Stem cells found to cure epilepsy in mice

May 6, 2013
Courtesy of UCSF
and World Science staff

Biologists report that they have cured seizures in epileptic mice using a one-time transplantation of stem cells that inhibit signaling in overactive nerve circuits.

The researchers put the embryonic stem cells, or progenitor cells, into the hippocampus, a brain region associated with seizures, as well as learning and memory. Other researchers had previously used different cell types in rodent cell transplantation experiments and failed to stop seizures, according to the scientists.

Current epilepsy medications only control symptoms and not the causes, said Scott C. Baraban, a neuroscientist at the University of California San Francisco who led the new study. In many types of epilepsy, he added, the drugs don't even work.

"This procedure offers the possibility of controlling seizures and rescuing cognitive deficits in these patients," although more research is needed, he said. "This is the first report in a mouse model of adult epilepsy in which mice that already were having seizures stopped having seizures after treatment." The findings were published online May 5 in the journal *Nature Neuroscience*.

During epileptic seizures, extreme muscle contractions and, often, loss of consciousness can lead patients to lose control, fall and sometimes suffer serious injury. The cause is the abnormal firing of many excitatory nerve cells in the brain at the same time. The transplanted cells, called medial ganglionic eminence cells, quenched this firestorm, ending seizures in half of the treated mice and dramatically reducing the number of spontaneous seizures in the rest, according to the scientists.

They also reported May 2 in the journal Cell Stem Cell that they found a way to reliably generate similar cells, but human versions, in the laboratory.

In many forms of epilepsy, loss or malfunction of inhibitory nerve cells within the hippocampus plays a critical role. The transplanted cells in question are progenitor cells that form early within the embryo and are capable of generating mature inhibitory nerve cells called interneurons. In the new study, the transplanted cells from mouse embryos migrated and generated interneurons, in effect replacing the cells that fail in epilepsy, the scientists explained. The new cells integrated into existing neural circuits in the mice, the researchers found.

"These cells migrate widely and integrate into the adult brain as new inhibitory neurons," Baraban said.

The mouse model of disease that Baraban's lab team worked with is meant to resemble a severe and typically drug-resistant form of human epilepsy called mesial temporal lobe epilepsy, in which seizures are thought to arise in the hippocampus.