Overview

PROTEINS OF MYELIN AND THEIR METABOLISM

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INTRODUCTION

The chemical composition of myelin has long been of interest to neurochemists, in part because of the relevance of such information to an understanding of the many human diseases of myelin. In recent years the realization that myelin, although highly specialized in function, shares many of the morphological and chemical properties of other membranes, has focused attention on its suitability as a model system for the study of membrane biogenesis and metabolism. This review stresses recent developments concerning the protein composition of myelin and the metabolism of these proteins.

MYELIN OF THE CENTRAL NERVOUS SYSTEM

Chemical Studies

Isolation of Myelin

The concept of myelin of the CNS as a specialized extension of the plasma membrane of oligodendroglial cells, and the ultrastructural details of how it is wrapped many times around the neuronal axon, are well understood (for a review, see Raine, 1,2). The characteristic lamellar
structure is formed when the cytoplasmic faces of the developing myelin membrane come together so that the proteins of the cytoplasmic face form the major period line while the external faces of successive layers of this double membrane coalesce so that proteins of the extracytoplasmic side form the intraperiod line (Figure 1).

Fig. 1. A composite diagram summarizing some of the ultrastructural data on CNS myelin (courtesy of Dr. William Norton; 6). At the top an oligodendroglial cell is shown connected to the sheath by a process. At the internodal region, the cross section reveals the inner and outer mesaxons and their relationship to the inner cytoplasmic wedges and the outer loop of cytoplasm, with cytoplasmic surfaces of the membranes forming the major period lines. The lower part of the figure shows the dimensions of one myelin repeating unit as seen with fixed and embedded preparations in the electron microscope. This is contrasted with the dimensions of the electron density curve of CNS myelin obtained by X-ray diffraction studies in fresh tissue.