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Discovery of 'creator' gene for cerebral cortex points to potential stem cell treatments

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University of California, Irvine researchers have identified a gene that is specifically responsible for generating the cerebral cortex, a finding that could lead to stem cell therapies to treat brain injuries and diseases such as stroke and Alzheimer's.

Dr. Edwin Monuki, doctoral student Karla Hirokawa and their colleagues in the departments of Pathology & Laboratory Medicine and Developmental & Cell Biology found that a gene called Lhx2 serves as the long-sought cortical "creator" gene that instructs stem cells in the developing brain to form the cerebral cortex. This portion of the brain is responsible for higher sensory and cognitive functions, such as language, decision-making and vision. Without this gene, cortical cells will not form.

"This new understanding of Lhx2's role in cortical development can potentially be used in stem cell research efforts to grow new cortical neurons that can replace damaged ones in the brain," said Monuki, an assistant professor of pathology. "This finding has implications for continuing efforts to help people recover from a stroke or slow the progress of neurodegenerative diseases."

Study results appear in the Jan. 18 issue of *Science*.

Lhx2 is among a group of genes – called selector genes – that act during key moments of embryonic and fetal development, directing stem cells to grow into specific parts of the body – such as brain, blood and bone.

In tests on rodents, the researchers found that Lhx2's cortical selector activity is critical only during the stage when the developing cortex is made up of stem cells, not before or after. In addition, they found that cortical stem cells that don't express the Lhx2 gene turn into a different cell type – called a hem cell – that induces neighboring cells to become the hippocampus, the oldest part of the cortex in evolutionary terms and a major memory center of the brain.

Lhx2's role in cerebral cortex development has far-reaching implications in the nascent field of stem cell research. The Monuki lab is currently studying how to activate Lhx2 genes in neural stem cells and initiate the process in which new cortical cells can grow. "If successful, the concept of using Lhx2 to instill stem cells with cortical properties could be a basis of clinical studies that could one day help treat patients," he said.

Researchers in Monuki's lab are deeply involved with stem cell research. Last month, they published a study identifying a new way to sort stem cells that should be quicker, easier and more cost-effective than current methods. The technique could in the future expedite therapies for people with conditions ranging from brain and spinal cord damage to Alzheimer's and Parkinson's diseases.

Source: University of California - Irvine

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