The aging brain is more malleable than previously believed

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Neuroscientists are finding that, as we get older, our aging brains are proving surprisingly malleable, and in ways not previously anticipated. But there are limitations.

There is growing evidence that, beyond what was previously believed, the adult human brain is remarkably malleable and capable of new feats -- even in the last decades of life.

In fact, new experiences can trigger major physical changes in the brain within just a few days, and certain conditions can accelerate this physical, chemical and functional remodeling of the brain.

"We used to think that the brain was completely formed by development and its basic structure didn't change much in adults, but as research went on we discovered that wasn't true, at least in the cerebral cortex," explains Randy Bruno, a member of the Kavli Institute for Brain Science at Columbia University. "We now know that an underlying portion of the brain called the thalamus, which feeds the cortex information from our senses, is also remarkably plastic."

Change can also happen quickly. Using new research techniques on rats, Bruno's lab has found that the neuronal connections bridging the thalamus to the cortex are not only massively plastic, but they grow and retract rather rapidly in only a few days in response to different sensations. "The rapidity of this growth is really striking—it happens within just three days, which is something nobody in the past thought

was possible. Those kinds of rapid physical changes also probably occur in other parts of the brain as well."

In fact, certain conditions accelerate this physical, chemical and functional remodeling of the brain. Said Michael Merzenich, Emeritus Professor at the Keck Center for Integrative Neurosciences at the University of California at San Francisco, and Director and founder of the Brain Plasticity Institute, "In our experiments in adult rats, changes only occurred when the animal was attentive within a rewarded learning environment. When we train the animals to improve their behavioral capabilities under near-optimal contextual conditions, we can drive easily recordable functional and physical changes in the cerebral cortex within a day or two. By contrast, little or no change is induced by the passive exposure of an animal to many days of stimulation with thousands of the same stimuli applied in training."

At the same time, there are limitations that come with age. "There is no evidence that there is any part of the adult brain that is not plastic," said Randy Nudo, Director of the Landon Center on Aging and Professor in the Department of Molecular and Integrative Physiology at the University of Kansas. "But studies indicate that some aspects of musical training, such as the ability to perceive temporal patterns, require the brain to be trained during early developmental periods when its primed for certain types of stimuli. For other aspects of musical development, such as the ability to perceive and repeat a sequence of tones, it's irrelevant whether you've had that experience and training early in life."

All of this matters when considering the relationship between age and brain developmental disorders such as autism, Down's syndrome, and dyslexia. "The brain is plastic for life," said Merzenich. "The fundamental thing that determines how much [persons with brain disorders] will improve is the level of their initial impairment, but not their age."

More information: The complete story is available at: www.kavlifoundation.org/scienc … tastic-plastic-brain

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