New neurons update remote memories

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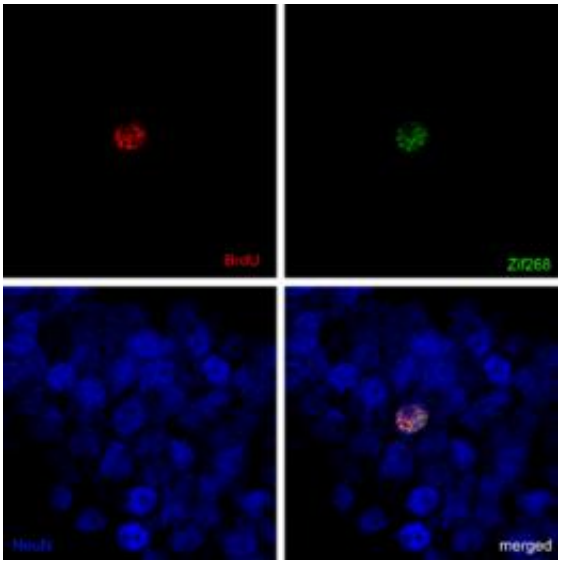

Images of a new nerve cell (in red, labeled with BrdU) which is a mature neuron (NeuN, labeled in blue) that is activated (Zif268-labeled in green) when the animal found the site of the platform once again. © Stéphanie Trouche CNRS /ANR

It is not easy to find your student bedroom when you left university 10, 20 or 30 years ago. But once you have found it, you can easily return the next day.

Indeed, by reactivating this memory, it has been strengthened and updated to provide spatial references. To achieve this, the brain recruits new neurons that were born just a week before memorizing this information. Scientists at the Centre de recherches sur la cognition

animale (CNRS, Université Toulouse 3), working in collaboration with a researcher from the Centre en neurosciences intégratives et cellulaires (CNRS, Université de Bordeaux), have recently demonstrated this process in mice.

"You enter a room you know, thinking that you understand it perfectly. You then realize the presence of new details, so your memory of this environment -- called the spatial memory -- is therefore updated", explains Claire Rampon, scientist at the CRCA. This updating of remote spatial memories, and the strengthening of those that are correct, is notably achieved thanks to the formation of new neurons during the initial visit to the room in question.

To demonstrate this, a team of researchers labeled newborn neurons in the brains of mice. These animals were trained to swim in a pool where the only way to escape from the water consisted in climbing onto a platform hidden just under the surface. When placed at random in the water, the mice tried and gradually learned the route to this platform during successive tests. A month later, the scientists replaced the animals in the same situation before observing their brains. They were then able to observe the involvement of labeled neurons that had formed a month previously in the updating and strengthening of spatial memories. The scientists also observed the brains of mice that had not learned to locate the immersed platform, and noted that a majority of these new neurons had not survived, and those which remained had not been activated.

Previous studies had demonstrated the continuous production of neurons in the hippocampus (the center of spatial memory in the brain) throughout the adult life of mammals. This study performed by scientists in the Centre de recherches sur la cognition animale (CNRS, Université Toulouse 3) and the Centre en neurosciences intégratives et cellulaires (CNRS, Université de Bordeaux) thus clarified the role of these newborn neurons in memory processes.

The authors of this paper emitted the hypothesis of the "tagging" of new, immature neurons present in the hippocampus during initial learning which, when an identical situation recurred, enabled the recruitment of these new neurons and the updating of previously-learned information.

More information: Recruitment of adult-generated neurons into functional hippocampal networks contributes to updating and strengthening of spatial memory, Stéphanie Trouche, Bruno Bontempi, Pascal Roullet and Claire Rampon, *PNAS*, 25 March 2009.

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