory bowel syndrome, Crohn's disease, has afflicted her. At times her weight dropped to a life-threatening 75 pounds. Nothing has helped her case of the disease, a syndrome that affects more than 700,000 people nationwide. "It's hard to remember a time when I could stand up straight without pain," she says.

For Duffey's treatment, doctors at Chicago's Northwestern Memorial Hospital will destroy her defective immune system, which has turned on her intestines, and then build a new one with the help of her own stem cells. Duffey consented to the procedure only when she learned doctors would use her own adult stem cells, not those from a human embryo. "To me, that (human embryo) is another life," she says.

Her conflict mirrors the national one, which grabs center stage next week when the U.S. Senate is expected to take up competing bills on cloning. All outlaw cloning babies. One goes further and forbids cloning human embryos for stem-cell research, so-called therapeutic cloning.

The focus of the debate is stem cells, the raw materials out of which more specialized tissues develop in the body. The stem cells in embryos are capable of evolving into any type of tissue — heart, skin, blood and so on. In adults, stem cells are already specialized. They hide within organs, ready to replace worn-out tissues.

Researchers hope to devise ways of using stem-cell transplants to cure diseases such as diabetes, Parkinson's and Alzheimer's. Many argue the more flexible stem cells from embryos hold the most promise for making rejection-free transplantable organs. But in extracting the cells, the embryo is destroyed. Critics say therapeutic cloning of human embryos to generate stem cells is unethical, likening it to abortion. The critics have no problem with using adult cells, however, because that doesn't involve destroying an embryo.

The politics of stem cells reached national prominence with President Bush's August decision to allow federal money to be spent on research on a limited number of already existing embryonic-stem-cell colonies. About 70 such collections of a single type of stem cell now have approval. Bush opposes the development of new colonies but privately funded researchers remain free to create human embryonic stem cells made the old-fashioned way, from sperm and an egg. Most are now donated by couples who have undergone in vitro fertilization.

Politicizing the research

In the cloning debate, both sides are using research on adult and embryonic stem cells as weapons.

In January, for example, an article in *New Scientist* magazine touted University of Minnesota research that suggested adult stem cells may be capable of turning into many kinds of new tissue. The "Do No Harm" coalition, which opposes obtaining stem cells from human embryos, sent out a news release saying the article discredited a National Academy of Sciences report that called for research into therapeutic cloning.

And last month, two papers in the journal *Cell* suggested that embryonic stem cells had partially repaired a defective immune system in mice. A study author openly acknowledged that the paper's release was meant to influence the debate. In response, the Americans to Ban Cloning (ABC) coalition sent out a news release titled "Why the 'Successful' Mouse Therapeutic Cloning Really Didn't Work."

"I don't think I've ever seen a biomedical issue so politically loaded and agenda-filled," says science writer John Tra-

vis of *Science News* magazine, who has written extensively about stem cells.

Emotions run high because the debate touches on a potential treatment that involves where life begins and where it ends. To make a cloned embryo, researchers would hollow out a donor egg, insert a patient's cells, then zap the egg with chemicals to shock it into dividing. After cells divided for about five days, the researchers would harvest the stem cells, destroying the embryo in the process. In theory, the cells would be coaxed into becoming replacement tissues, and because they would carry the patient's genes, researchers expect they would not be rejected by the body's immune system.

"There is no question that embryonic stem cells can readily turn into new tissues of every kind," unlike adult stem cells, says Robert Lanza, medical director of Advanced Cell Technology (ACT) in Worcester, Mass. "You only have to compare them under a microscope to see the vitality of one type compared to the other."

Lanza confirmed reports, still unpublished, that he and colleagues have used therapeutic cloning to create kidneys that were transplanted into a cow. Nationwide, about 50,000 people are on waiting lists for a kidney transplant.

Asked whether the political debate has pushed the pace of study publications, Lanza says, "Well, yes. As a matter of fact, we have been sitting on a pile of data that proves therapeutic cloning works. We probably should have published it a year ago."

On the adult-stem-cell side, tantalizing data suggest adult stem cells can change their nature and bulwark many tissues, says stem-cell transplant expert Richard Burt of Northwestern Memorial Hospital, who is Duffey's doctor.

"That's kind of where the excitement is," he says.

Burt and others point to research such as the University of Minnesota report and another in *The New England Journal of Medicine* that suggest bone-marrow-based adult stem cells can develop into heart and brain cells.

However, like Catherine Verfaillie, a well-known Minnesota researcher, Burt supports allowing embryonic-stem-cell research to proceed. In Senate testimony on her research, which remains partly unpublished, Verfaillie complained her work "was being misinterpreted to suit legislative agendas."

While politicization of the research has made weighing stem cells' usefulness problematic, Travis says, "I haven't heard serious adult-stem-cell researchers saying their work eliminates the need for embryonic stem cells."

One researcher who does oppose therapeutic cloning, Micheline Mathews-Roth of Harvard Medical School, partly bases her stance on the belief that adult stem cells will turn out to be as flexible as embryonic ones and partly on her opposition to abortion.

"The fact is that any research that involves early stages of human life has to be treated with respect and understood in moral and ethical terms," says researcher Sally Temple of the Albany (N.Y.) Medical College. "Personally, I feel such research is entirely justified," she says, given the hundreds of embryos made daily in fertility clinics, then frozen away forever amid the urgent need for cures to devastating illnesses.

In the past, proving the usefulness of a medical technology as new as stem-cell therapy has taken decades. While a stampede of various results may appear in the coming weeks of political debate, "I'd beware of any big claims at this point," Travis says.



By Anne Ryan, USA TODAY

In Chicago: Physician Richard Burt holds the hand of Kathy Duffey as she undergoes the preliminary stages of treatment for Crohn's disease, using her stem cells.

How to transplant a patient's stem cells

Medical researchers foresee numerous ways to replace failing or damaged organs with stem cells. Two ways start with a patient's own stem cells to avoid tissue rejection.

Embryonic stem cells: During fetal development, these cells give rise to virtually every type of tissue in the human body.

Adult stem cells: In life, the body uses these more specialized cells to rebuild lost tissues.

1 Cloning a patient's cells may create an embryo. The United States is considering banning cloning.

2 A human embryo at five days of development after fertilization is called a blastocyst. It is a ball of cells the size of a pinhead.

3 At Day 6, the inner stem cell mass begins to form. These embryonic stem cells give rise to virtually all cells of the human body. If implanted in a woman, the embryo could potentially transform into a fetus.

4 Stem cells are extracted from the blastocyst and put into cultures. The process destroys the embryo, raising ethical concerns.

1 Drugs trigger the release of adult stem cells from bone marrow into the bloodstream.

2 Doctors "harvest" the stem cells from the bloodstream.

3 Stem cells are put into culture.

4 To treat diseases of complex organs, such as diabetes or Alzheimer's, stem cell biologists may have to first "reprogram" the cells into becoming, essentially, embryonic stem cells.

5 Scientists say they can trigger stem cells to grow into many different types of tissues, including heart cells that beat in a petri dish.

6 The goal of stem cell research is to one day use them as sources of replacement cells to treat diseases such as heart failure, Alzheimer's, Parkinson's, diabetes, spinal injuries and cancer.

5 For other diseases, such as multiple sclerosis and some cancers, experimental re-infusions of adult stem cells right now can replace diseased immune or blood cells wiped out during treatment. Some researchers think adult stem cells are flexible enough to turn into even more tissues without first "reprogramming" them, perhaps removing the need for embryonic stem cells.

Source: Research by The Howard and Dana Virginia, USA TODAY

By Julie Totter, USA TODAY