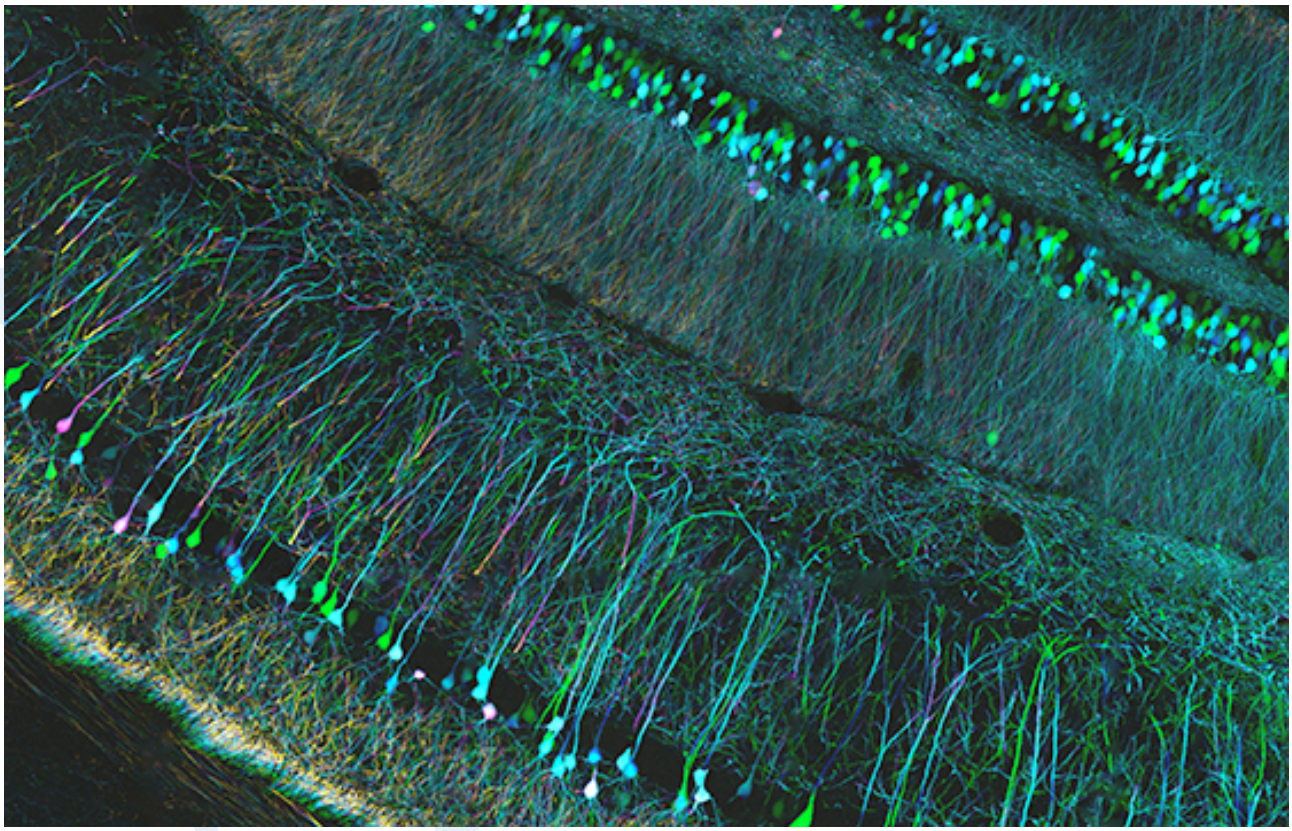
Eleven maps for eleven rooms



The hippocampus stores more place maps than expected

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The hippocampus – a structure in the brain – contains the representation of the environment we move in. But how many maps is it able to store without confusing one place with another? Quite a few, more than had been observed until now. That is the main finding of a study just published in PNAS and carried out by a research team led by May-Britt and Edvard Moser, scientists who were recently awarded the Nobel Prize. SISSA was also involved in the study.

The hippocampus is "meticulous" and efficient: it can store in memory lots of place maps without mixing up one location with another, even if their differences are minimal. A study conducted by the research group led by May-Britt and Edvard Moser, Nobel Laureates in Medicine and Physiology 2014, showed, for the first time, that in rats this cerebral structure can store at least 11

different rooms. "But the number is likely to be even higher", comments Alessandro Treves, professor at the International School for Advanced Studies (SISSA) in Trieste, who works with the Mosers' group and took part in this study just published in the journal PNAS. "The finding is new. So far, it had been demonstrated that at least two, perhaps three, maps could be stored in the hippocampus. We have now gone further, but we may still be far from the actual number". A mathematical model, developed a few years ago by Francesco Battaglia when he was still a PhD student at SISSA and never validated experimentally, predicts that the hippocampus can in fact contain several thousand maps, and the new finding seems to lead towards this hypothesis.

How does the hippocampus encode these maps? "This structure, and in particular the area known as CA_3, contains so-called "place cells", cells that fire when an individual finds himself at a certain location in space", explains Treves. Different combinations of a number of these cells form the code for a given environment. "In our experiments, in each rat, a certain group of cells would fire in each room, the cell group was always the same for a given room and always different from one room to another".

"Between rooms", continues Treves, "the combinations were clearly different and the statistical analysis confirmed this difference, showing that the representations were totally independent from one another. There was no kind of overlap and this explains why there was no confusion between places".

In addition, other observations in the study suggest a possible link between neurogenesis (the birth of new neurons in the brain, a very rare event in adults which in rats only occurs in two brain areas and involves a very small number of cells) and the ease with which the single place cells in the hippocampus take part in the representation of a new environment. "At this time, this is only a hypothesis that we have to investigate with additional studies", explains Treves, "but the possibility is interesting and if validated it could contribute to develop methods for intervention in people with spatial memory problems related to neurodegenerative diseases".

USEFUL LINKS:

- **Original paper on PNAS: http://goo.gl/NfJ1sf**

IMAGES:

- **Credits: Zeissmicro (Flickr: http://goo.gl/WoQFo1)**

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