

Adult Stem Cells Are Therapy's Real Future

by Dr. Wolfgang Lillge

Whoever really seeks to cure, must turn exclusively to work with the adult stem cell. Perhaps he would not make as much money, but he would instead, with far greater likelihood, develop therapeutic possibilities for severe degenerative diseases, such as Parkinson's, multiple sclerosis, or diabetes.

"Adult" stem cells are, so to speak, ideal for medical operations on the human body. They are already there in the person's system, continuously refreshing bodily functions and replacing cells. The skin, by way of example, is completely "replaced" every 14 days; in the blood, several million cells are completely replaced every 24 hours. Other phenomena are less known, like, for instance, their powerful regenerative power; or, the established fact that even full-grown adults grow new nerve cells from the stem cells in the brain. The source and engine of all these growth processes are the adult stem cells in the respective tissue.

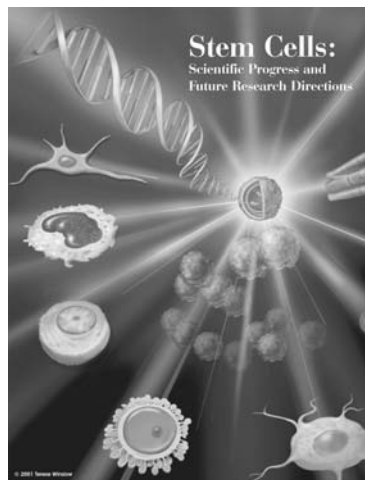
From this comes the new realization, that adult stem cells clearly have a highly adaptive capability. If, for example, a bone marrow stem cell is implanted in the brain, it can readily transform itself into a nerve cell. Likewise, in the spectacular treatment of a heart attack patient in the Düsseldorf University Clinic this past Summer, the stem cells came from the bone marrow, and in a short time, built themselves into heart muscle cells.

However, probably the greatest advantage is that the adult stem cells for therapeutic purposes come from the patient's own body; they thus in no way cause rejection reactions by the immune system, and show the same "genetic stability" as adjacent cells. If one, on the contrary, wants to extract compatible immune tissue from embryonic stem cells, in that case, one would have to follow the course of so-called "therapeutic cloning" of human embryos—exactly that procedure in America, which now has run into so much condemnation.

Likewise, the not insignificant risk involved in implanting embryonic stem cells, does not occur with adult stem cells.

First Research Results

Numerous experiments in the recent period have demonstrated the great transformation potential of adult stem cells. In patients with a liver transplant, it can be proved that their bone marrow cells have migrated into the new liver, and have created new liver cells there. And, in a new study from Canada, it was shown, that human skin cells can be re-programmed to other cell types.



The U.S. National Institutes of Health issued a detailed report this year. A Responsible Stem Cell Research Act, which would authorize \$30 million through NIH for adult stem cell research, is canvassing Congressional support; a German parliamentarian has called for \$50 million. Stem cells from living adults show more therapeutic promise than embryonic stem cells.

Adult stem cells have been isolated from mice, as well as from human skin, which then developed a multitude of characteristics of nerve cells in the cell culture. One may easily change the conditions in the cell culture, having thus generated from the skin stem cells of the mouse even a specific kind of muscle cell or fat cell. Even after a year in the cell culture, the skin stem cells of the mouse retained the capability to build different kinds of cells. Because small pieces of skin can be removed without great hygienic or technical problems, this tissue would be capable of developing into an optimal source of stem cells for therapeutic purposes.

Of course, considerable problems also still have to be overcome with adult stem cells: Adult stem cells are relatively scarce; hard to find with present techniques; and also not very easy to propagate outside the body. Thus, it was an important advance that Australian researchers at the Walter and Eliza Hall Institute of Medical Research have now found a way to isolate "extremely pure" adult nerve stem cells from the brain of a mouse. In *Nature* (412, Aug. 16, 2001, 736-739), they report being able to produce a culture with 80% purity, compared with the present rate of 5% in the "best case."

Germany is leading in some areas of research with adult stem cells, but in view of the prospects for medicine and basic research, a biophysical "Great Project" is needed in this field; comparable, as it were, in order of magnitude, only to the efforts in cancer research. The Christian Democratic Deputy Hubert Hüppe, assistant chairman of the German Bundestag's Commission of Inquiry for Law and Ethics in Modern Medicine, has already demanded a DM 100 million (roughly \$50 million) program for adult stem cell research—for which about DM 6 million has currently been allocated in public support. That would be perhaps a first estimate. However, it would have to follow a broadly designed research project, whose purpose is not only developing immediate therapeutic applications, but advancing our understanding of the process of life altogether.