New and Notable

Mechanical Spikes from Nerve Terminals

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Scientists think about what they measure, at least they are supposed to. Biologists have measured electrical signals from nerve cells for a very long time—more than 200 years back to the time of Galvani and Volta—and they have shown that voltages and currents are the most important signals of the nervous system. Electrical impulses (called action potentials or ''spikes'') carry information from one cell to another, sometimes for very long distances (as in elephants, sauropod dinosaurs, or blue whales); and electrical impulses signal nerve terminals to secrete transmitter chemicals that in turn induce currents and voltages in attached nerve cells. If the sum of the induced voltages is large enough, the second nerve cell initiates a spike to pass the information further. Spike (in the presynaptic terminal), then summation (in the postsynaptic dendrite or cell body), perhaps then spike (in the postsynaptic axon) is a main method of information processing in nerve terminals and nervous systems.

Nerve terminals are small, hidden away, and as important to information processing in the brain as transistors are to information processing in computers. Transistors are much more important than their wires. Nerve terminals are much more important than their axons. Nerve terminals are hard to study, particularly in mammalian and primate and human nervous systems that have astronomically large numbers of very small terminals. More complex nervous systems have more nerve terminals, just as more powerful computers have more transistors. Complex nervous systems are hard for scientists to study because they stop processing information once they are taken apart. Scientists study what they can, measuring what they can, hoping someday to convert measurements into understanding. Scientists think of nerve terminals reflexively, emphasizing the secretory processes they can measure, hoping someday to understand the role of terminals in information processing as thoroughly as engineers understand the role of transistors.

Nerve terminals have been studied optically for many years, led by measurements of neurosecretion by Salzberg et al. (1–4). Salzberg's laboratory (5) has now measured a mechanical spike, a rapid mechanical signal from nerve terminals that is associated with the electrical impulse. They measure the signal with an atomic force microscope and carefully show that the signal is real and not an artifact, using a variety of physical and physiological control experiments in the best tradition of British electrophysiology (see Hodgkin (6,7)). Kim et al. (5) report a mechanical spike related to the arrival of the action potential followed by a ''dip'' that seems to reflect secretion itself.

Salzberg does not know what the mechanical spike does biologically, if it does anything at all, but now that the spike is measured, scientists will think about it, and find out much more, as Hodgkin (8,9) did. Perhaps Salzberg and successors will discover something wonderful. Perhaps they will not; but the quest will undoubtedly turn up important new results and be fun to follow. The fun is important to the science because it motivates scientists in their forbiddingly frustrating quest, a journey without a known destination. The first contribution of Salzberg's article will be to spike interest and motivate investigation of the rapid volume change and what it does for secretion and function of the nerve terminal.

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