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New adult brain cells may be central to lifelong learning

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The steady formation of new brain cells in adults may represent more than merely a patching up of aging brains, a new study has shown. The new adult brain cells may serve to give the adult brain the same kind of learning ability that young brains have while still allowing the existing, mature circuitry to maintain stability.

Hongjun Song and colleagues reported their findings in the May 24, 2007 issue of the journal *Neuron*, published by Cell Press.

In their experiments, they used a virus to selectively label new brain cells with a fluorescent protein in the hippocampus, a major brain center for learning and memory, of adult mice.

The researchers then analyzed the electrophysiological properties of the new neurons at different times after their formation. This analysis enabled them to measure how adaptable, or "plastic," the brain cells were.

The researchers found that the new adult neurons showed a pattern of changing plasticity very similar to that seen in brain cells in newborn animals. That is, the new adult brain cells showed a "critical period" in which they were highly plastic before they settled into the less plastic properties of mature brain cells. In newborn animals, such a critical period enables an important, early burst of wiring of new brain circuitry with experience.

What's more, the researchers' molecular analysis showed that the plasticity of new adult neurons depended on the function of one of the same types of receptors that is associated with learning-related processes in newborn animals. Such receptors are the receiving stations for chemical signals called neurotransmitters, launched from neighboring neurons to trigger a nerve impulse in the receiving neurons. Subtle alterations in receptor populations are the means by which the brain wires the preferred pathways in the process of learning and memory.

The researchers also observed in the new adult neurons anatomical evidence of the same kind of formation of new connections that take place in the brains of newborns as they wire new pathways in response to experience.

The researchers wrote that, since the adult form of critical-period plasticity resembles that seen in young brains, "adult-born neurons within the critical period may serve as major mediators for experience-driven plasticity and therefore function as special units in the adult circuitry to contribute to specific brain functions throughout life."

They concluded that "adult neurogenesis may represent not merely a replacement mechanism for lost neurons, but instead an ongoing developmental process that continuously rejuvenates the mature nervous system by offering expanded capacity of plasticity in response to experience throughout life."

Source: Cell Press