BACKGROUND: A FEW DEFINITIONS AND OBSERVATIONS

A number of common chronic diseases, acquired and genetic, might be cured by replacing faulty cells and tissues with new ones.

- Acquired: heart failure because of scarring from heart attacks; diabetes; paralysis from spinal cord injury; neurodegenerative diseases—Parkinsonism, the dementias
- Genetic: sickle cell disease

Stem cells, particularly pluripotent ones—those able to make any tissue and reconstitute a whole organism, presumably a whole human in the case of the ethically impermissible field of reproductive cloning—stem cells offer a potential solution to cell and tissue replacement, so-called regenerative medicine.

How so? Stem cells are capable of so-called asymmetrical division—after division into 2, 1 may become another undifferentiated stem cell, while the other moves along a differentiation pathway. In the case of primitive, pluripotent stem cells, the progeny of multiple differentiated cells can yield multiple tissues, organs—even a whole individual.

Stem cell therapy for the complex, common diseases remains a theoretical construct, albeit with much done in animals to make it likely translatable into clinical (human) medicine.

There are precedents for a kind of stem cell therapy. A generic example is the use of undifferentiated or multi-potent stem cells DERIVED FROM SOMATIC TISSUES (NOT SPERM AND EGGS AND EMBRYOS)—those are able to differentiate into one or a limited number of cells or tissues. A specific example is the use of blood and bone marrow stem cells in transplantation into the blood stream to cure some with blood diseases like leukemia or sickle cell disease—albeit at considerable cost in terms of side effects because of immune reactions to the donors cells.

A source—perhaps not the exclusive source but perhaps the TECHNICALLY optimal source—of pluripotent stem cells is an early embryo (some would call it a “pre-embryo”). These early embryos can be variously crafted to yield embryonic stem cells that are a potential starting point in regenerative medicine.
There are two potential new sources of therapeutic pluripotent stem cells. One is an adult somatic cell (e.g., a skin cell) whose nucleus is transferred into a donated egg cell in a process called somatic cell nuclear transfer (SCNT). This yields stem cells through the mediation of an embryo-like structure. The second is an adult somatic cell that is exposed to molecular signals that mimic those from the egg (but no egg is in the picture). This yields stem cells (induced pluripotent stem cells, “iPS cells) that do not derive from an embryo-like structure.

These newer technologies, particularly that generating iPS cells, may advance the feasibility of and blunt ethical objections to the use of stem cells.

Stem cell therapy—because it is a new mode of therapy and because it highlights issues of what it is to be a human—raises important scientific, clinical, ethical, spiritual, and policy issues.

In the Year of Darwin (and Lincoln—and Obama) it seems a good time to touch on some of these issues.