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NEUROGENESIS

A bombshell of a finding

> this model suggests that about 80% of human dentate gyrus cells undergo renewal in adulthood

The question of whether adult neurogenesis occurs in the human hippocampus has been a hotly debated topic in neuroscience. In a study published in *Cell*, Frisén and colleagues now settle the debate by providing evidence that around 1,400 dentate gyrus cells are born in the human brain every day.

The authors made use of a birth-dating method that is based on the principle that ^{14}C in the atmosphere is taken up by plants and — because humans eat plants and animals that eat plants — eventually also by humans. As ^{14}C is incorporated into DNA during cell division, the ^{14}C content of a cell is thought to reflect ^{14}C levels in the atmosphere at the time of the birth of the cell. Importantly, atomic bomb testing in the 1950s and 1960s resulted in a spike in atmospheric ^{14}C levels, and levels declined after 1963; this means that the level of ^{14}C in cellular DNA can be used as a relatively precise marker of a cell's birth date.

The authors applied the ^{14}C birth-dating method to whole hippocampi dissected from post-mortem brains donated by individuals who were born in different years in the twentieth century. They separated neurons from non-neuronal hippocampal cells, purified the neuronal DNA and determined ^{14}C levels. Neuronal ^{14}C levels did not match atmospheric ^{14}C levels in the individual's birth year but were either higher (for people born before 1950) or lower (for people born after 1963), suggesting that at least some of the hippocampal cells were born after the year in which an individual was born.

Computer modelling of the data revealed that the best-fit model was one in which 35% of hippocampal cells showed such turnover, whereas the majority did not (that is, they were born during development). Assuming that, in humans, adult neurogenesis would take place in the dentate gyrus rather than in other hippocampal areas (as it does in rodents), and as the dentate gyrus contains about 44% of all hippocampal neurons, this model suggests that about 80% of human dentate gyrus cells undergo renewal in adulthood. This is in striking contrast to the scenario in mice, in which only ~10% of adult dentate gyrus neurons undergo renewal. The study further showed that there is very little decline in the level of hippocampal neurogenesis with ageing in humans, which is again in contrast to rodents.

It is now well established that adult-born neurons have a functional role in the mouse and rat dentate gyrus and olfactory bulb. A previous study using the same neuronal birth-dating method established that no adult neurogenesis takes place in the olfactory bulb and cortex in humans, but the new study has elegantly shown that the situation is different in the dentate gyrus. Whether the adult-born neurons have functional implications in humans remains a topic for future investigation.

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ORIGINAL RESEARCH PAPER Spalding, K. L. *et al.* Dynamics of hippocampal neurogenesis in adult humans. *Cell* **153**, 1219–1227 (2013)
FURTHER READING Kempermann, G. New neurons for 'survival of the fittest'. *Nature Rev. Neurosci.* **13**, 727–736 (2012)

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