HIGHLIGHTS

LEARNING AND MEMORY

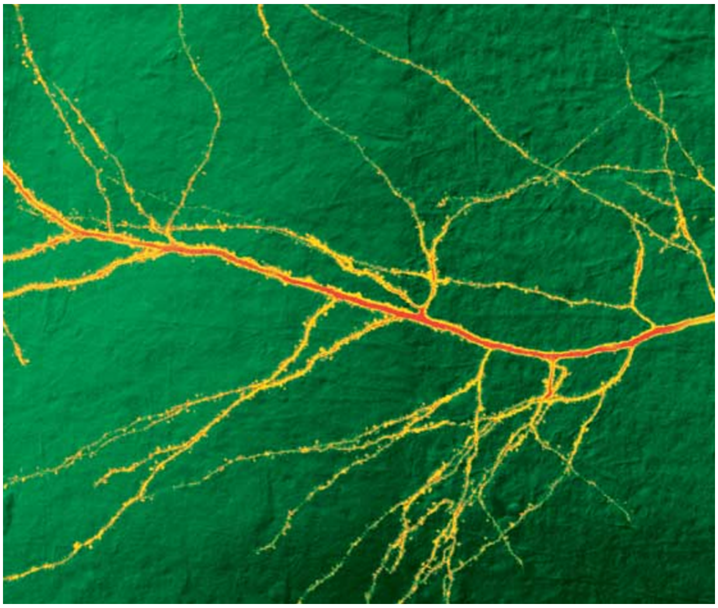
LTP makes dendrites excitable

Since the pioneering work of Hebb, models to explain how memory traces are established have focused predominantly on plasticity at the synapse. However, it is becoming clear that changes in conductivity within the neuron are also important features of memory storage. It has already been shown that the induction of long-term potentiation (LTP) at a synapse can increase the intrinsic excitability of the postsynaptic neuron. Now, in *Nature Neuroscience*, Frick and colleagues propose a molecular mechanism to explain a link between LTP and dendritic excitability.

Frick *et al.* used a combination of calcium imaging and dendritic patch-clamp recording to measure the activity of CA1 pyramidal neurons in slices of rat hippocampus. To gauge the excitability of individual dendrites, they measured the amplitude of action potentials that backpropagated from the soma into the dendritic tree. Before LTP was induced, the amplitude of the backpropagating action potential declined rapidly as it travelled towards the distal end of the dendrite. However, if LTP was induced at synapses within a dendrite, the propagation of the backpropagating action potential in that dendrite was enhanced.

The attenuation of the backpropagating action potential that normally occurs along the dendrite has been attributed to a transient outward K^+ current known as I_A, which is mediated by A-type K^+ channels. The authors asked whether the effect of LTP induction on backpropagating action potential amplitude was related to a change in I_A, and they found that this current was indeed reduced around the potentiated synapses. The number of A-type K^+ channels was unchanged, so Frick *et al.* concluded that LTP somehow brings about a change in the channel properties.

What is the functional significance of this increase in dendritic excitability? Apart from the obvious effect of facilitating the transmission of information, it has been suggested that it might also prime the postsynaptic neuron to undergo subsequent plasticity — a phenomenon that is often referred to as metaplasticity.



Courtesy of D. Johnston, Baylor College of Medicine, USA.

These findings illustrate that neuronal plasticity is a highly complex process that affects numerous aspects of neuronal activity, and the task of unravelling these complexities is set to keep researchers occupied for years to come.

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References and links

ORIGINAL RESEARCH PAPER Frick, A. *et al.* LTP is accompanied by an enhanced local excitability of pyramidal neuron dendrites. *Nature Neurosci.* **7**, 126–135 (2004)

FURTHER READING Stuart, G. *et al.* Action potential initiation and backpropagation in neurons of the mammalian CNS. *Trends Neurosci.* **20**, 125–131 (1997) | Häusser, M. Storing memories in dendritic channels. *Nature Neurosci.* **7**, 98–100 (2004)

WEB SITES
Encyclopedia of Life Sciences:
http://www.els.net/
Long-term potentiation