

Neuroscientists pinpoint brain site for rapid learning

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MIT researchers have provided the first two-pronged evidence--based on both behavior and physiology--that a specific juncture in the memory center of the brain is crucial for rapid learning.

The work, presented Oct. 18 at a meeting of the Society for Neuroscience in Atlanta, helps explain how injury or Alzheimer's disease result in loss of the ability to form new memories of facts and events.

The researchers, led by Thomas J. McHugh, research scientist at the Picower Institute for Learning and Memory, engineered a mouse lacking a receptor for a key neurotransmitter in the dentate gyrus. This serrated strip of gray matter is wrapped around and within the seahorse-shaped hippocampus, which is crucial in memory formation. Information arriving at the hippocampus first travels through the dentate gyrus.

"While it has long been known that damage to this region of the hippocampus affects short-term memory formation, little is understood about how each type of neuron-to-neuron connection contributes to memory in this circuit," McHugh said.

The researchers observed the behavior of the genetically manipulated mice and measured their neuronal activity. They found that neurons at a key juncture in the dentate gyrus that receives new input from other parts of the brain help mice recognize and remember new environments.

The mice without neurotransmitter receptors at this juncture "learned normally when trained slowly with hours or days between trials, but showed learning deficits when challenged to learn the same tasks quickly, with only minutes between trials," McHugh said. The finding shows that synapses--the connections among neurons--at the dentate gyrus are critical for rapid learning.

"This advance in the understanding of how the hippocampal circuit functions suggests possible therapeutic targets in diseases that lead to memory deficits," McHugh said.

McHugh's MIT colleagues on the work are Matthew Wilson, Picower Scholar and professor of neuroscience; Susumu Tonegawa, Picower Professor of Biology and Neuroscience and director of the Picower Institute; and Matthew W. Jones, a former Picower postdoctoral associate now at the University of Bristol.

Source: MIT

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