SCIENCE NEWS of the week

Adult Neurons: Not Too Old to Divide

A naturally occurring protein can prompt mature nerve cells taken from the brains of adult mice to grow and divide, according to new findings that have startled many neuroscientists.

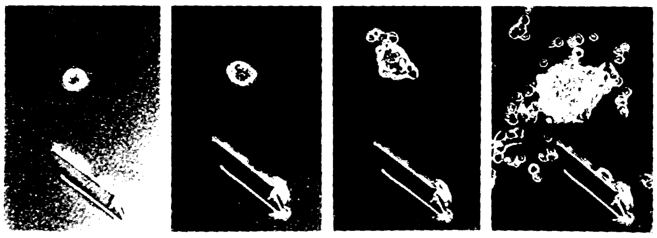
The results overturn a long-accepted theory that central nervous system nerve cells in mammals lose the ability to reproduce before or soon after an individual's birth. The discovery also indicates that mammalian central nervous systems may have a latent capability to heal themselves following injury or disease, holding out new hope for patients suffering from head trauma or neurodegenerative disorders such as Parkinson's disease. However, the authors of the study and other neuroscientists caution that any clinical applications of the findings will take many years to develop.

In the new study, neuroscientists Samuel Weiss and Brent A. Reynolds of the University of Calgary Faculty of Medicine in Alberta isolated previously unknown brain "stem cells" that give rise to the two major types of brain cells: nerve cells, or neurons, and the glial cells that feed and nurture them. The researchers found the stem cells by mincing the brains of adult mice and placing 1,000 of the resulting cells into each of 40 culture dishes containing epidermal growth factor (EGF), a protein known to orchestrate the development of skin and nervous tissue in embryos. They also put some of the cells in dishes without EGF.

Weiss and Reynolds suspected that EGF might affect adult brain cells because several other groups of researchers had previously demonstrated that adult neurons from mice and humans bear receptors for EGF on their surfaces.

In the March 27 SCIENCE, they report that EGF caused an average of 15 cells out of the 1,000 in each dish to live beyond two days, when the rest of the cells died off. And surprisingly, when the researchers put one of the surviving cells into a separate dish that also contained EGF, it multiplied into a mass of new cells. In contrast, no cells survived or grew in the dishes not treated with EGF, Weiss and Reynolds found.

To prove that the multiplying cells were indeed brain cells, the two researchers treated them with fluorescently labeled antibodies made to bind to nestin, a protein usually found only in young nervous-system cells. Almost all of the cells began to glow, indicating that they contained nestin. Moreover, the developing cells began to look like brain cells when the researchers placed some of them on a sticky surface: The young neurons sprouted two types of long tendrils, called dendrites and axons, that they use to connect to one another, while the young glial cells became characteristically plump and star-shaped. The neurons also produced two chemicals used to send signals between nerve cells.



Weiss and Reynolds

In the presence of EGF, a single adult brain cell proliferates into a larger clump of cells over six days.

Weiss says the results suggest that adult human brains might also harbor a tiny number of dormant cells that have the potential to replace dead or damaged ones. He speculates that these cells fail to develop in people with brain injuries or neurodegenerative diseases because the cells require EGF, which may not move readily from the blood into the brain.

Weiss and Reynolds are now collaborating with neuroscientists Cindi M. Morshead and Derek van der Kooy of the University of Toronto to test whether EGF injections administered directly into the brains of mice can stimulate the dormant stem cells. Such a strategy might offer an alternative to transplants of fetal brain tissue, a technique that federally funded U.S. researchers are currently prohibited from testing in humans (SN: 11/11/89, p.310). "This information . . . may open up a new line of research using what the brain already has rather than trying to transplant foreign cells from other sources," Weiss suggests.

Pasko Rakic, a neuroscientist at Yale University, terms the findings of Weiss and Reynolds "really interesting and exciting." But he warns that prompting the growth of new neurons in the brains of adults might further muddle the memories and brain functions of such patients.

– C. Ezzell

A moisture problem muddles climate work

The world's 19 best computer climate models differ substantially in the way they simulate "moist" processes in the atmosphere – a problem scientists must solve to improve global warming predictions, a new study warns.

"This study and others suggest to me that existing models are capable of giving qualitative evaluations but are not capable of making quantitative predictions," says study leader David A. Randall of Colorado State University in Fort Collins.

The study by 31 researchers in eight countries expands on a previous comparison which showed that models disagree in their assessment of how clouds affect radiation leaving or entering the top of Earth's atmosphere. The new study looked at another facet of the climate: energy absorbed and released from Earth's surface.

The scientists compared the models by running identical simulations of simple climate changes. At first, they lowered sea-surface temperatures by 2°C below present conditions and then let the atmosphere react. Later, they raised sea temperatures by 2°C above present conditions.

The comparison revealed that models differed greatly in their portrayal of energy entering and leaving Earth's surface, the researchers report in the March 20 JOURNAL OF GEOPHYSICAL RESEARCH. But unlike the previous disagreement, this inconsistency does not trace directly back to the effect of clouds on radiation. Instead, it results from the way each model treats processes involving moisture. Most important among these are surface evaporation, the development of cumulus clouds and the absorption and emission of radiation by water vapor.

The results have important implications for those trying to improve predictions of climate change. Some scientists and administrators have emphasized the need to boost computer power, thereby permitting the use of models with greater spatial resolution. But Randall and his colleagues say this will not solve existing problems. From their study and others, they conclude that "dramatically increased computer power would not, by itself, be sufficient to greatly improve either our ability to simulate the present climate or our confidence in climate-change simulations produced by existing models."

Instead, Randall emphasizes the need for meteorological observations and theoretical investigations aimed at improving scientific understanding of how the climate works. *– R. Monastersky*