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TRANSPLANTED STEM CELLS FORM PROPER BRAIN CONNECTIONS

In new animal study, neurons developed from stem cells successfully wired with other brain regions

Washington, DC — Transplanted neurons grown from embryonic stem cells can fully integrate into the brains of young animals, according to new research in the Jan. 20 issue of *The Journal of Neuroscience*. Healthy brains have stable and precise connections between cells that are necessary for normal behavior. This new finding is the first to show that stem cells can be directed not only to become specific brain cells, but to link correctly.

In this study, a team of neuroscientists led by James Weimann, PhD, of Stanford Medical School focused on cells that transmit information from the brain's cortex, some of which are responsible for muscle control. It is these neurons that are lost or damaged in spinal cord injuries and amyotrophic lateral sclerosis (ALS). "These stem cell-derived neurons can grow nerve fibers between the brain's cerebral cortex and the spinal cord, so this study confirms the use of stem cells for therapeutic goals," Weimann said.

To integrate new cells into a brain successfully, the researchers first had to condition unspecialized cells to become specific cells in the brain's cortex. Cells that were precursors to cortical neurons were grown in a Petri dish until they displayed many of the same characteristics as mature neurons. The young neurons were then transplanted into the brains of newborn mice — specifically, into regions of the cortex responsible for vision, touch, and movement.

Until now, making these proper cellular connections has been a fundamental problem in nervous system transplant therapy. In this case, the maturing neurons extended to the appropriate brain structures, and, just as importantly, avoided inappropriate areas. For example, cells transplanted into the visual cortex reached two deep brain structures called the superior colliculus and the pons, but not to the spinal cord; cells placed into the motor area of the cortex stretched into the spinal cord but avoided the colliculus.

"The authors show that appropriate connectivity for one important class of projection neurons can be obtained in newborn animals," said Mahendra Rao, MD, PhD, an expert in stem cell biology at Life Technologies, who was unaffiliated with the study.

The researchers also compared two methods used to grow transplantable cells, only one of which produced the desired results. "The authors provide a protocol for how to get the right kind of neurons to show appropriate connectivity," Rao said. "It's a huge advance in the practical use of these cells."

Researchers will now explore whether the same results can be achieved in adult animals and, ultimately, humans. Weimann and his colleagues also hope to understand how the transplanted cells "knew" to connect in precisely the right way, and whether they can generate the right behaviors, such as vision and movement.

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Images are available upon request.

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Sincerely,

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