

**Address by Senator James M. Talent on Stem Cell Research
February 10, 2005**

Mr. President, nine years ago, scientific advances in the technology of nuclear transfer permitted the cloning of a sheep named Dolly. The immediate reaction of most Americans, and most members of Congress, was to try to make certain that this process was never used to create a human being, never allowing a human Dolly to be cloned. I remember thinking at the time that I personally did not want to live in a world where I was walking down the street and saw myself coming in the opposite direction.

Why this reaction? After all, cloning is an acceptable thing in the agricultural world. The difference, of course, is that human beings have a unique dignity. When parents decide to have a child, they do it for the benefit of the baby, to nurture that new life to live up to the potential and live out the plan which God created for him or her. Mr. President, all of us agree that people should not be cloned because the only reason you clone something is to use it, and human beings should and do exist for reasons of greater dignity than simply to be used by others. I think we all understand that if we were ever to allow a race of clones to be created as workers or body parts warehouses for society, we would cheapen the dignity of humanity to the point where none of the rest of us would be safe in our lives or freedoms.

Yet, despite this shared impulse against cloning, it has been nine years since Dolly was created, and no safeguards against cloning have passed the Congress. Nor are there prospects of any such bill passing in the near future. The reason is that there is an area of overlap between the issues of cloning and stem cells. Many scientists believe that stem cells from a cloned human embryo may have unique advantages for medical research. This part of the scientific community has resisted the total ban on cloning which has been introduced each of the last six years in the belief that such a ban would inhibit one important aspect of stem cell research. Both sides have settled into what has now become a rigid stalemate, like the Western Front in WWI. Even though the idea of cloning human beings is morally repugnant to most of us, there is currently no federal prohibition or even regulation of any aspect of human cloning, or for that matter of warehousing body parts and creating "fetus farms," and no prospect of getting such prohibitions.

Mr. President, I've spent the better part of a year researching this issue, meeting with people on all sides: groups who oppose cloning embryos to get stem cells, scientists who support it, parents who don't know who or what to believe but who are desperate for a cure for their children. Many to whom I've spoken have strong opinions about the underlying moral issues. In every case, I respected the sincerity and passion of those whom I spoke with. I have strong opinions of my own.

I believe human beings are precious. I am concerned about the tendency of our society to devalue people because they are too old, too young, or too inconvenient to have around. At the same time, I understand the desperation of parents whose children are

sick or dying and who are desperate for treatments that will make them well. I often tour neonatal units. It breaks my heart to see children there fighting for life. I also meet with kids who are struggling heroically with chronic disease. I want to find cures for these children—but I also want them to grow up in a society that values them for their inherent dignity, for who they are, regardless of their age, infirmity, or level of achievement in the world's eyes.

Just because we are deadlocked about what to do in the present is no reason we cannot agree on what we want the future to be. We find ourselves at the beginning of a great new era of biology. I believe we can and should determine what our children's future will look like, and what objectives we want for our nation. And, clearly, for all of us this would include progress in biomedicine built upon a solid foundation of moral principles in defense of human dignity.

I have come to the floor of the Senate today because there are just such hopeful prospects for the future. As is so often the case, the technology that generates the problem may also provide the solution. Just as recent scientific advancements created a moral dilemma, discoveries that are even more recent may provide a way out. Within a short time, it may be possible to get the exact stem cells researchers say they need without cloning an embryo. This means that we need no longer argue about such important but difficult questions as whether an embryo is fully a person or whether and when stem cell research may actually produce medical cures. The good news is that we can effectively prohibit human cloning and do it with a consensus that heretofore has not been possible; we can honorably reconcile our positions without requiring anyone to compromise their principles – provided that we are willing to approach the cloning issue humbly and practically, and provided also that both sides really do want what they say they want.

Mr. President, one of the difficulties with this issue is that much depends on understanding at least the basics of the science involved, and the science is complicated – especially for those of us who limped through high school biology. So I want to review some of the facts about stem cells and in particular about how stem cell research intersects with cloning.

A stem cell is a cell that does not itself perform a physiological or structural function in the body but instead serves as a source for cells that do perform such functions. During early development stem cells help form the human body; in adult life, stem cells stand in reserve, to be used as needed to create new blood cells, brain cells, liver cells, and many other cells with a specific function in the body.

In current scientific language, there are two basic categories of stem cells: first, adult stem cells and, second, embryonic stem cells (which are also called pluripotent stem cells).

Adult stem cells exist all over the body. Their purpose is to maintain and repair damaged tissue. Science has known about, researched and used adult stem cells for years. To date, adult stem cell research has resulted in the development of a variety of therapeutic treatments for diseases: over 60 peer-reviewed treatments using adult stem cells exist today. These treatments include autoimmune diseases such as lupus and multiple sclerosis and blood diseases such as sickle cell disease.

A few years ago, American scientists announced that they had isolated stem cells from human embryos as well. These stem cells (called, naturally, “embryonic” stem cells) are the cells that, during the first days of life, begin dividing and differentiating, developing into the various parts of the body. Currently the cells can only be obtained from embryos created through in vitro fertilization (IVF). Once isolated, however, embryonic stem cells are self-replicating, which means an individual embryonic stem cell can produce tens of thousands of additional stem cells.

There is an important difference between “adult” and “embryonic” stem cells. Adult stem cells are found in the developed tissue or organs of the body and they can in general differentiate only to yield the cell types of the tissue or organ from which they came. In general, that means that an adult stem cell can become only one kind of tissue. A heart stem cell, for example, becomes heart tissue; a liver adult stem cell becomes liver tissue, and so on. Remember, the primary roles of adult stem cells are to maintain and repair the tissue in which they are found.

An embryonic stem cell, on the other hand, is considered “*pluripotent*.” That means an embryonic stem cell could develop into any of the different cell types of the body. They could in theory, if properly controlled, be commanded to become any one of a number of different tissues. This is logical, because embryonic stem cells are derived from the very cells in the embryo that are awaiting genetic instructions on what organ or other part of the body they will become. It is important to remember that the major reason science wants embryonic stem cells is because of this pluripotent quality. The fact that pluripotent stem cells come from embryos is a problem rather than a good thing, because of the obvious ethical concerns in extracting a cell from a human embryo and thereby destroying the embryo.

Whereas the value of adult stem cell research is accepted by consensus, there is more controversy over the scientific efficacy of embryonic stem cell research. The pluripotency of embryonic stem cells gives them more diverse potential, since they can in theory be “programmed” to become any kind of tissue. In practice, controlling pluripotent stem cells enough to produce actual treatments has been very difficult, and researchers to whom I have spoken, while supporting research with these cells, have emphasized that cures are likely to be many years away, if they come at all.

Because of this, some have argued that pluripotent stem cell research is of negligible value and that we should feel no compunction about preventing such research. But too many scientists of different backgrounds have insisted otherwise for me to be certain of

that conclusion. The truth is that it is simply too soon to know whether science can control pluripotent stem cells well enough to use them for medical therapies; to the extent there is a consensus on this issue, it is that such research is speculative but promising.

Even more recently science has determined that a third category of stem cells may be useful. These stem cells are genetically matched to the patients who need the cell therapies. For several years scientists have believed that it may be possible to derive these genetically matched stem cells through a process called Somatic Cell Nuclear Transfer – or SCNT.

In SCNT the nucleus of an unfertilized human egg, which contains 23 chromosomes, is removed and replaced by the nucleus of an adult body cell. The new “transferred” nucleus would be genetically complete, containing all 46 chromosomes of the donor cell. (This imitates the effect of normal fertilization in which the sperm's 23 chromosomes add to the egg's 23 to make the needed 46.) The egg with the transferred nucleus is then stimulated and begins dividing like a naturally fertilized embryo. If all goes well, in 4-5 days it gets to a stage of development, called the blastocyst, from which embryonic stem cells would be harvested. These stem cells would be distinct from the embryonic stem cells derived from IVF in that they would genetically match the donor. Proponents of SCNT are hopeful that assuming they can overcome the challenge of controlling the development of any pluripotent stem cell, and assuming that they can successfully complete SCNT at all, these genetically matched stem cells would be superior to other forms of pluripotent stem cells in curing disease.

Again, stem cell research in general has nothing to do with SCNT. It is only with respect to one particular type of embryonic stem cell—a stem cell which no one has ever developed but that might have incremental advantages over other embryonic stem cells—that science wants to do SCNT. The reason SCNT is controversial is that it is a form of cloning. In fact, it is the same technique that was used successfully to create Dolly the sheep.

Both the proponents and opponents of SCNT agree that, if successful, it would result in the cloning of a human embryo.

Some supporters of SCNT, however, argue that a human embryo does not become a human being until it is implanted in a womb, and that unless researchers intend to implant the cloned embryo, SCNT should be permitted. The opponents of SCNT believe just as passionately that a human being does not depend on developmental age, and that a human embryo is therefore a human being from its beginning. From this perspective SCNT is the creation of a human being for purely instrumental use—exactly what, in theory, a cloning ban is designed to prevent. But up until now, both sides have assumed that *any* nuclear transfer procedure which would result in the creation of pluripotent stem cells must first have produced a human embryo.

Yet the most recent scientific developments suggest that this is not true. In May 2005 the President's Council on Bioethics released a White Paper entitled "Alternative Sources of Human Pluripotent Stem Cells." In this report, the Council outlined four specific proposals for a scientific solution to our current political impasse over stem cell research. In the months since that report was issued, progress in each of these approaches has been reported in the leading peer-reviewed scientific journals. Research on one of these proposals, Altered Nuclear Transfer, is especially encouraging and suggests that all the scientific and medical goals of SCNT could be realized without the cloning or destruction of human embryos.

Remember, Mr. President, with Somatic Cell Nuclear Transfer researchers would take the genetic material out of a human egg, replace it with the complete genetic code of the donor, and then shock it so that it starts to divide. In theory, an organism created in such a way—artificially rather than naturally—could divide and grow until it became an adult human being. Altered Nuclear Transfer is a form of somatic cell nuclear transfer in that it uses nuclear transfer but with a preemptive alteration of the genetic material. To put it simply, the somatic cell is altered prior to being transferred. The resultant entity would be capable of producing pluripotent stem cells but because of the preemptive alterations during the transfer process it would be incapable, from its creation, of the organization and developmental potential that are the defining characteristics of an embryo.

Altered Nuclear Transfer is a broad umbrella concept with many possible specific approaches. For example, one proposed approach using ANT is called ANT-OAR. This form of ANT involves reprogramming the somatic cell to enter directly into a pluripotent stem cell state, without going through any of the normal developmental stages. All of this means that ANT could create genetically matched stem cells without ever having to produce anything with the capacity to be considered a human embryo.

This distinction between SCNT and ANT is vital from a moral and legal perspective. Until the last few months, everyone has assumed that nuclear transfer which was successful in generating pluripotent stem cells must first have created a human embryo. The entity which ANT could create would produce pluripotent stem cells from a laboratory-constructed cellular source lacking the developmental potential of a human embryo. In laymen's terms, the entity which ANT would create could only develop for a few days and would then "close down." ANT thus transcends the moral dilemma which has heretofore prevented any legislation from passing. It renders moot the question of whether human life begins at creation or implantation of an embryo since the entity that ANT could create would not have at its inception the organizational and developmental capability to be considered a human life.

Further exploration of the ANT proposal already has the support of a long list of scientists and ethicists and religious leaders, including the Former Chairman of the U.S. Conference of Catholic Bishops Committee on Doctrine. The author and most vocal champion of ANT is Dr. William Hurlbut of Stanford. Dr. Hurlbut assured me months

ago that ANT was technologically feasible and would soon be validated through animal models. And, indeed, just four months ago stem cell biologists, Alexander Meissner and Rudolf Jaenisch (of the Whitehead Institute at MIT) used Altered Nuclear Transfer to produce fully functional pluripotent stem cells from a laboratory-construct that is dramatically different in developmental potential than a natural embryo. In testimony to an October 2005 senate hearing on stem cells, Dr. Jaenisch explained that this procedure is simple and straightforward and does not involve the creation of an embryo. Dr. Jaenisch said, "Because the ANT product lacks essential properties of the fertilized embryo, it is not justified to call it an "embryo." (October 19, 2005 testimony at an Appropriations Subcommittee on Labor, Health and Human Services, Education hearing on "An Alternative Method for Obtaining Embryonic Stem Cells.") This scientific advance was widely reported precisely because it signals the end of the ethical dilemma in this area of research; it suggests that science may soon be able to get this special kind of stem cell--pluripotent stem cells that genetically match the donor/patient--without cloning, creating, or destroying a human embryo.

Mr. President, I appreciate the patience of the Senate in bearing with me as I wound my way through the scientific thicket. I believe it was necessary to lay this foundation before proceeding, and I suspect that the Senate may already see the practical suggestion which I see as the logical result given the latest technological developments and the current stalemate.

Again, to reaffirm my central point, many scientists have resisted a total ban on human cloning because they believed it was necessary to clone human embryos for a narrow purpose: to get pluripotent stem cells which are a genetic match of the person whom they hope to treat medically. However, it now appears that it will be possible to get such stem cells without cloning an embryo.

Some may argue that these alternative forms of nuclear transfer and other new technologies are unproven and may never produce usable new discoveries. But the same thing can be said of embryonic stem cell research in general and SCNT in particular. Bear in mind that science has yet to succeed in getting pluripotent stem cells from SCNT at all. Nor, for that matter, is there a single new cure from embryonic stem cells derived from any source. If researchers cannot learn how to isolate and control genetic signals, then pluripotent stem cell research will turn out to have little medical application; if such control does prove possible, then there should soon be no reason to have to get the stem cells by a method that clones or destroys a human embryo.

The Legislative Environment

As I mentioned earlier, we appear to be at a legislative stalemate. The key to reaching the proper legislative solution, I believe, is to recognize that the new scientific developments create possibilities for an honorable reconciliation that simply did not exist at the time Senators developed and sponsored the various cloning bills that are currently introduced in the Congress. In effect, the new technology is rendering the

approach of those pieces of legislation out of date.

For example, the main anti-cloning bill, S. 658, of which I am a cosponsor, would ban the use of nuclear transfer whenever it resulted in the creation of a human embryo or an organism that was “virtually identical” to a human embryo. This standard satisfies one of the important principles of the pro-life community, because it recognizes that the dignity of pre-born human beings doesn’t depend on their gestational age. But it fails to account for the possibility, created by Altered Nuclear Transfer and some of the other alternative methods, that an entity may be “virtually identical” to an embryo in the sense that it has a similar external appearance (and can seem to be developing as it divides) without ever possessing the inherent organizational capability to be rightly considered a human being.

Because of this, there is a danger that the language of S. 658, which was adequate when we all assumed that any entity capable of creating embryonic stem cells must be a human embryo, would outlaw or imperil precisely those alternatives which hold the greatest promise of allowing stem cell research while protecting the integrity of human life. I discussed this problem with Doctor Hurlbut and, in a recent letter, he expressed concern that S. 658 as drafted might be misinterpreted to outlaw ANT. He pointed out that the term ‘virtually identical’ is vague and unscientific and, therefore, could be open to misinterpretation—either more broadly or more narrowly than intended by the proponents of this legislation.

The existence of alternatives like ANT actually strengthens the case of those of us who oppose the cloning of human embryos, since it promises another, ethically untroubling way of getting the same genetically matched stem cells scientists need. But it also shows that there is much about nuclear transfer that we have yet to discover, and it cautions against enacting criminal sanctions, like S.658, that could have unintended consequences because they presume a scientific equilibrium that simply doesn’t exist. Congress should still move effectively to prohibit human cloning but the approach of S. 658 needs to change. At minimum, the “virtually identical” language in S. 658 should be discarded, and the bill should specifically define when a cloned entity has the organizational capability and developmental potential to be considered a human being. But, I would prefer to enact a regulatory ban that could be adjusted over time to reflect changes in the science like ANT (perhaps after consultation with the President’s Council on Bioethics), and I would couple that ban with aggressive funding of ANT and other alternatives, perhaps in the form of the competitive incentive program I will discuss in a moment.

The other main cloning legislation, S.876, should in light of recent developments, be equally unsatisfactory to many of its supporters, although for different reasons. S. 876 does not regulate the initial nuclear transfer process at all but simply bans implanting a cloned embryo. This is good as far as it goes, but S. 876 would provide no protection whatsoever to human life before implantation. Under generally accepted medical protocols today, science can’t even experiment on animals if other methods of doing

the same research are available, yet S. 876 would permit the cloning of human embryos for any purpose and under any circumstances, regardless even of whether the researchers need or intend to use the embryos for stem cell research.

The proponents of S. 876 were almost forced into this position to protect the stem cell research they thought necessary, because they believed, as we all did, that the only way to get genetically matched stem cells was through cloning and that any such cloning would necessarily produce a human embryo. But the evidence now suggests that this is not true. I am sure that the supporters of S. 876 are sincere in their belief that a human embryo does not acquire full personhood until some point after it is created. But I respectfully suggest that this view is no longer a reason, given the changing science, to continue supporting a legal standard that affords no dignity whatsoever to human life at its earliest stages.

The answer is for both sides to take advantage of scientific changes to find proposals which they can mutually support and which offer advantages to each compared to the current stalemate.

To that end, I propose a competition, to be managed by the National Institutes of Health, which would create incentives for our great research institutions to get the genetically matched stem cells we need without risking cloning an embryo. Simply put, the NIH would take applications from research institutions with research plans to accomplish the goal. The exact funding and practical details of this would have to be carefully worked out, but let me put forward a preliminary proposal. Five institutions would be selected for the competition and provided \$10 million each to conduct their comprehensive plan. The first institution to successfully harvest genetically matched stem cells without cloning a human embryo would receive a prize of \$20 million. NIH would develop the boundaries of the competition with the restriction being that the research could not violate the terms of the Dickey Amendment. Once ANT or one of the other alternative methods was successful and we had a proven means to get genetically matched stem cells without cloning a human being, the NIH could issue regulations requiring science to use that technology in its research.

The idea of a competition is not new. They've successfully been used for centuries to educate, inspire, and motivate. For example, Charles Lindberg won a \$25,000 prize for the first non-stop flight between Paris and New York in 1927. In 2004, a company called Scaled Composites won a \$10 million prize for the first privately funded manned suborbital flight from the St. Louis-based X Prize Foundation. Inspired by the success of the X prize—and with the support of Congress, the President and his Commission on Implementation of U.S. Exploration Policy—NASA has begun a federally funded program called “Centennial Challenges” that awards prizes to stimulate innovation in technical areas of interest to space exploration. In fact, the program manager at NASA, Brant Sponberg, said they expect to spend \$80 million on prizes over the next five years.

A proposal of this kind moves us forward in a way both sides should be able to support.

After all, the sole argument for SCNT is that we need it to get certain kinds of stem cells; the argument against it is that it involves the cloning of human embryos. If we can get the stem cells without the cloning, we render the current controversy scientifically obsolete. Science would have the stem cells it needs in a morally acceptable way that would allow for full federal funding of stem cell research. The pro-life community would have an effective ban on human cloning. We would turn a zero sum game into a win-win proposition for everyone.

Conclusion:

Mr. President, we are entering a promising new era in biomedical technology, but as our power over human life increases, so does the seriousness of the moral issues. It is important to acknowledge that both sides in this difficult debate are defending something important to all of us. We should all want to advance biomedical science while sustaining fundamental principles for the protection of human life.

Biomedical science should be a matter of unity in our national identity: no one should enter the hospital resentful that positive possibilities for the best therapies were not explored, or with moral qualms about the research on which their therapies have been developed.

The revelation that the South Koreans have not succeeded in obtaining pluripotent stem cells from cloned human embryo returns this research to square one. This presents to our nation both a challenge and an opportunity: a social challenge to seek a way forward as a unified society, and an opportunity to set a solid scientific and moral foundation for future generations. The differences within our nation can be a source of strength as we seek to open a way forward for biomedical science. Altered Nuclear Transfer, and the other alternative approaches put forward by the President's Council on Bioethics offer us just such a path to progress.

We are at a difficult impasse, but we have extraordinary possibilities. Our current conflict reflects deep differences in our personal perspectives, but our wider goals are similar. Any purely political victory will leave our nation bitterly divided and erode the social support that is essential for continuing public funding of biomedical science. It is with this recognition that I have put forward this proposal in a spirit of unity. And beneath this spirit of unity must be a spirit of humility: these are difficult issues and no one of us has the clarity of understanding or depth of knowledge to answer them alone. But with mutual good will we can transcend the current paralysis and find grounds for practical progress in scientific research. In his presentation on stem cell research last July to the Senate Appropriations Committee, Dr. Hurlbut said the goal should be to find "islands of unity in a sea of controversy." We can move from one such island to another and end up in a world of progress and decency. There is no reason to continue glaring at each other across the legislative barricades, when the means are at hand to embrace the future of developmental biology without moral qualms or political division?