A COVENANT BIOETHICIST LOOKS AT THE COMPLEX AND CONTROVERSIAL ISSUE OF EMBRYONIC STEM CELL RESEARCH.

Miracle Cure OR Moral Quagmire?

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In 1999, Becky McSherry of Shippensburg, Pennsylvania, was diagnosed with a life-threatening case of lupus. With other treatment options failing, her doctors turned to an experimental stem cell therapy at Northwestern Memorial Hospital in Chicago. Hospitalized there in March 2004 and fighting for her life, McSherry, a thirty-year-old mother of two, was given chemotherapy and a drug called Neupogen to stimulate stem cell growth in her blood. Those cells were then harvested and, after McSherry underwent further treatment, were reinfused into her body. Again she was given Neupogen to help the bones accept the infused stem cells and to produce new red blood cells. Her hope of living depended on the success of her participation in a stage III clinical trial of stem cell therapy.

Dr. Yu Oyama, who oversaw McSherry's treatment, told *Public Opinion*, McSherry's hometown newspaper, that the stem cells "made a major impact in her treatment." In two out of three cases, Oyama said, patients like McSherry saw significant improvement. Within two months, she was back home and continued to improve by summer's end.

Stem cell research offers hope that treatment like the one McSherry received can be found for other illnesses. The potential of stem cells has both researchers and those suffering from heart degeneration, muscular dystrophy, diabetes, spinal cord injuries, and bone cancer asking, "What if?"

What if we were able to safely infuse cells into the body that would change into healthy, self-reproducing cells of the type needed by the damaged organ? Hearts and livers could generate healthy tissue, allowing the organs to repair themselves. Physicians could introduce insulin-producing cells into dysfunctional pancreases and new cells into injured spinal cords to restore injured nerves, so that diabetics would not have to take insulin and paraplegics could actually walk again.

Although such possibilities once existed only in the realm of science fiction, research is under way to enable scientists and physicians to actually do these things and more.

Stem cell research is part of an approach to treating diseases called regenerative medicine. On the scientific side, stem cell research seeks to understand how and why stem cells possess plasticity—the ability to develop into different kinds of tissue. On the medical side, the research seeks to harness that plasticity to create tissue-replacement therapies that restore the functions lost by damaged organs.

What are stem cells?

Stem cells are undifferentiated cells that satisfy three criteria. They are able to renew themselves indefinitely. They can differentiate or change into multiple cell types. Once differentiated, they can carry on specific functions in living organisms.

Stem cells exist in the embryo, fetus, umbilical cord and placenta, and several adult organs, including bones, skin, liver, pancreas, and the neural system. When they can transform into any bodily cell, they are *totipotent*; they are *pluripotent* when they can become almost any tissue type, and are *multipotent* when their ability is somewhat more limited.

Embryonic stem cells are harvested from a stage of fetal development called the embryo. At the earliest stage the embryonic cells are totipotent. As the embryo develops, it forms a blastocyst at about six days after fertilization. Smaller in diameter than a human hair, a blastocyst is a hollow ball-like structure that contains two types of cells, surface cells that turn into the placenta and interior cells that develop into the fetus. Scientists can remove the totipotent inner cells to create cell culture lines of undifferentiated cells.

Fetal stem cells, which are pluripotent, can be taken from various parts of the fetus, including the brain, skin, liver, and blood. The blood in the umbilical cord and placenta is a source of multipotent stem cells. Adult stem cells, which are multipotent, can be found in bone marrow, blood, skin, muscles, and nerves. These cells func-

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tion throughout life to aid the development and functioning of the bodily organs.

Adult versus embryonic stem cells

Until recently, adult stem cells were thought to have too many strikes against them to be useful for cultivating stem cell lines. Some of these problems have been disproved, while others remain.

First, it was thought that they are not multipotent—further research has proven this wrong. Hematopoietic (cells found in bone marrow that produce blood cells) stem cells, for example, may be able to become cells like those found in the liver, pancreas, and skeletal and muscular tissue.

Second, adult stem cells were believed to experience symptoms of old age after several generations, a feature not found in embryonic stem cells. Whether this is always the case remains to be studied.

Third, adult stem cells are rare, difficult to identify and isolate, and equally difficult to develop into stem cell lines. When used in experiments, it is difficult to tell whether the cell was truly a stem cell to begin with; and if it was a stem cell, whether it has changed into a new type of cell or mere-

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ly fused with other cells of that type. The advantage of adult stem cells, however, is that their acquisition does not require the death of the donor.

Embryonic stem cells avoid some of these difficulties. These totipotent cells can be extracted from the embryo and have a wide range of application. They appear not to degrade over time but maintain their integrity in cell culture lines over many generations, and are much easier to identify, harvest, and propagate. Like adult stem cells, they are difficult to manipulate into the particular kinds of cells needed to regenerate a failing organ. The drawback of using embryonic stem cells, however, is that harvesting these cells brings about the embryo's death.

Since 2001, funding for embryonic stem cell research has been available but limited. Under guidelines imposed by President Bush, federal funds for embryonic stem cell research may be used on a limited number of stem cell lines created before that time. (Prior to 2001, no federal funds were allocated for stem cell research.)

Myth and reality

What can stem cells accomplish? Following the death of Ronald Reagan, the call for a major research effort in stem cell research aimed at curing or ameliorating the debilitating effects of Alzheimer's and other diseases has received wide press coverage. This summer, fifty-eight U.S. senators signed a letter encouraging the president to relax the restrictions he placed on embryonic stem cell research.

But the idea that stem cells are a cure for *all* major diseases is a myth. There is little evidence, for example, that stem cells can benefit Alzheimer's patients. That idea is promoted because "people need a fairy tale," Ronald D.G. McKay, a noted stem cell researcher at the National Institute of Neurological Disorders and Stroke, told the *Washington Post*. "Maybe that's unfair," he added, "but they need a story line that's relatively simple to understand."

Several major problems make it unlikely that stem cell therapy is appropriate for Alzheimer's. Alzheimer's is too diffuse—it affects not just one but many types of cells in the brain. Second, we are a long way from being able to engineer cells to replace specific cells in the brain. To inject cells into a vein and get them to the brain would be enormously difficult, let alone to get the stem cells to replace the diverse damaged cells in the brain. Third, it is not clear that replacement therapy is relevant to the effects of the disease, in which amyloid-beta plaques accumulate in the brain tissue and bring about the death of the neurons. Drug therapy to decrease or prevent the plaque buildup seems more promising.

Despite the fact that accounts have been plagued with optimistic and misleading claims and that the research is in its infancy, stem cell therapy seems promising for some diseases.

A recent study on rats suggests that stem cells might be able to reduce the symptoms of Parkinson's, a disease that affects some five and a half million Americans. Other possible targets are cardiovascular disease (58 million patients), auto-immune diseases (30 million), diabetes, (16 million), osteoporosis (10 million), and various cancers.

But implementation is still a long way off. In 2001 the National Institutes of Health reported a study in which embryonic stem cells from mice differentiated into insulin-producing cells, offering a possible treatment for diabetes. A more recent study, however, suggests that the cells did not produce the insulin after all, but absorbed it from their culture medium.

Use of adult stem cells from bone marrow currently seems the most promising. Since these are some of the easiest cells to isolate and cultivate, they provide a promising beginning for regenerative therapy. Recent research indicates that stem cells derived from bone marrow can renew themselves continuously in the marrow and differentiate into the types of cells found in other organs. Bone marrow cells have been introduced into the livers of mice, where with signals from the liver they become the cells necessary to repair a damaged liver. In another study, these stem cells were transplanted into an irradiated mouse; they generated not only blood cells, but also the epithelial cells found in the lungs, stomach, and skin. But some have questioned whether these cells really differentiated into other types, or merely fused with differentiated cells already in the organ. Additional, difficult research remains to be done to bring this promising technology to therapeutic use.

Ethical issues

Stem cell therapy faces many important ethical issues, especially about the origin of stem cells used in research and infusion. Stem cells taken from adults or umbilical cords pose no difficulty, so long as they are derived with properly obtained informed consent. Embryonic stem cells are problematic, since their derivation requires the death of the embryo from which they are harvested.

Embryos are available from several sources. When couples attempt to have children by in vitro fertilization (IVF), only some of the embryos are implanted. Others are stored until the procedure is successful; when they are no longer needed they are destroyed. Currently about 400,000 embryos are stored for possible future implantation. Although current donors have allowed only 11,000 of these embryos to be available for research, this source has been tapped to create most of the currently used embryonic stem cell lines.

Embryos can also be produced specifically for research, either through IVF using donor eggs and sperm or through cloning. Recent Parkinson's research in Israel was accomplished using embryos cloned specifically for that purpose.

Herein lies the moral dilemma—when does morally protectable human life begin? It is true that at conception what is conceived is human; it is not a member of another species. But are the early stages of human development

morally protectable in the same way that human life is morally protectable at later stages, when organs are formed and functioning?

On the one hand, it is difficult to believe that the blastocyst, which is only a fraction of a millimeter in size, has the same moral protectability as developed human beings. Its undifferentiated cells lack the ability to function in any other way than to divide. Only later do the cells become differentiated, leading to the development of the organs that enable us to function effectively as persons.

This is not to say that blastocysts are not valuable. It is rather to question whether they have developed to the stage where they should be considered on a par with human persons. Looking at embryos this way, embryos are valuable, for they are the beginning stage of human life, but there is no moral problem with creating embryos that neither will be implanted nor were intended to mature into human beings, for morally protectable life begins some time after conception. These embryos have value because others can benefit from the knowledge obtained by research and or by actual therapy that uses them.

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On the other hand, if morally protectable human life begins at conception, then using embryos and fetuses for research or for therapy is to treat humans in this vulnerable stage of life as commodities that involuntarily serve others at the cost of their life. On this view, conception forms a distinct point of discontinuity. As evidence, one might point to the fact that once conceived, the fetus has its distinct DNA. When embryos are viewed as morally protectable, it is morally unacceptable to intentionally produce embryos that are not meant to develop into human beings but instead serve other, extrinsic purposes.

As with most moral issues, caveats need to be considered. In this case important distinctions must be made, lest the entire project of regenerative therapy be tarred with the same brush. For example, those who believe that protectable human life begins at conception might hold that IVF is wrong when it produces multiple embryos, some of which are slated for death when unused.

At the same time, they need not reject the harvesting of stem cells from embyros. Since IVF is practiced, the question arises whether any good can be brought out of an "evil act." It is not that evil is done so as to bring about good—this would invoke the suspicious principle that the end justifies the means. But once the evil is committed, we can be justified in bringing good out of it. Since the death of the embryos or fetuses already has been determined on grounds having nothing to do with stem cell research or therapy—the embryos are no longer needed for having children—the tissue they contain could morally benefit living sufferers.

Consider, as an analogue, an instance of a crime where the victim is killed. Though murder is a moral evil, should we therefore decline to transplant the organs of the deceased? Transplanting the victim's organs does not condone what was done; that should be denounced in any case. But when we bring good out of the evil, we treat the victim as valuable in the sight of God and humans.

Similarly, those who decry abortion or believe IVF morally questionable might still find stem cell research acceptable. If the abortion or IVF was not performed specifically for the purpose of obtaining stem cells, or as long as using these embryonic tissues does not encourage the creation of embryos strictly for research purposes, one may attempt to bring good out of the evil.

Whether enough stem cells can be derived from unused embryos and whether enough different stem cells lines can be created is unknown. But perhaps combined with the recent success of working with adult stem cells, sufficient diverse stem cells lines can be generated without creating new embryos solely for the purpose of research.

Christian stewardship

The opening two chapters of Genesis portray God creating human beings and giving them three stewardship tasks: to fill the earth, to exercise dominion over it, and to care for it. The Christian might evaluate regenerative therapy in light of these commands. The command to fill can be considered not only quantitatively, but also qualitatively. God has given us the intellectual resources to improve our existence and that of the rest of creation. When coupled with the command to care for the creation, stem cell therapy is simply another medical tool God has given his stewards to care for each other in a fallen world.

The question remains concerning how we go about being stewards of stem cells, both in terms of obtaining them and in using them. Several biblical principles are clear. Where this technique is employed, it must be with justice to all, not merely to those who can afford the procedure. It must follow the principle of love shown in the Golden Rule, by treating others as we would want to be treated, minimally with the clear, informed consent of the patients. Those who suffer should be looked on as full participants in the research, not as means to others' goods.

Finally, we must balance the needs of those who suffer with our evaluation of the beginning of human personal life. That issue is not easy to resolve, but at the same time it has deep significance, for how we treat the beginning of human life has significant implications for how we treat the end of human life. From beginning to end, we must understand that we are acting as stewards of creation and of each other on behalf of God. ❑