

quence. This avoids the problem associated with coordinating simultaneous growth in different regions of the nervous system and prevents errors of topography among higher-order cells like Purkinje neurons from disrupting the topographic organization at all lower levels. Sotelo and collaborators have successfully grafted genetically normal embryonic Purkinje cells into the adult cerebellum of an adult neurological mutant mouse (PCD) in which all Purkinje cells degenerate. Sotelo demonstrates that the grafted cells carry their own agenda for orientation, growth, and differentiation and follow an "internal clock that regulates all their developmental programs independently of environmental agents."

A highlight of the section of the book devoted to the electrophysiology of Purkinje cells and inferior olivary neurons is the chapter by Llinás and Sugimori. The authors not only summarize much of their work on calcium conductance in Purkinje cells but, perhaps more significant for the non-specialist, offer some functional interpretations of the results. That specialized voltage-dependent conductance channels for sodium or calcium can be triggered by either parallel-fiber or climbing-fiber excitation to produce simple or complex spikes respectively has been well documented by these authors. However, the additional bewildering variety of calcium conductances means that different parts of the dendritic tree are independently responsive and that Purkinje cells can generate as many as six different all-or-none potentials in addition to the plateau potential. Moreover, the dendritic spikes and the plateau potentials differ only in that they are generated at different regions of the dendrites with different complements of potassium channel types. Some dramatic color images of calcium conductance changes after intracellular application of the voltage-sensitive dye fura-2 are used to document the plateau potentials in *in vitro* cerebellar slices. The illustrations are of excellent quality throughout the book, and the anatomical figures are especially noteworthy, although I noted a few discordances between legends and figures.

The final section of the book deals with cerebellar activity in movement and more particularly with learned movements. The perpetual riddle of the role of the climbing fibers is posed once again, but the varied answers failed to generate the heat and passion that characterized the debate on the same issue at a similar symposium in Turin a year earlier. Alas, there still appears to be no agreement in sight. Even the consensus that complex spikes diminish Purkinje cell responsiveness to parallel fiber excitation appears to some extent equivocal according to Bloedel and collaborators. Although more than half the book is devoted to elaborating the organization of Purkinje

cells into narrow rostrocaudal bands, Thach adds evidence to support an old hypothesis that runs counter to the parasagittal bands both literally and figuratively. He suggests that in addition to the rostrocaudal organization, the long parallel fibers running mediolaterally serve to link the functionally different parasagittal bands of the cerebellum together to create specific muscle synergies for multijoint movements.

In some ways we have come full circle with this book since Cajal's pioneering demonstration of the simple geometric arrangement of cerebellar neurons. Neuroscientists expecting that the simple geometric structure would soon be followed by a similarly simple and elegant explanation of its function have been disappointed. Rather ironically, it appears clear from this excellent collection of papers that, after one hundred years of impressive progress, we have developed an elaborate neuron doctrine of the whole brain, but a simple explanation of cerebellar function has yet to be achieved.

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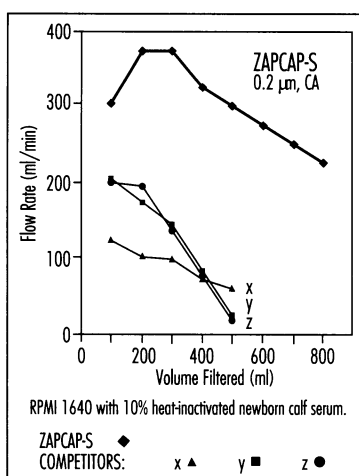
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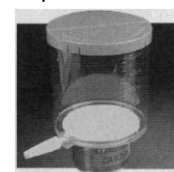
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