# Handbook of Neurochemistry

## SECOND EDITION

## Volume 7
## STRUCTURAL ELEMENTS OF THE NERVOUS SYSTEM

Edited by
Abel Lajtha

# *Handbook of*
# *Neurochemistry*

*SECOND EDITION*

*Volume 7*
*STRUCTURAL ELEMENTS OF THE NERVOUS SYSTEM*

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# *Foreword*

Neurochemistry, having the objective of elucidating biochemical processes subserving nervous activity, emerged as an application of chemistry to the investigation of neurobiological problems as a post-World War II phenomenon. However, only in the last 40 years has the chemical community recognized neurochemistry as a distinct, if hybrid, discipline. During this period great strides have been made. However, recently neurochemistry, along with neurophysiology, neuropharmacology, neuroanatomy, and the behavioral sciences, has emerged to form *neuroscience*, a new community of scientists with its own national society, journals, and meetings. Actually, this recently formed hybrid, neuroscience, is in the process of merging with another well-established discipline, molecular genetics (frequently called molecular biology, and itself a hybrid), which appears to have sufficient hybrid vigor to form yet a new community of scientists, which, for want of a more imaginative term, has been called *molecular genetic neuroscience*.

Clearly, advantages resulting from such mergers or hybridizations accrue not only from the merging discipline (neurochemistry in this case) to the new community (molecular genetic neuroscience), but also in the reverse direction. This Foreword will be concerned primarily with examples of this latter process.

Among the first products of the new dispensation was the invention and development of biochemical technologies that have greatly facilitated research in this field. Complex equipment made its appearance academically and commercially early on, such as "gene machines" for nucleotide sequence analysis and synthesis of DNA. Submicrogram quantities of particular proteins (identified by monoclonal antibodies or two-dimensional electrophoresis) sufficed to determine, and even isolate, the gene or genes that synthesize the protein. With such equipment it is possible to pass from phenotype (e.g., a microgram or less of purified protein) to genotype (expressed as the nucleotide sequence of DNA). Similarly, it is possible to pass from genotype to phenotype. A method has recently been published indicating how, from cDNA clones, it is possible to determine nucleotide sequences, hence amino acid sequences, of protein encoded by brain-specific mRNAs. Antisera to corresponding proteins are used immunocytochemically to localize the protein in the brain. Such proteins may serve as markers for novel neuronal pathways and transmitters used in pathways.

With conventional neurochemical methods it has, over the years, been possible to discover but a small number (circa several dozen) of brain-specific proteins. However, by application of the new technologies, evidence has been obtained for the existence of many thousands of different brain-specific proteins. Many of these proteins may occur very sparsely in the brain, but in the subpopulations of cell types they may occur in high-copy amounts and may play a significant role.

In addition to the approximately ten classical small-molecule transmitters, a large and rapidly growing list of putative peptidergic transmitters or modulators of neurotransmitters has been identified and chemically characterized by application of the new technology, as have other substances of high neurobiological activity (e.g., peptides, receptors, hormones, and factors). Clearly a large flood of new compounds will soon be appearing in the literature, forming a handsome grist for neurochemical study and for function determination.

Neurochemistry will, in the next decade, doubtless pass through a historic transition, which may spin off new communities of scientists with new opportunities for scientific discovery and valuable biomedical application.

Francis O. Schmitt

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