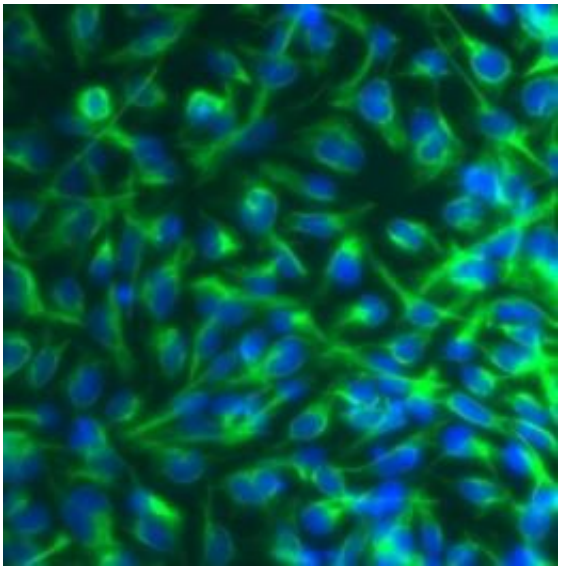
Transplanted neural stem cells treat ALS in mouse model

December 19 2012



Transplanted neural stem cells (shown here) were used to treat a mouse model of ALS. Credit: Sanford-Burnham Medical Research Institute

Amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease, is untreatable and fatal. Nerve cells in the spinal cord die, eventually taking away a person's ability to move or even breathe. A consortium of ALS researchers at multiple institutions, including Sanford-Burnham Medical Research Institute, Brigham and Women's Hospital, and the University of Massachusetts Medical School, tested transplanted neural stem cells as a treatment for the disease. In 11 independent studies, they found that transplanting neural stem cells into

the spinal cord of a mouse model of ALS slows disease onset and progression. This treatment also improves host motor function and significantly prolongs survival. The transplanted neural stem cells did not benefit ALS mice by replacing deteriorating nerve cells. Instead, neural stem cells help by producing factors that preserve the health and function of the host's remaining nerve cells. They also reduce inflammation and suppress the number of disease-causing cells in the host's spinal cord.

These findings, published December 19 in *Science Translational Medicine*, demonstrate the potential neural stem cells hold for treating ALS and other nervous system disorders.

"While not a cure for human ALS, we believe that the careful transplantation of neural stem cells, particularly into areas that can best sustain life—respiratory control centers, for example—may be ready for clinical trials," Evan Y. Snyder, M.D., Ph.D., director of Sanford-Burnham's Stem Cell and Regenerative Biology Program and senior author of the study.

Neural stem cells

In this study, researchers at multiple institutions conducted 11 independent studies to test neural stem cell transplantation in a well-established mouse model of ALS. They all found that this cell therapy reduced the symptoms and course of the ALS-like disease. They observed improved motor performance and respiratory function in treated mice. Neural stem cell transplant also slowed the disease's progression. What's more, 25 percent of the treated ALS mice in this study survived for one year or more—roughly three to four times longer than untreated mice.

Neural stem cells are the precursors of all brain cells. They can self-

renew, making more neural stem cells, and differentiate, becoming nerve cells or other brain cells. These cells can also rescue malfunctioning nerve cells and help preserve and regenerate host brain tissue. But they've never before been studied extensively in a good model of adult ALS.

How neural stem cells benefit ALS mice

Transplanted neural stem cells helped the ALS mice, but not for the obvious reason—not because they became nerve cells, replacing those missing in the ALS spinal cord. The biggest impact actually came from a series of other beneficial neural stem cell activities. It turns out neural stem cells produce protective molecules. They also trigger host cells to produce their own protective molecules. In turn, these factors help spare host nerve cells from further destruction.

Then a number of other positive events take place in treated mice. The transplanted normal neural stem cells change the fate of the host's own diseased neural stem cells—for the better. This change decreases the number of toxin-producing, disease-promoting cells in the host's spinal cord. Transplanted neural stem cells also reduce inflammation.

"We discovered that cell replacement plays a surprisingly small role in these impressive clinical benefits. Rather, the stem cells change the host environment for the better and protect the endangered nerve cells," said Snyder. "This realization is important because most diseases are now being recognized as multifaceted in their cause and their symptoms—they don't involve just one cell type or one malfunctioning process. We are coming to recognize that the multifaceted actions of the stem cell may address a number of these disease processes."

Provided by Sanford-Burnham Medical Research Institute