IN THE NEWS

Sex cells

"A hormone that generates new brain cells after sex could be the key to stroke recovery", says the *Calgary Herald* (3 January 2003). This was the response to the publication of work by the team of Samuel Weiss at the University of Calgary, showing that prolactin, a hormone that is released after sexual intercourse and also during pregnancy and breastfeeding, can stimulate the production of new neurons in the mouse olfactory bulb.

This finding might explain why women have a heightened sense of smell during pregnancy, and the researchers also suggest that the brain might put the new neurons to other uses. Weiss explained "The importance of it, beyond the basic biology of stem cells, is the fact that prolactin may be an important neurogenic molecule that may have significant potential for generating new brain cells" (*The Globe and Mail*, Canada, 2 January 2003).

Using animal models, the team are investigating the possibility that prolactin could be administered immediately after a stroke to encourage the brain to repair itself. Weiss said "We have exciting preliminary data suggesting that the new stem cell-generated brain cells can be redirected to parts of the rodent brain that are damaged after a stroke and this results in partial improvement of the animal's ability to move its limbs" (*Calgary Herald*, 3 January 2003).

As yet, there is no evidence that prolactin can boost the brain power of healthy individuals. However, the press did not allow this fact to get in the way of a saucy headline or two, as *The Globe and Mail* proved with "Sex makes your brain grow" (2 January 2003) and "A roll in the hay is good for the brain, new research shows" (3 January 2003).

Heather Wood

CEREBRAL CORTEX

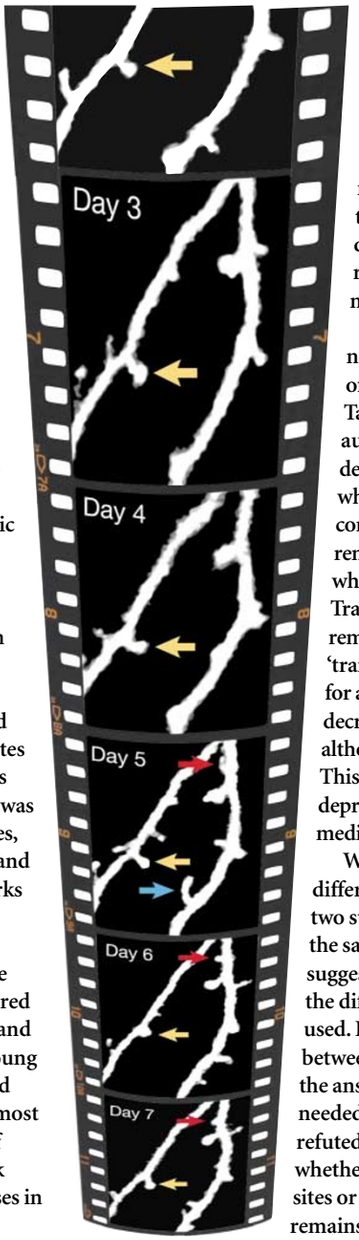
Spiny controversy

Dendritic spines in primary sensory cortex are surprisingly stable — or surprisingly dynamic, depending on who you ask. Two papers published in *Nature* use the same technique to image the dendrites of cortical pyramidal cells over time, and come up with very different results on the stability of spines — tiny protrusions on dendrites that receive most of the excitatory synapses in the brain.

To be able to image identified dendrites and spines repeatedly in the living brain over days or even weeks is a remarkable feat. The two groups — Trachtenberg *et al.* and Grutzendler *et al.* — used transgenic mice in which a small subset of cortical pyramidal neurons expressed fluorescent marker proteins. The fluorescence was then visualized, through thin 'windows' in the skull, using two-photon microscopy. This technique allowed the researchers to image the dendrites of individual layer 5 pyramidal cells with a contrast and resolution that was high enough to see individual spines, and to identify the same dendrites and spines repeatedly by using landmarks such as blood vessels.

Grutzendler *et al.* used this technique to observe neurons in the primary visual cortex. They compared spine stability in young (1 month) and adult (~4 months) mice. Even in young mice, most spines (~73%) remained stable over a 1-month period, and most changes represented elimination of spines (consistent with earlier work showing that the number of synapses in the visual cortex decreases during development). In the adult, around 96% of spines were stable over one month, although their shapes (length and head diameter) often changed. Such morphological changes could, in theory, mediate changes in synaptic efficacy.

Trachtenberg *et al.* looked at a different area of cortex, the barrel cortex. This is the primary sensory cortex that receives inputs from the whiskers. They also used mice of a different age (6–10 weeks, corresponding to young adulthood). In these neurons, around 20% of spines disappeared from one day to the next, and only about 60% of spines persisted for more than a week. Despite the high turnover of spines, the total spine density remained constant, presumably reflecting some homeostatic mechanism.



Yellow arrow indicates a stable spine that lasted over eight days of imaging; blue and red arrows indicate transient spines. Modified, with permission, from Trachtenberg *et al*. © Macmillan Magazines 2002.

Ultrastructural analysis showed that new spines, generated during the course of the experiment, formed synapses. Taking the study a step further, the authors looked at the effect of sensory deprivation on spine dynamics. When a whisker is removed from a mouse, the corresponding area of cortex is rapidly remodelled so that the neighbouring intact whiskers are more strongly represented. Trachtenberg *et al.* found that whisker removal led to an increase in the number of 'transient' spines — those that were present for a day or less — and a corresponding decrease in the number of 'stable' spines, although spine density did not change. This finding supports the idea that sensory deprivation induces cortical plasticity that is mediated by synaptic reorganization.

What could be responsible for the differences between the findings of these two studies? In a News and Views article in the same issue of *Nature*, Otterson and Helm suggest that it is unlikely to result solely from the differences in the ages of the animals used. Intrinsic differences in spine stability between visual and barrel cortex might hold the answer, but much more work will be needed before this can be confirmed or refuted. In the meantime, the question of whether spines represent stable connection sites or dynamic sources of plasticity (or both) remains open.

Rachel Jones

References and links

ORIGINAL RESEARCH PAPERS Trachtenberg, J. T. *et al*. Long-term *in vivo* imaging of experience-dependent synaptic plasticity in adult cortex. *Nature* **420**, 788–794 (2002) | Grutzendler, J. *et al*. Long-term dendritic spine stability in the adult cortex. *Nature* **420**, 812–816 (2002)

FURTHER READING Hering, H. & Sheng, M. Dendritic spines: structure, dynamics and regulation. *Nature Rev. Neurosci.* **2**, 880–888 (2001) | Ottersen, O. P. & Helm, P. J. How hardwired is the brain? *Nature* **420**, 751–752 (2002)

WEB SITES

Encyclopedia of Life Sciences: http://www.els.net/ dendritic spines

Svoboda lab: http://svobodalab.cshl.edu/

Gan lab: http://saturn.med.nyu.edu/groups/GanLab/