

Stem Cells for Everyone: A Breakthrough?

As far as dramas go, the stem cell saga contains all the elements of a juicy prime-time soap opera. The excitement, the promises, the characters, the politics, the lies, the scandal, the money—the only thing missing is sex, but that's the point, isn't it?

On November 20, 2007, the journals *Science* and *Cell* announced a truly major discovery. It was a way to convert human skin cells taken from a simple skin biopsy into *stem cells* that behave like an *embryonic stem cell* but the byproduct is not an embryo and can in no way become one. {1} This has the effect, say many, of sidestepping the ethically troublesome practice of creating then destroying human embryos in order to treat diseases.

This new method is efficient. One biopsy can produce 20 stem cell lines, and can be taken from the patient himself, eliminating the risks associated with tissue rejection. We hear about stem cell breakthroughs all the time; how is this one different? Is this method ethical? Will it save as many lives as embryonic stem cells promise to? Is this the end of the stem cell controversy?

The Saga

Stem cells are simply cells that make other cells. Their job is to be a cell factory. By analogy, think of a rose. From the stem of the rose grows leaves, the flower, and thorns. The thorns don't produce flowers, the leaves don't produce thorns, and the flower doesn't produce leaves, but the stem does. The stem is versatile; it can make many parts of the plant. Stem cells operate the same way. Some stem cells are more versatile than others. In other words, some stem cells can make many types of cells and others can only make one type of cell.

The history of embryonic stem cells dates back to the 1950s when two scientists isolated a teratoma from a mouse. A teratoma is a tumor that is composed of various types of cells from hair cells to eye cells to teeth to nails, so the scientists aptly named it a *teratoma*, or monster. When investigating this tumor, the scientists found that the stem cells that produced this array of cell types had very similar properties of embryonic cells. Thus began the investigation into embryonic stem cells. {2}

Before the term stem cells had become popular, bone marrow transplants had been used to treat patients with leukemia. Whenever a patient receives a bone marrow transplant from a donor, they are really receiving a type of stem cell therapy. At this point, scientists could only use bone marrow stem cells for very specific cell replacement. These stem cells were not very versatile—at least that was the theory at the time. Since then, bone marrow stem cells have been found to be quite versatile, and can be coaxed into becoming a variety of cells. Scientists have now found a variety of adult stem cells throughout the body and have been using them in humans to cure or alleviate a number of diseases or conditions (see www.stemcellresearch.org for a complete list).

Another breakthrough with stem cells arose from tissues such as umbilical cord blood, placental tissue, amniotic fluid and even menstrual blood—all obtained without harming the life of the baby at any stage of development. Each of these stem cells are a little more versatile than the adult stem cells, meaning that they can become two or three different types of cells, and in many cases the donor/recipient need not be an exact match. The National Cord Blood Program is just one group that allows parents to put their baby's umbilical cord blood in a bank so that he or she could use it for therapy sometime in the future, or they can donate the umbilical cord for others to use. See www.nationalcordbloodprogram.org for a list of patient success stories. {3}

If these are *adult* stem cells, then what are *embryonic* stem cells? These are cells removed from the eight-day-old embryo. When these cells are removed, the embryo dies. These cells produce almost all of the cells in the human body, and therefore are the most versatile stem cells. You may have heard of these cells as being pluripotent. That simply means that they are very versatile. Some scientists believed that embryonic stem cells (ESC) research was where time, money and resources should go since we know that these cells have the potential to become any cell type.

Numerous success stories of treatments with adult stem cells have been under-reported by the media, while the supposedly cure-all ESC were hyped even though they have shown no actual success in humans. Ironically, adult stem cells have been saving patients' lives for years (bone marrow transplants), while ESC scientists have yet to control the growth rate of the ESC. In what shouldn't be a surprise to anyone, ESC tended to form grotesque tumors (teratomas) composed of various cells found in the body.

Debate over the ethics of using embryos became heated within the political arena. The individuality and dignity of the embryo came into question. Scientists wanted unfettered research{4} so that all options can be explored to cure diseases, while others considered the embryo a very vulnerable life that has the right to be protected from experimentation. Both sides claimed to be arguing for the good of humanity.

These debates, however, have taken a slightly different turn with the recent discovery of converting skin cells into pluripotent stem cells mentioned above.

Skin Cells

As mentioned, now scientists have isolated human stem cells that are as versatile as embryonic stem cells, but no embryos were used to obtain these stem cells. While more studies are needed to confirm that these cells act like ESCs in the human body, they behave just like ESCs in the lab.

There are a few concerns with this procedure. One of the biggest concerns is the way these stem cells are made. Both research groups had to use a type of virus to insert the right code into the skin cells to tell it to become a stem cell. This virus may be harmful to humans. However, both scientists are researching safer methods for coaxing the skin cells into stem cells.{5}

So is this method ethical? I strongly believe the answer is yes. As Leon Kass, former head of the President's Council on Bioethics, stated in a *National Review Online* symposium, Reprogramming of human somatic cells to pluripotency is an enormously significant achievement, one that boosters of medical progress and defenders of human dignity can celebrate without qualification.{6} Sanctity of life advocates can celebrate because no embryos are created or destroyed for research.

Both scientists who first published on this new discovery, Dr. James A. Thomson from the U.S. and Dr. Shinya Yamanaka from Japan, said that this research could not have been done without the knowledge that we already had from embryonic stem cells. And Thomson, who was one of the first scientists to remove a stem cell from a human embryo,{7} has specifically stated that embryonic stem cell research should continue.{8} We must keep this point in mind, but we must also remember that, contrary to what some in the scientific community are saying, both scientists had more than just economic reservations about using embryos in their research:

Thomson: If human embryonic stem cell research does not make you at least a little bit uncomfortable, you have not thought about it enough. I thought long and hard about whether I would do it.{9}

Yamanaka: When I saw the embryos, I suddenly realized there was such a small difference between it and my daughters I thought, we cant keep destroying embryos for our research. There must be another way. {10}

Is This Match Point?

Most people agree that this changes the political and scientific culture of the stem cell debate. Surprisingly, some major players have come around.

Jose Cibelli, research scientist whose successful primate cloning was overshadowed by the skin cell announcement states, If their method is as good as the oocyte (the cell that forms a human egg) we will be no longer in need of the oocytes, and the whole field is going to completely change. People working on ethics will have to find something new to worry about. {11} Even Ian Wilmut, the scientist famous for creating Dolly the Sheep [see Probe article], decided to abandon cloning and work with reprogramming cells instead. As the Britains *Telegraph* reports, The scientist who created Dolly the sheep, a breakthrough that provoked headlines around the world a decade ago, is to abandon the cloning technique he pioneered to create her. I decided a few weeks ago not to pursue nuclear transfer, Prof Wilmut said. {12}

Several of the participants of *National Review Online* Symposium agree that this removes the ethical concerns from researching pluripotent cells, and, pragmatically, this seems to be significantly more efficient than cloning embryos to remove stem cells. Case closed? Not quite.

Not all agree that this is the end of using embryos to extract stem cells. As Wesley Smith, bioethicist, vocal ESC critic and Discovery Institute fellow, points out on his blog, www.bioethics.com:

If anyone thought that the pro-human cloners would fold up their tents and steal away after the news was released that patient-specific, pluripotent stem cells had been derived from normal skin cells, they just dont understand how fervently some scientists and their camp followers want to clone human life and how hopeful some are that the stem cell issue can be the vehicle that wins the culture war. {13}

Recall that we are dealing with scientists careers and, for the most part, scientists with a utilitarian worldview. A scientist whose worldview is dictated by whatever is for the greater good and has built his entire career and reputation around embryonic stem cell research is not going to readily abandon it. To see the interplay of both career and worldview choices, Dr. Hans Keirstead, neurobiologist and stem cell researcher at the University of California-Irvine, had this to say in an interview for the *Arizona Daily Star*:

I do think a great deal of this work could be done with the skin-cell derived stem cells. But wed have to start completely over, from scratch, and we are not going to slow down to do that, not at this point.

It is my personal feeling its a very ethical decision to use this tissue [Embryonic Stem Cells] to end human suffering, to better human life, than to destroy it. {14}

Conclusion:

As Christians, we operate within an ethical framework dictated by Gods word. Although the Bible does not mention stem cells, it *does* make clear that we are made in Gods image (Genesis 1:26, 27), that God knew us and knit us together within our mothers womb (Psalm 139: 13-16), and how God called prophets before they were even born (Isaiah 49:1; Jeremiah 1:4-5). God values the life of the unborn. We do not always have the privilege of seeing ethical decisions vindicated in our lifetime, but we can be confident that God is sovereign over all things.

Notes:

1. Takahashi, Kazutoshi, et al, *Cell* 131, 861-872, November 30, 2007; Yu, Junying, et al *Scienceexpress*, www.sciencexpress.org, (fee/registration to access full article) November 20, 2007.
2. From teratocarcinomas to embryonic stem cells and beyond: a history of embryonic stem cell research Solter, *Davor Nature Reviews* 326, vol. 7, April 2006.
3. See list of references from Family Research Council, www.frc.org/get.cfm?i=IS06H01. See also www.stemcellresearch.org/facts/asc-refs.pdf for a sampling of peer reviewed research articles.
4. This case history [of ESC research] again reinforces the old truism that unfettered basic research driven only by scientific curiosity is usually the best way to discover things of enormous practical value Solter, *Davor Nature Reviews* 326, vol. 7, April 2006.
5. Two Major Studies Show: Human Pluripotent Stem Cells without Cloning or Destroying Embryo analysis by Maureen Condic, Ph.D. from www.stemcellresearch.org/statement/pptalkingpointsweb.pdf.
6. National Review Online NRO Symposium, nationalreview.com, Brave New Future.
7. Thompson, James A. et al, *Science* 282, 1998.
8. Standing in the Way of Stem Cell Research by Alan I. Leshner and James A. Thomson *Washington Post*, 12-0-07, pg. A17.
9. Man Who Helped Start the Stem Cell War May End It by Gina Kolata, *New York Times*, Nov. 22, 2007.
10. Risk Taking Is in His Genes by Martin Fackler, *New York Times*, 12-11-07.
11. Vogel, Gretchen, and Holden, Constance , Field Leaps Forward with New Stem Cell Advances *Science* 318, 23 November 2007, p. 1224.
12. Dolly creator Prof Ian Wilmut shuns cloning by Roger Highfield, *Telegraph* 11/16/07, www.telegraph.co.uk.
13. 'Lead Into Gold:' Stem Cell Counter-Attack by Wesley Smith. Posting for November 27, 2007 www.bioethics.com.
14. Human embryonic stem-cell work must go on, says researcher by Carla McClain, *Arizona Daily Star*, 11-28-2007.