Researchers identify gene involved in building brains

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A tiny molecule is key to determining the size and shape of the developing brain, researchers from the Picower Institute for Learning and Memory at MIT reported in the March issue of *Nature Neuroscience*. This molecule may one day enable scientists to manipulate stem cells in the adult brain.

A candidate plasticity gene and its growth-promoting protein, CPG15, could potentially be used to develop therapies for renewing damaged or diseased tissue. While stem cells regenerate neurons in only a few regions of the adult brain, researchers have speculated that a lack of adult stem cells may cause memory deficits and other disorders.

Elly Nedivi, Fred and Carol Middleton assistant professor in brain and cognitive sciences at MIT, found that CPG15--one of many novel plasticity-related genes she has uncovered--is key to the survival of neural stem cells in early development.

Nedivi, postdoctoral associate Ulrich Putz and brain and cognitive sciences graduate student Corey C. Harwell identified a form of CPG15 that protects cortical neurons from apoptosis, or programmed cell death. Apoptosis is a normal and essential part of early development, when brain cells proliferate rapidly and some are killed off, but little is known about how apoptosis of growing neurons is regulated.

"CPG15 is one of the few molecules shown to be essential for survival of specific stem cell populations in the developing brain," Nedivi said.

"By controlling apoptosis, CPG15 allows the progenitor pool (of cells) to expand, and even modest changes in the size of the progenitor pool during its exponential growth phase can drastically affect the final size and shape of the cortex."

Over-expressing CPG15 in rats gives them bigger brains. In addition, their enlarged brains have grooves and furrows like evolved mammalian brains with larger surface areas.

"We propose that by countering early apoptosis in specific progenitor populations, CPG15 has a role in regulating size and shape of the mammalian forebrain," the authors wrote.

This knowledge may one day be used to enhance survival of normally occurring stem cells in the human brain, or to grow neurons outside the body and then deposit them where needed to replace damaged or diseased tissue.

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Source: Massachusetts Institute of Technology