

SENATE PUBLIC HEALTH, WELFARE & SAFETY

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Research at the University of Wisconsin-Madison

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What are embryonic stem cells?

Embryonic stem cells are undifferentiated cells that are unlike any specific adult cell. However, they have the ability to form any adult cell. Because undifferentiated embryonic stem cells can proliferate indefinitely in culture, they could potentially provide an unlimited source of specific, clinically important adult cells such as bone, muscle, liver or blood cells.

Where do embryonic stem cells come from?

Human embryonic stem cells are derived from fertilized embryos less than a week old. Using 14 blastocysts obtained from donated, surplus embryos produced by in vitro fertilization, a group of UW-Madison developmental biologists led by James Thomson established five independent stem cell lines in November 1998. This was the first time human embryonic stem cells had been successfully isolated and cultured.

The cell lines were capable of prolonged, undifferentiated proliferation in culture and yet maintained the ability to develop into a variety of specific cell types, including neural, gut, muscle, bone and cartilage cells.

The embryos used in the work at UW-Madison were originally produced to treat infertility and were donated specially for this project with the informed consent of donor couples who no longer wanted the embryos for implantation.

In virtually every in vitro fertilization clinic in the world, surplus embryos are discarded if they are not donated to help other infertile couples or for research. The research protocols were reviewed and approved by a UW-Madison Institutional Review Board, a panel of scientists and medical ethicists who oversee such work.

Why are embryonic stem cells important?

Embryonic stem cells are of great interest to medicine and science because of their ability to develop into virtually any other cell made by the human body. In theory, if stem cells can be grown and their development directed in culture, it would be possible to grow cells of medical importance such as bone marrow, neural tissue or muscle.

The first potential applications of human embryonic stem cell technology may be in the area of drug discovery. The ability to grow pure populations of specific cell types offers a proving ground for chemical compounds that may have medical importance. Treating specific cell types with chemicals and measuring their response offers a short-cut to sort out chemicals that can be used to treat the diseases that involve those specific cell types. Stem cell technology, therefore, would permit the rapid screening of hundreds of thousands of chemicals that must now be tested through much more time-consuming processes.

The study of human development also benefits from embryonic stem cell research. The

earliest stages of human development have been difficult or impossible to study. Human embryonic stem cells offer insights into developmental events that cannot be studied directly in humans in utero or fully understood through the use of animal models. Understanding the events that occur at the first stages of development has potential clinical significance for preventing or treating birth defects, infertility and pregnancy loss. A thorough knowledge of normal development could ultimately allow the prevention or treatment of abnormal human development. For instance, screening drugs by testing them on cultured human embryonic stem cells could help reduce the risk of drug-related birth defects.

How might embryonic stem cells be used to treat disease?

The ability to grow human tissue of all kinds opens the door to treating a range of cell-based diseases and to growing medically important tissues that can be used for transplantation purposes. For example, diseases like juvenile onset diabetes mellitus and Parkinson's disease occur because of defects in one of just a few cell types. Replacing faulty cells with healthy ones offers hope of lifelong treatment. Similarly, failing hearts and other organs, in theory, could be shored up by injecting healthy cells to replace damaged or diseased cells.

Why not derive stem cells from adults?

There are several approaches now in human clinical trials that utilize mature stem cells (such as blood-forming cells, neuron-forming cells and cartilage-forming cells). However, because adult cells are already specialized, their potential to regenerate damaged tissue is very limited: skin cells will only become skin and cartilage cells will only become cartilage. Adults do not have stem cells in many vital organs, so when those tissues are damaged, scar tissue develops. Only embryonic stem cells, which have the capacity to become any kind of human tissue, have the potential to repair vital organs.

Another limitation of adult stem cells is their inability to proliferate in culture. Unlike embryonic stem cells, which have a capacity to reproduce indefinitely in the laboratory, adult stem cells are difficult to grow in the lab and their potential to reproduce diminishes with age. Therefore, obtaining clinically significant amounts of adult stem cells may prove to be difficult.

Studies of adult stem cells are important and will provide valuable insights into the use of stem cell in transplantation procedures. However, only through exploration of all types of stem cell research will scientists find the most efficient and effective ways to treat diseases.

What are the benefits of studying embryonic stem cells?

Pluripotent stem cells represent hope for millions of Americans. They have the potential to treat or cure a myriad of diseases, including Parkinson's, Alzheimer's, diabetes, heart disease, stroke, spinal cord injuries and burns.

This extraordinary research is still in its infancy and practical application will only be possible with additional study. Scientists need to understand what leads cells to specialization in order to direct cells to become particular types of tissue. For example, islet cells control insulin production in the pancreas, which is disrupted in people with diabetes. If an individual with diabetes is to be cured, the stem cells used for treatment must develop into new insulin-producing islet cells, not heart tissue or other cells. Research is required to determine how to control the differentiation of stem cells so

they will be therapeutically effective. Research is also necessary to study the potential of immune rejection of the cells, and how to overcome that problem.

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By Maggie Fox, Health and Science Correspondent

 WASHINGTON (Reuters) - Batches of human embryonic stem cells available under the strict policies of the U.S. government are contaminated with an animal molecule and are probably no good for using to treat people, scientists reported on Sunday.

Their finding, published in the journal Nature Medicine, supports arguments that federal government policy is holding back research in the promising but controversial field of stem cell research.

 The only way around the problem is to start again with new batches of stem cells -- something that cannot be done using federal funds, said the team at the University of California San Diego.

Human embryonic stem cells are taken from embryos at fertility clinics. Many researchers say they can form any cell or tissue if grown correctly, and offer the promise of treating diseases like Parkinson's, Alzheimer's and juvenile diabetes.

 Opponents, who include President Bush, say destroying a human embryo for any purpose is immoral and unethical. Bush issued an executive order in 2001 restricting federal funding for stem cell research to only those batches of the cells, called cell lines, that existed at the time.

The idea was to prevent the destruction of any more embryos while allowing the research to continue.

Many scientists argued this was too restrictive and later said it was likely the existing cells would be contaminated by the animal products the cells were grown with.

Dr. Ajit Varki of UCSD, Dr. Fred Gage of the Salk Institute and colleagues said they had confirmed this.

By Jon Hurdle

 PHILADELPHIA (Reuters) - New Jersey's Acting Governor Richard Codey on Tuesday urged President Bush to lift restrictions on federal funding for stem-cell research given a recent report that says that available human embryonic stem cells are contaminated.

Codey, in a letter to the president, challenged Bush's executive order restricting federal funding for stem cell research to only those lines -- or batches of cells -- that existed when the order was signed in 2001. Researchers hope the cells could lead to cures for Alzheimer's, Parkinson's and spinal cord injuries.

Citing research released on Sunday, Codey said the available stem cells were contaminated with an animal molecule and may not be suitable to treat people.

The research by the University of California at San Diego and Salk Institute for Biological Studies at La Jolla, said the stem cells were contaminated with a foreign molecule from mice.

"Why should our national policy force our best scientists to spend years researching a way to clean up contaminated stem cells when other stem cells exist that can advance scientific knowledge today?" wrote Codey, a Democrat. Codey took over last November when former Gov. James McGreevey stepped down after confessing to a homosexual affair with a former aide.

Codey said two weeks ago that New Jersey, home to major pharmaceutical firms, will spend \$380 million to build a stem-cell research institute, making it America's second-biggest public backer of the research after California.

Bush, whose re-election was aided by anti-abortion Christians, opposes the use of stem cells from human embryos.

White House spokesman Jim Morrell said federal government scientists have always known that the authorized stem cells contained "animal traits" and are convinced the 60 available stem cell lines hold the possibility of scientific advances.

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LOS ANGELES (Reuters) - Ron Reagan, son of the late president and conservative hero Ronald Reagan, will co-host a new political talk show on MSNBC, the network said on Wednesday.

Reagan will host "Connected: Coast to Coast" from MSNBC.com headquarters in Redmond, Washington, MSNBC said in a statement.

The show, which will air twice daily, will base its other host -- Monica Crowley, a former Richard Nixon aide and Fox News analyst -- at MSNBC headquarters in New Jersey.

X | Reagan drew attention last year when he gave a spirited eulogy at his father's funeral condemning politicians for using their religion for political gain and for a speech on stem-cell research at the Democratic National Convention.

The show will premiere on Tuesday. The early broadcast will present developing news, while the later show will focus more on analysis and debate.

President Reagan, who served from 1981 to 1989, fought with Democrats on Capitol Hill over tax cuts and battled communism as well as a recession. His death touched off a national mourning not seen in decades.

X | WASHINGTON (Reuters) - President Bush plans to press for even stricter limits on human embryo research and has no intention of softening restrictions on stem cell research, a senior administration official said on Thursday.

The official doused speculation from activists and members of Congress who hoped a brief mention of medical research in Bush's State of the Union address on Wednesday night might mean he was being swayed by pressure from them.

"I will work with Congress to ensure that human embryos are not created for experimentation or grown for body parts and that human life is never bought or sold as a commodity," Bush said on Wednesday night.

Supporters of embryonic stem cell research studied the brief comment for some signal of change in the policy, which limits the use of federal funds for embryo research to a few batches that existed as of August 2001.

But there was none, the official said, adding that the White House would pursue limits on other research conducted by what she called "rogue scientists."

She referred to a 2003 experiment by Dr. Norbert Gleicher of the Foundation for Reproductive Medicine in Chicago, whose team injected male cells into female embryos.

"This would prohibit that type of experimentation as well," the official said, adding Bush plans to lay out a detailed, broader bioethics agenda in the near future.

Colorado Democratic Rep. Diana DeGette said if Bush wants ethical medical research, he should free up federal funding, not restrict it.

"Only with the full force of the federal government, through the National Institutes of Health, can we ensure that scientific research is conducted ethically, with full respect for human life and human dignity," DeGette, a leading proponent of embryonic stem cell research said.

Supporters of stem cell research in both the House and the Senate have said they have majorities to move ahead with legislation that would specifically authorize federal funding of the research, which doctors say has the potential to transform medicine.

Specifically, supporters say they see nothing wrong with using embryos from fertility clinics, created in the process of making "test-tube" or IVF babies, that would otherwise be discarded.

Stem cells are the body's master cells, giving rise to tissue and organs. Stem cells from days-old embryos have the ability to form any kind of tissue and scientists are working to learn how to manipulate them to create transplants to treat diseases ranging from diabetes to Alzheimer's to cancer.

Table E. Deaths and percentage of total deaths for the 10 leading causes of death, by race: United States, 2001

[Data for races other than white and black should be interpreted with caution because of misreporting of race on death certificates; see "Technical Notes." For explanation of asterisks preceding cause-of-death categories, see "Classification of terrorism-related deaths" in this report.]

Cause of death (Based on the International Classification of Diseases, Tenth Revision, 1982)	White		Black		American Indian		Asian or Pacific Islander	
	Rank ¹	Deaths	Rank ¹	Deaths	Rank ¹	Deaths	Rank ¹	Deaths
All causes	1	2,079,691	1	287,709	1	11,977	2	37,048
Diseases of heart (I00-I09, I11, I13, I20-I51)	1	810,638	1	77,674	1	2,402	2	9,428
Malignant neoplasms (C00-C97)	2	479,651	2	62,170	2	2,155	1	9,792
Cerebrovascular diseases (I60-I69)	3	140,485	3	19,002	5	574	3	3,497
Chronic lower respiratory diseases (J40-J47)	4	113,819	8	7,589	7	427	6	1,178
Accidents (unintentional injuries) (V01-X59, Y85-Y86)	5	85,964	4	12,462	3	1,361	4	1,750
Diabetes mellitus (E10-E14)	6	57,160	5	12,305	4	644	5	1,243
Influenza and pneumonia (U10-U19)	7	54,774	11	5,771	9	318	7	1,171
Alzheimer's disease (G30)	8	50,348	14	3,114	15	93	15	297
Nephritis, nephrotic syndrome and nephrosis (N00-N07, N17-N19, N25-N27)	9	31,345	9	7,274	10	286	9	625
Intentional self-harm (suicide) (U03, X80-X84, Y87.0)	10	27,710	16	1,957	8	321	8	634
Septicemia (A40-A41)	11	25,806	10	5,880	12	155	11	397
Chronic liver disease and cirrhosis (K70, K73-K74)	12	23,408	15	2,775	6	533	14	319
Assault (homicide) (U01-U02, X85-Y09, Y87.1)	19	11,328	6	8,226	11	211	10	543
Human immunodeficiency virus (HIV) disease (B20-B24)	22	6,171	7	7,844	16	74	24	86
		100.0		100.0		100.0		100.0
		29.4		27.0		20.1		25.4
		23.1		21.6		18.0		26.4
		6.8		6.6		4.8		9.4
		5.5		2.6		3.6		3.2
		4.1		4.3		11.4		4.7
		2.7		4.3		5.4		3.4
		2.6		2.0		2.7		3.2
		2.4		1.1		0.8		0.8
		1.5		2.5		2.0		1.7
		1.3		0.7		2.7		1.7
		1.2		2.0		1.3		1.1
		1.1		1.0		4.5		0.9
		0.5		2.9		1.8		1.5
		0.3		2.7		0.6		0.2

... Category not applicable.
¹Rank based on number of deaths.