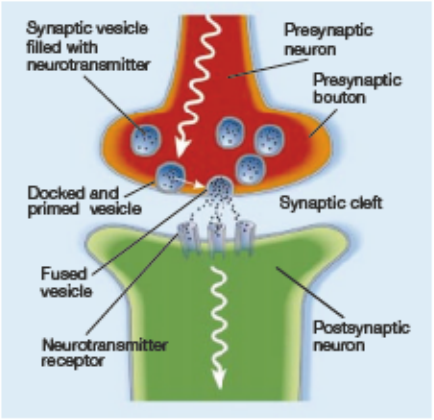

Figure 1 **Signalling at a chemical synapse. Chemical synapses are specialized cellular junctions that enable nerve cells to communicate. The presynaptic bouton is filled with vesicles (blue circles) containing neurotransmitter (black dots). These vesicles dock at the plasma membrane, where they undergo a 'priming' step that renders them capable of fusing with the plasma membrane, once an electrical impulse (wavy white line) arrives in the presynaptic bouton. Upon fusion, a vesicle's contents are released into the synaptic cleft. Receptors on the postsynaptic neuron detect the neurotransmitter, and trigger a postsynaptic electrical response. The strength of neurotransmission can be altered, and such 'synaptic plasticity' is thought to underlie the brain's ability to compute, learn and remember. Schoch *et al.*[1] and Castillo *et al.*[2] now suggest that a synaptic protein called RIM1α is involved in synaptic plasticity — specifically, through its role in vesicle priming.**

vesicles for fusion; they are then held in check until an electrical impulse causes an influx of calcium ions into the neuron, triggering fusion[5]. So changing the activity of certain presynaptic proteins involved in docking, priming or fusion could alter the probability of neurotransmitter release.

Several proteins have emerged from genetic and molecular analyses as possible regulators of presynaptic plasticity. These include synaptotagmin, a calcium sensor involved in vesicle fusion; Munc13, a protein required for priming; and Rab3A, a synaptic-vesicle protein involved in docking. Another synaptic protein that might be involved is RIM, a Rab3A-interacting molecule, whose function has until now been enigmatic. RIM is a modular protein that can bind Munc13 and synaptotagmin as well as Rab3A. These characteristics, as well as the tight and specific association of RIM with the presynaptic active zone, led to the hypothesis that RIM may help to localize its protein partners near their sites of action. Furthermore, its ability to interact with Rab3A indicated that RIM might also be involved in vesicle docking. But genetic studies indicated — at least in nematode worms — that RIM is not essential for the assembly of synapses, nor for the docking or fusion of synaptic vesicles, and that it is instead involved in synaptic-vesicle priming[6].

Schoch *et al.*[1] and Castillo *et al.*[2] have now used a combination of mouse genetics, biochemistry and electrophysiology to investigate the role of RIM in mammals. They analysed synapses from mice in which the gene encoding RIM1α — one of the two mammalian forms of RIM — was disrupted. The authors find that RIM1α acts at a vesicle-priming step in mammals, as it does in nematodes. As the probability of vesicle fusion is proportional to the number of primed vesicles, these results suggest that RIM has an essential function in regulating neurotransmitter release.

Excitingly, Schoch *et al.* and Castillo *et al.* also show that RIM1α is involved in certain forms of short- and long-term synaptic plasticity. In particular, RIM1α is essential in establishing the long-term potentiation of synaptic strength at certain synapses ('mossy fibre' synapses) in the hippocampal region of the brain[2]. In addition, disrupting RIM1α causes increases in the long-term depression of synaptic strength at mossy-fibre synapses[2]. It also causes increases in two forms of short-term plasticity at hippocampal CA1 synapses[1]. All are forms of presynaptic plasticity. Interestingly, RIM1α seems to be involved in both Rab3A-dependent and Rab3A-independent contributions to synaptic plasticity[1,2], consistent with the idea that RIM, through its many interactions with other proteins, can regulate neurotransmitter release through parallel yet possibly distinct signalling pathways[1,6,7].

All in all, it seems that regulation of the priming step of the vesicle cycle has important consequences for synaptic function, by regulating the amount and activity dependence of neurotransmitter release. Thus, vesicle priming might be crucial in determining the fidelity with which presynaptic boutons speak to postsynaptic cells. It remains to be seen whether and how vesicle priming is regulated during normal brain activity, and what function the regulation of priming has in computation, learning and memory. ■

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correction The caption to Corinne Charbonnel's News & Views article of 3 January — "Cosmology: A baryometer is back" (*Nature* 415, 27–28; 2002) — should have read "primordial abundances of ^{4}He (observed in extra-galactic [not galactic] H II regions)".

Daedalus

Drifting continents

The modern world was created by the drifting of the continents, says the theory of plate tectonics. Thus the Atlantic Ocean has widened, and is continuing to do so, as America and Europe drift apart. So, says Daedalus, why have the Atlantic cables not snapped? Presumably because the drift is very slight, a few centimetres a year, and is well within the elastic stretch of a few thousand kilometres of cable.

Nonetheless, a transoceanic cable is a perfect electrical strain gauge. The resistance of the Atlantic cables must be rising as their conductors lengthen and their conductive cross-section falls. Other oceanic cables span the Pacific, the Indian Ocean and so on. They may be shortening as their paths slowly decrease, so their resistance should be falling. Many of these cables were laid in the days of telegraph and low-frequency telephone traffic. It would cost little to take them out of service for measuring, and transfer their burden to modern high-frequency or fibre-optic cables.

So here is a splendid way of checking the theory of continental drift. The world is bound by many cables, and the ships that laid them were navigated carefully and have left detailed logs. The only snag is that the resistance of a single cable cannot be measured. You need at least two, there and back. They must be joined, and their final termination must be coupled by an excellent conductivity bridge.

Sadly, you cannot tell where or how evenly over its length the multiple cable is being stretched. A large extension in a small region (say, where plates are separating) has the same effect as a slight stretch maintained over many kilometres. Daedalus will be pleased by a change in resistance of a few parts per billion. A continuous watch will show whether the movement is slow and steady, or occurs in sudden jerks, possibly with oscillations about each burst of movement.

DREADCO communications engineers are now seeing which cables can be coupled into useful pairs or triangles. To provide a good test of current theories, each such multiple must allow an accurate measure of its round-trip resistance. The engineers may include long pipelines in their list, provided their resistance is also well defined. Railways usually maintain signalling and power currents which would interfere with the measurements. The whole experiment gives a cheap and novel way of testing one of the boldest theories of modern geology. **David Jones**