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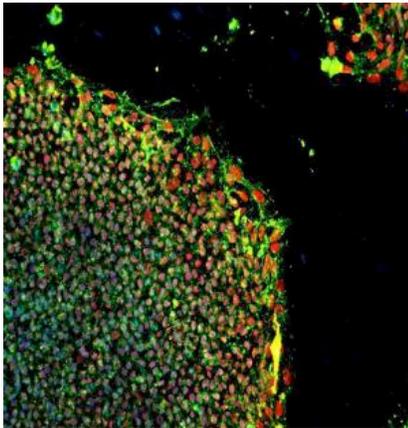
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Embryonic stem cells may restore brains damaged by radiation

November 10, 2009 | 1:13 pm

Scientists at UC Irvine and UC San Francisco have found a potential new use for [human embryonic stem cells](#) – helping cancer patients recover the cognitive function lost when their brains are treated with radiation.

People with tumors in their head or neck often undergo radiation therapy after the cancer is surgically removed. That radiation helps kill off any malignant cells left behind. But it can also debilitate the region of the brain called the [hippocampus](#), which is responsible for learning, memory and processing of spatial information. It is also one of only two areas in the brain known to produce new neurons.



The UC researchers wondered whether embryonic stem cells could pick up the slack. In their pluripotent state, they have the potential to grow into any type of cell in the body. When injected into the hippocampus, would they naturally replace neurons damaged or killed by radiation therapy?

To find out, they radiated the heads of 18 rats. Two days later, six of those rats got two injections of human embryonic stem cells directly into the hippocampus.

After four months, the researchers used a standard test to measure the rats' cognitive abilities. They placed the animals in an arena with two Lego blocks – borrowed from the son of senior researcher [Charles Limoli](#) – and were allowed to

explore as long as they liked. When they were done, the researchers took the rats out of the arena and moved one of the blocks. Five minutes later, the rats went back in.

All of the animals studied both of the blocks, but the rats that were treated with stem cells spent significantly more time nosing around the one that had been moved. They did so, the researchers say, because they remembered where it used to be and thus were curious about its new position. In fact, they spent almost as much time investigating the block as did a group of control rats that were never subjected to any radiation. But the radiated rats that didn't get stem cells lost roughly half of their cognitive function, [according to the study](#), published in this week's edition of Proceedings of the National Academy of Sciences.

The scientists tested the rats again 24 hours later and got similar – though less pronounced – results.

When the tests were over, the researchers euthanized the rats and studied their brains. Sure enough,

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the stem cells had grafted into the hippocampus, where they grew into neurons and another kind of brain cell called astrocytes. In the four months that they were in the rat brains, the stem cells didn't appear to grow into tumors, though that might have happened if the rats lived longer.

The results suggest that embryonic stem cells could spare cancer patients much of the short-term memory loss that results from cranial radiation and perhaps boost long-term memory as well, the researchers wrote. But several hurdles would have to be cleared before it could be tried in people.

Instead of using embryonic stem cells – which many people object to because they are derived from embryos – patients could be treated with induced pluripotent stem cells. Better known as iPS cells, these reprogrammed cells have been found to behave almost exactly like embryonic stem cells in a variety of laboratory tests. They could be custom-made for cancer patients, reducing the risk that the stem cell transplants would be rejected. But more research is needed to ensure that they would not form new tumors.

“Any treatments showing promise at reversing this are worthy of pursuit,” Limoli, an associate professor of radiation oncology at UCI, said in a statement.

The experiments were funded by the [National Institutes of Health](#) and the [California Institute for Regenerative Medicine](#).

-- Karen Kaplan

Photo: These human embryonic stem cells restored cognitive function to rats whose brains were damaged by radiation. Credit: Munjal Acharya / UCI

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