Adult brain neurons can remodel connections

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Overturning a century of prevailing thought, scientists are finding that neurons in the adult brain can remodel their connections. In work reported in the Nov. 24 online edition of the *Proceedings of the National Academy of Sciences (PNAS)*, Elly Nedivi, associate professor of neurobiology at the Picower Institute for Learning and Memory, and colleagues found that a type of neuron implicated in autism spectrum disorders remodels itself in a strip of brain tissue only as thick as four sheets of tissue paper at the upper border of cortical layer 2.

"This work is particularly exciting because it sheds new light on the potential flexibility of cerebral cortex circuitry and architecture in higher-level brain regions that contribute to perception and cognition," said Nedivi, who is also affiliated with MIT's departments of brain and cognitive sciences and biology. "Our goal is to extract clues regarding the contribution of structural remodeling to long-term adult brain plasticity — the brain's ability to change in response to input from the environment — and what allows or limits this plasticity."

In a previous study, Nedivi and Peter T. So, professor of mechanical engineering and biological engineering at MIT, saw relatively large-scale changes in the length of dendrites — branched projections of nerve cells that conduct electrical stimulation to the cell body. Even more surprising was their finding that this growth was limited to specific type of cell. The majority of cortical neurons were stable, while the small fraction of locally connecting cells called interneurons underwent dynamic rearrangement.

In the current study, they show that the capacity of interneurons to remodel is not predetermined by genetic lineage, but imposed by the circuitry within the layers of the cortex itself. "Our findings suggest that the location of cells within the circuit and not pre-programming by genes determines their ability to remodel in the adult brain," Nedivi said. "If we can identify what aspect of this location allows growth in an otherwise stable brain, we can perhaps use it to coax growth in cells and regions that are normally unable to repair or adjust to a changing environment.

"Knowing that neurons are able to grow in the adult brain gives us a chance to enhance the process and explore under what conditions we can make it happen," Nedivi said. "In particular, we need to pay more attention to the unique interneuron population that retains special growth features into adulthood."

Source: Massachusetts Institute of Technology

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