

This Week's Citation Classic®

Peters A, Palay S L & Webster H deF. *The fine structure of the nervous system. The neurons and supporting cells.* New York: Harper and Row, 1970. 198 p.; and
The fine structure of the nervous system. The neurons and supporting cells.
Philadelphia: Saunders, 1976. 406 p.

This book describes the salient features of the fine structure of neurons, neuroglial cells, and other cells investing the nervous system. The book attempts to correlate the morphology of these cells with their functions. [The SCI® indicates that the two editions of this book have been cited in more than 1,585 publications.]

A Guide to the Cellular Structure of the Nervous System

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In 1963, I took sabbatical leave from Edinburgh University to learn from Sandy Palay his recently developed technique for fixing nervous tissue by osmic acid perfusion¹ and to work on the fine structure of the lateral geniculate body. During that time at the Harvard Medical School, we often talked about writing a book on the fine structure of the nervous system, but we felt that such an undertaking would be premature.

Two years later, I returned to Boston, excited to tell Sandy that I had recognized the initial axon segment of the pyramidal cell in the cerebral cortex,² only to find that he, Constantino Sotelo, and Paula M. Orkand also had seen this portion of the nerve cell. We agreed to pool our resources and publish the discovery together.³

The recognition of this unique segment of the axon meant that we now knew the structural features of all parts of the nerve cell, and so the last obstacle to a complete description of the neuron was surmounted. Sandy and I decided to proceed with writing a book that would explain the fine structure of the nervous system. We discussed the project with Harry Webster, who was then still at Massachusetts General Hospital, and convinced him to be a coauthor and to deal with the peripheral nervous system. We all agreed that the book should describe and define the features of neurons and neuroglial cells and should be illustrated by the best electron micrographs we could produce. It took us a couple of years to complete the book. It was finished in 1968 and published early in 1970.

In the 1970 edition, the reference list, which contained practically all the articles on neurocytology that had been written up to that point, consisted of some 550 publications. At that time, we had not really defined the microglial cell, and we knew

practically nothing about the morphological correlates of inhibition. Except for the recently examined olfactory bulb,⁴ presynaptic dendrites remained unknown.

All copies of the first edition of the book were sold out within four years. And, during that time, great strides were made in neurocytology, and an explosion in the literature occurred. The advances of the 1970s were due to marked improvements in the preservation of tissue, the introduction of freeze-fracturing, the production of better and more efficient ultramicrotomes and electron microscopes, and the more general availability of diamond knives.

Scanning electron microscopy and freeze-fracturing added new information about the structure of the nervous system. The introduction of tracing techniques employing tritiated amino acids and horseradish peroxidase provided new and detailed information about interneuronal connection. Not least in importance was the vast increase in the number of neuromorphologists, as our students and those of our peers entered the field.

Stimulated by these exciting developments and encouraged by the users of our book, we decided to undertake a new edition by rewriting it completely and adding improved plates illustrating the new techniques. This second edition was published in 1976, and although it listed some 1,700 references, we could not cover the literature completely.

Ten years later, the second edition was also out of print. This edition is still widely used, and we have been flattered to hear of the number of copies stolen from laboratories and libraries throughout the country. In preparing a new edition, we were initially deterred by the new explosion that had occurred in neuroscience, because we knew that we could not include all of the literature that had accumulated since 1970. By 1987, however, we became convinced that if we restricted ourselves to the fine structure of the cells in the nervous system and introduced new information to aid in interpreting structure in terms of function, we might succeed in maintaining our original goal while updating the book. Much of the new information has been derived from the use of antibodies to localize specific substances, particularly structural and neuroactive chemicals, and this new information has led to a much better appreciation of how structure and function in neurons and other cells in the nervous system are correlated. We hope that our readers will not be disappointed with our new effort.⁵

1. Palay S L, McGee-Russell S M, Gordon S & Grillo M A. Fixation of neural tissues for electron microscopy by perfusion with solutions of osmium tetroxide. *J. Cell Biol.* 12:385-410, 1962. (Cited 480 times.)
2. Peters A, Proskauer C C & Kaiserman-Abramof I R. The small pyramidal neuron of the rat cerebral cortex. The axon hillock and initial segment. *J. Cell Biol.* 39:604-29, 1968. (Cited 125 times.)
3. Palay S L, Sotelo C, Peters A & Orkand P M. The axon hillock and the initial segment. *J. Cell Biol.* 38:197-201, 1968. (Cited 215 times.)
4. Rall W, Shepherd G M, Reese T S & Brightman M W. Dendrodendritic pathway for synaptic inhibition in the olfactory bulb. *Exp. Neurol.* 14:44-56, 1966. (Cited 305 times.)
5. Peters A, Palay S L & Webster H deF. *The fine structure of the nervous system. The neurons and supporting cells.* New York: Oxford University Press, 1990. 528 p.

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