Amy Daniels, Wisconsin, successfully treated for Systemic Scleroderma with her own adult stem cells.

Also in contrast to ESCs, stem cells from more mature tissues can be more easily immune-matched to patients because cells taken from a patient's own tissues are a perfect match and those from birth-associated tissues are widely compatible. When it is not possible to obtain stem cells from the patient directly, donor registries, similar to the bone marrow registry, could provide a wide range of immune matches. Finally, with over four million births in the United States every year, stem cells from birth-associated tissues could provide immune matches for the great majority of American patients.

Lastly, while stem cells from mature tissue may be more limited in the kinds of mature cells they can produce, the flip-side of this limitation is that the cells produced are much more likely to be fully mature and therefore clinically safe and clinically useful.

Direct reprogramming

In the fall of 2007, three independent research groups stunned the world by showing that adult skin cells could be converted directly into stem cells having all the important properties of human ESCs. By providing patient-matched stem cells, the iPSC technique solves the problem of immune rejection.

Barry Goudy, Michigan, was successfully treated for multiple sclerosis with adult stem cells.

Reprogrammed iPSCs are therefore superior to ESCs on both ethical and scientific grounds. While the problems of tumor formation and correct differentiation remain for iPSCs, just as they do for ESCs, reprogrammed iPSCs have already proven medically useful in an animal model of human sickle cell anemia.

Currently, iPSCs are produced using viruses that could pose additional risks for patients. These safety concerns can almost certainly be addressed, however. Scientists already have found ways to eliminate the most risky virus used in iPSC production and have shown that small modifications of the procedure greatly improve iPSC safety.

What price are we willing to pay for medical cures?

On purely practical grounds, embryonic stem cell research is not the most effective use of research money, and does *not* offer the greatest hope to patients.

On a more fundamental level, we must not be so blinded by our concern for patients and their families that we ignore the moral cost of scientific research. Medical stem cell research must operate within the constraints of ethical principles, with the first principle being do no harm. Research on human ESCs involves the intentional destruction of human life at its earliest and most vulnerable stage. Regardless of any potential benefit this research may offer, as citizens and as Christians, we must ask ourselves: Can medical cures justify the price of destroying human life?

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The full-length version of this article is posted at http://www.usccb.org/prolife/programs/rlp/condic.pdf.

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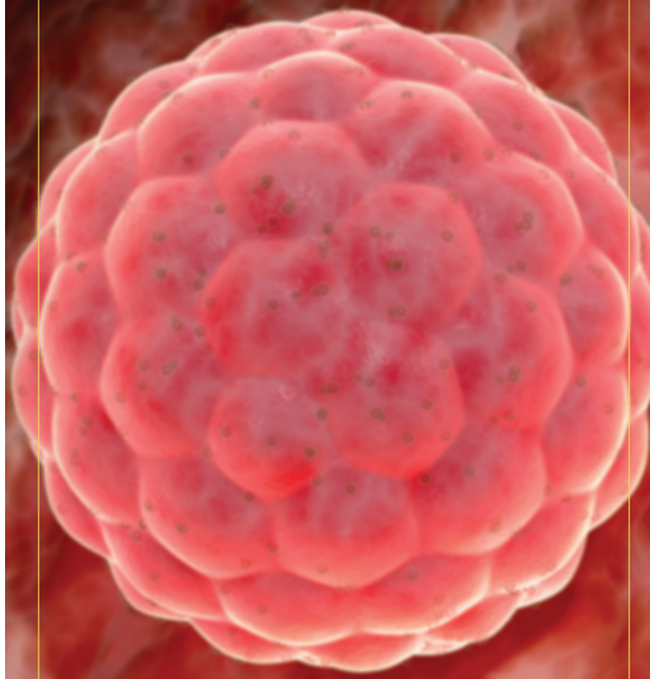
Stem Cells and Hope for Patients

by Maureen Condic, Ph.D.



Hope and Trust in Life!

Respect Life

Most Americans know someone afflicted with an incurable medical condition. The possibility of stem cell cures has given hope to many who face such suffering and loss. Unfortunately, there is a tremendous amount of misinformation about stem-cell therapies. To make sound decisions about this rapidly advancing field of research, it is important to understand what stem cells are and what promise they actually offer patients and their families.

A stem cell is simply any cell that, when it divides, can make another cell like itself or make different kinds of cells with specialized functions. Because stem cells replace themselves at every cell division, they may be medically useful for replacing tissue damaged by injury or disease. Following a heart attack, for example, many cells of the heart die, leaving the heart weakened and less able to pump blood. Heart muscle cells produced from adult stem cells can be used to repair the heart and restore normal function.

Three sources of stem cells

The earliest stem cells are found in the human embryo during the first few days of life. They give rise to all the tissues of the mature body. To obtain embryonic stem cells (ESCs) for research and for possible future therapies, however, the embryo must be destroyed. This raises the critical ethical question: Should the life of one human being (albeit at a very early stage) be sacrificed to advance scientific research or to benefit the health of an older human being?

Carron Morrow, Alabama, successfully treated for heart disease with her own adult stem cells.

In contrast to ESCs, many sources of stem cells do not raise ethical problems. Stem cells can be obtained from a patient's own bone marrow or other tissues, and from a variety of birth-associated tissues, including placenta, amniotic fluid, umbilical cord, and cord blood. All of these non-embryonic sources of stem cells are referred to as adult stem cells, to distinguish them from stem cells obtained by destroying human embryos.

Thirdly, recent work has shown that stem cells can be produced easily and without controversy by introducing a small number of factors into ordinary adult skin cells to reprogram the mature cells into stem cells that, like ESCs, are able to generate all the cells of the body. Unlike embryonic stem cells, however, these induced pluripotent stem cells (or iPSCs) are genetically identical to patients and are generated without destroying human embryos or using human or animal eggs.

The false promise of embryonic stem cells

Apart from the grave ethical problem of destroying human embryos for research, there are three significant *scientific* problems with ESCs that must be overcome before they could be considered safe for use in human patients. First, when transplanted into mature tissues, ESCs form tumors that can be fatal if they form in vital organs. They are generally benign, i.e., not cancerous, but recent work has shown that ESCs are also genetically unstable, and tend to accumulate mutations that convert them to cancer cells. Thus, the advantages of ESCs (their flexibility and rapid proliferation) also cause these cells to form tumors and convert to cancer.

A second serious hurdle is the problem of immune rejection. ESCs will be rejected by the patient's immune system unless a very close match is made. Yet, unlike conventional organ transplant, stem cells disperse throughout the body and cannot be removed if the patient's body rejects them.

Also, millions of embryonic stem cell lines would be required to find a good immune match for most patients. Thus, stem cell therapies would almost certainly require the intentional production and destruction of millions of embryos.

Finally, despite more than 25 years of research, no one has been able to coax embryonic cells to become mature, stable cell types that are useful in the clinic. While it is relatively easy to make cells in the laboratory that have some of the properties of mature cell types, laboratory-produced cells generally do not survive when transplanted into mature animals. If not fully mature when transplanted, they often produce fatal tumors.

Stephen Sprague, Staten Island, NY, one of the first adults successfully treated for leukemia with cord blood stem cells.

These three problems (tumor formation, immune rejection and stable differentiation) can all, in theory, be solved. Yet solving these problems is likely to take decades of research and billions of dollars before benefits could be realized for patients.

The real promise of adult stem cells

Adult stem cells can be derived from many of a patient's own tissues, including bone marrow, muscle tissue, nasal mucosa, and even fat. Stem cells from more mature tissues present significant advantages for use in medical therapies. First, these stem cells do not form tumors and are not genetically unstable. Because adult stem cells and their derivatives can be safely transplanted to patients, more than 1,500 clinical studies are currently underway, testing the medical usefulness of adult stem cells for diverse medical conditions, including (among others) diabetes, heart disease, Lou Gehrig's disease, multiple sclerosis (MS), arthritis, sickle cell disorder and many types of cancer. In contrast, in the quarter century since their discovery, not a single clinical study has been approved for ESCs, due to the serious safety concerns discussed above.