Stem Cells Branch Out

Heals all manner of ailments, unlimited quantities, tailor-made for you. … No, it's not an advertisement for snake oil but may represent the promise of stem cells—cells that have the potential to produce various cell types that make up the body and might therefore provide replacements for tissues damaged by age, trauma, or disease. But the work raises numerous questions as well: Can such promise be true? What is the ethical cost of such developments? Who will fund the necessary R&D?

This special issue takes a look at these questions. The Reviews begin with Watt and Hogan's (p. 1427) description of what's currently known about stem cells. As the authors note, some stem cells are pluripotent: essentially blank slates that are ready when called on to differentiate into any cell type. But, as described by Slack (p. 1431), stem cells of certain tissues, such as epithelial structures, must fit in with existing tissue architecture. In a related Report, Meng *et al.* (p. 1489) describe progress in the search for stem cells that give rise to sperm.

A particular surprise has been the discovery of stem cells in unexpected places. As reviewed by Gage (p. 1433), the adult central nervous system, long thought not to contain cells capable of dividing, in fact harbors stem cells. Such cells may help treat Alzheimer's and Parkinson's disease. In addition, as discussed by Weissman (p.1442), hematopoietic stem cells from bone marrow may one day provide transplants to replace blood and immune cells.

The very blankness of stem cells has turned out to be a surprise as well: The right signals can send some adult stem cells down unexpected paths of differentiation. Van der Kooy and Weiss (p. 1439) discuss theories about the origins and development of this remarkable plasticity.

PAGE 1418

With these developments come great ethical challenges. Certain stem cells that show therapeutic potential are derived from early embryos or from fetal germ cells. As shown in a series of Viewpoints, opinions vary widely about whether the potential benefits outweigh the ethical costs of using such cells. To Young (p. 1424), the answer is clearly yes. But, as Perry notes (p. 1423), the use of such cells involves ethical issues that must be considered with great respect for the sanctity of human life. Reflecting the issue's complexity, policies of various governing bodies also vary. Lenoir (p. 1425) presents a European perspective.

Finally, the News component of this special issue includes three stories. One addresses the issue of whether adult stem cells can provide cells for all kinds of tissues, thereby relieving the ethical quandary posed by the use of embryonic or fetal cells. The second looks at the companies now going into the stem cell business, and the third deals with the lessons that 10 years of fetal cell transplants for treatment of Parkinson's disease might provide for the stem cell work.

Whatever the scientific and ethical uncertainties, as Frankel notes in the Editorial (p. 1397), we must move with all due consideration, but without unnecessary delay, toward the answers so that the promises and benefits of stem cells can be effectively explored.

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CONTENTS

See also Editorial on p. 1397 and Report on p. 1489.

Science