



Researchers Coax Human Stem Cells to Become Motor Neurons

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TIMING IS EVERYTHING IN THE DEVELOPMENT of human stem cells, researchers from the University of Wisconsin in Madison have discovered. By exposing human embryonic stem cells to various biologic factors in a precisely timed manner, they succeeded in coaxing the stem cells to develop into motor neurons, which transmit messages from the central nervous system to the muscles. The research provides valuable insights into the unique challenges of working with human stem cells, and it may speed the development of treatments for such motor neuron disorders as amyotrophic lateral sclerosis.

“The main point is that human stem cells can be directed to become any cell you would like, but you have to tell them what to do and when,” said Su-Chun Zhang, MD, PhD, an assistant professor and stem cell researcher at the Waisman Center at the University of Wisconsin. The research was published online in the journal *Nature Biotechnology* on January 30, 2005 (available online at <http://www.nature.com/nbt>).

While laboratory-grown motor neurons may someday provide cells for transplantation into individuals with spinal injuries and motor neuron-related diseases, the findings have more immediate applications in stem cell research and neurological disease research, Zhang said.

Research on mouse stem cell differentiation has not translated well into human stem cell differentiation, in part because mouse development occurs so

quickly that the importance of timing is masked, explained Zhang. Because development in humans is slower, studying human stem cell differentiation “has allowed us to tease out the [timing] of introducing biologic factors,” he said.

Zhang emphasized the need for continuing basic research on human stem cells. “There are fundamental questions not yet solved in human stem cells, and people should not jump ahead into translational research,” he said.

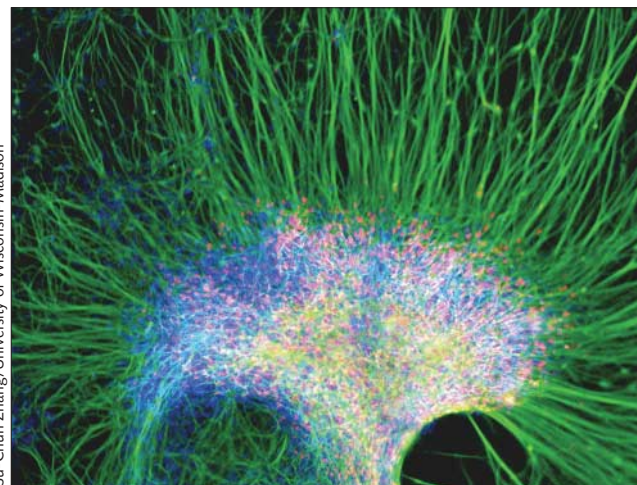
The ability to grow human motor neurons in the laboratory will provide new insights into disease processes and could be used as an alternative to animal models for finding therapeutic targets and testing drugs.

“The motor neurons we have grown give us an opportunity to look at the processes of motor neuron degeneration and to learn how to stop them,” Zhang said.

Serge Przedborski, MD, PhD, a professor of neurology and pathology at

Columbia University Medical Center in New York City, who is studying the potential uses of stem cells in treating such conditions as amyotrophic lateral sclerosis and spinal cord injuries, said the Wisconsin group’s information has important clinical implications. He noted this research may help identify developmental problems as well. “There may be some subtle imperfection in this complicated program of [motor neuron] differentiation that may place individuals at greater risk of ultimately developing the disease.”

Lucie Bruijn, PhD, scientific director and vice president of the ALS Association in Calabasas Hills, Calif, which provided most of the funding for the research, said the cells will have an immediate impact on amyotrophic lateral sclerosis research. “We now have an abundant resource of human motor neurons, which we can use in cell cultures and in vitro studies to test various pharmacological drugs,” he said. □



University of Wisconsin researchers grew this cluster of neural cells from human embryonic stem cells. The cells shown in pink are motor neurons; the gradual loss of motor neuron function is a key feature of amyotrophic lateral sclerosis.