Brain activity boosts processes that promote neural connections

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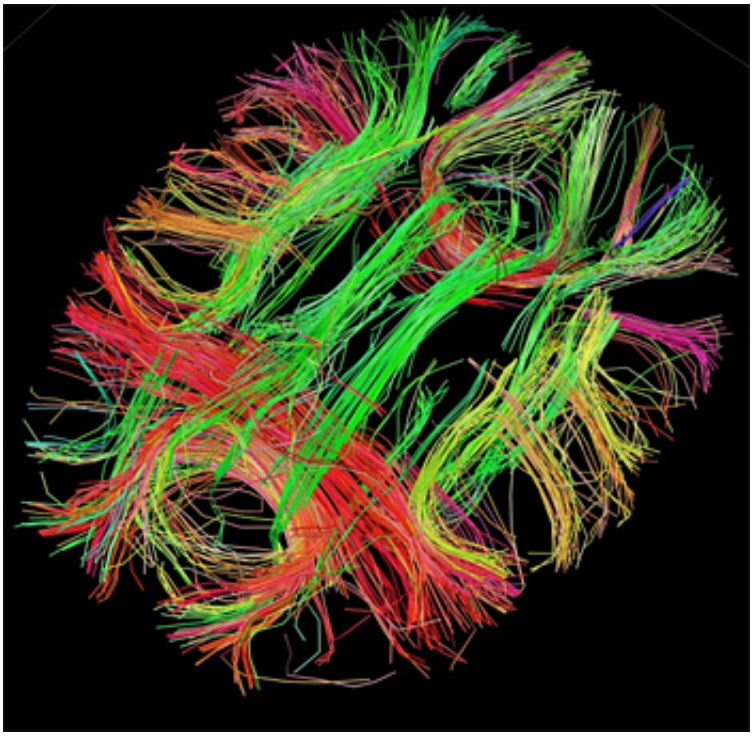

White matter fiber architecture of the brain. Credit: Human Connectome Project.

Brain activity affects the way the developing brain connects neurons and a study by researchers at the School of Medicine on the University of Colorado Anschutz Medical Campus and Children's Hospital Colorado suggests a new model for understanding that process.

In a study of zebrafish, scientists tested how brain activity affected the development of insulating sheaths on selected axons, which are slender nerve fibers that conduct electrical impulses between neurons. They found that, while the wrapping of axons was indiscriminate, the molecular and cellular mechanisms that stabilize the sheaths contribute substantially to axon selection in response to activity.

"Our study has implications for understanding psychiatric disease and ties into the current conversations about the changing adolescent and teenage brain," said Bruce Appel, PhD, who is professor of pediatrics, the Diane G. Wallach Chair of Pediatric Stem Cell Biology at Children's Hospital Colorado and senior author of the study, which is published in the April 6 edition of the journal *Nature Neuroscience*.

This study builds on previous research showing that white matter of the brain can develop by learning to juggle or play a musical instrument. The brain's white matter consists of axons, the long nerve fibers that conduct electrical signals between nerve cells and connect different parts of the brain together.

"We asked, 'What is it about brain activity that could affect white matter?'" Appel said.

In experiments, the scientists found that activity-dependent secretion from axons promoted extension and stabilization of the prospective sheaths that protected the axons. Without brain activity, the sheaths were able to form, but did not extend and were retracted at a higher frequency.

More information: Neuronal activity biases axon selection for myelination in vivo, DOI: 10.1038/nn.3992

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