



Fred H. Gage

Professor, Laboratory of Genetics
Vi and John Adler Chair for Research on Age-Related Neurodegenerative Diseases

“How the adult nervous system adapts to environmental stimulation may hold the key to new therapies that replace or enhance damaged brain and spinal cord tissues. That’s why our lab is so intent on pursuing the mechanisms behind this process.”

Like a frenzied file clerk, the hippocampus, a small seahorse-shaped area located deep within the brain, processes and distributes memory to appropriate storage sections after readying the information for efficient recall. As it happens, the first relay station in the hippocampus, a part called the dentate gyrus, is also the brain’s hotbed of neurogenesis. Neurogenesis, the process by which new neurons are added to the brain, declines with aging and is thought to be associated with some of the cognitive changes that take place as we grow older. What precise purpose these newborn neurons serve has been the topic of much debate, but apart from studies showing that they somehow contribute to hippocampus-dependent learning and memory, their exact function has remained unclear. A study in Gage’s lab, however, has shed new light on their function.

While passing through the dentate gyrus, incoming signals are split up and distributed among ten times as many cells. This process, called pattern separation, is thought to help the brain separate individual events that are part of incoming memories.

Since the dentate gyrus also is where neurogenesis principally occurs, Gage and his team hypothesized that adding new neurons could help with the pattern separation. In experiments that specifically challenged this function of the dentate gyrus, researchers used different behavioral tasks and two distinct strategies to selectively shut down neurogenesis in this structure in mice. Those without neurogenesis had no problem recalling spatial information in general but were unable to discriminate between locations that were close to each other. This observation led Gage and his group to theorize that new brain cells help us to distinguish between memories that are closely related in space.

Contributing to pattern separation might not be the only function of new neurons in the adult brain, however; a computer model simulating the neuronal circuits in the dentate gyrus suggests an additional function: “time-stamping” memories by forming a link between individual elements of episodes occurring closely in time.

For more information, please visit
salk.edu/faculty/gage.html

Left to right:

Front row: Carol Marie Marchetto, Sheryl Christenson, John Jepsen, Fred H. Gage, Lynne Moore, Yangling Mu, Jaso Ray, Diana Yu, Jessica Jou, Kim McIntyre, Chunmei Zhao

Second row: Iryna Gallina, Ben Hu, Xinwei Cao, Mohamedi Kagalwala, Ruth Keithley, James Aimone, Stephane Alfonso, Lara Rangel, Eunice Mejia, Andrea Pabon, Bobbi Miller, Bilal Kerman, Martin Regensburger, Dane Clemenson, Hoonkyo Suh, Chris Tse, Wei Deng and Yan Li

Last row: Tatjana Singer, Dien Sun, Dan Sepp, Arianna Mei, Paolo DiGiorgio, Ari Morcos, Ahmet Denli, Kristen Brennand, Beate Winner, Stefan Aigner, and Mike McConnell

