Technical Papers

The Electron Microscopy of Sectioned Nerve

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Nerve is one of the most important tissues for study under the electron microscope both because knowledge of its macromolecular structure is needed for an understanding of the mechanism of impulse propagation and because this knowledge is essential for any study of the neurotropic virus diseases. Until recently little progress in such a study has been possible on account of the large size and fragility of most nerve fibers. They can, however, now be examined to great advantage in thin section.

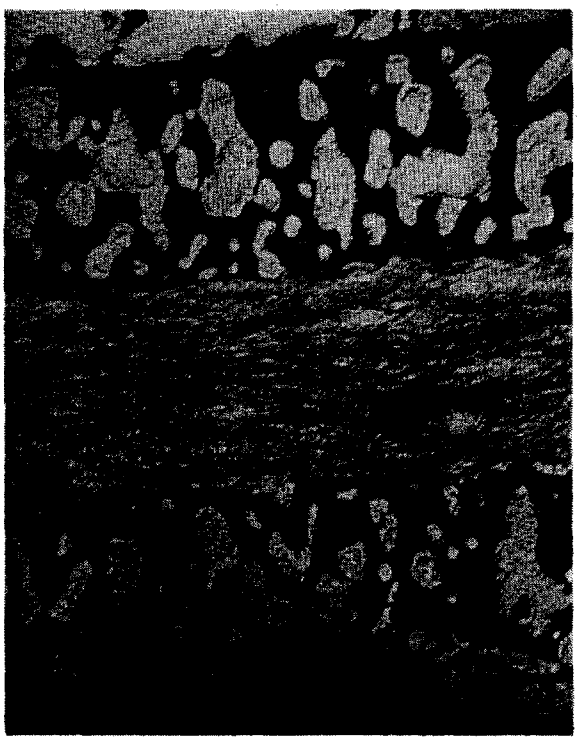

FIG. 1. An electron micrograph of a longitudinal section through a single fiber of myelinated nerve. The fibrous contents of the central axon are clearly seen, as are the denser lamellae of the surrounding myelin. The thin neurilemma enveloping the whole is visible at the very top and bottom of the photograph. Magnification, 5,000 ×.

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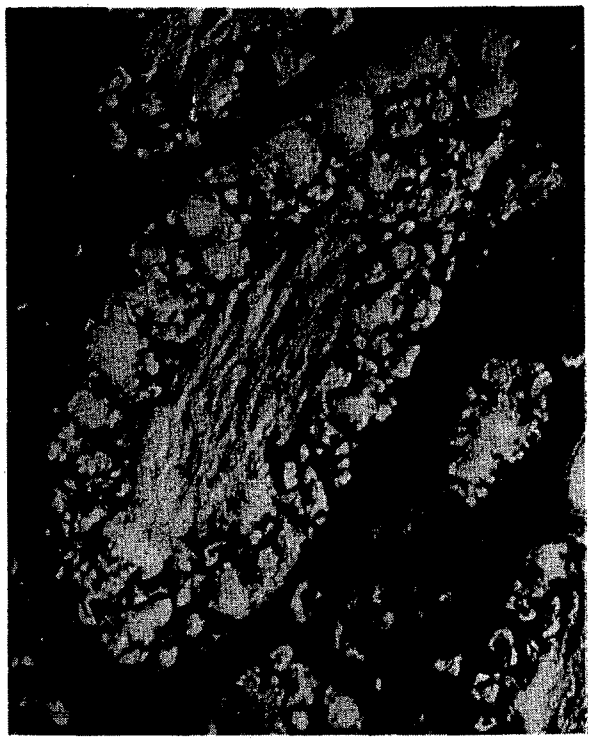

FIG. 2. A nearly transverse section through part of a nerve bundle. One fiber showing the same structures as Fig. 1 fills most of the picture. Small parts of two other fibers are in the lower right corner and the top, left of center. A band of connective tissue and the embedded sectioned tip of another fiber separate the lower fiber from the one in the center. Magnification, 5,000 ×.

Very recently preliminary electron micrographs have been published of sectioned nerve (*1*) but these photographs were of fibers that were so seriously damaged during preparation that their fine structures and the relation of these structures to one another were not evident. We have found that excellent sections can be obtained of nerve prepared and cut according to the techniques outlined by Newman, Borysko and Swerdlow (*2*). What is seen in such sections under the high resolution of the electron microscope depends in marked degree on the kind of fixation and dehydration used, and it will require much experimentation with many reagents to establish beyond doubt all aspects of the macromolecular texture of native nerve. Nevertheless, nerve can now be sectioned without disturbing its various components and consequently a detailed study can now be begun of its structure and of the changes caused by various preparative reagents.

Results of a first set of such experiments are being published elsewhere (*3*) but the accompanying photographs illustrate the kind of electron micrographs of sectioned nerve that can readily be prepared. These

show a longitudinal (Fig. 1) and nearly transverse (Fig. 2) section through the *nervus ischiadicus* of the adult rabbit fixed in 4% formalin and dehydrated in one case in ethyl alcohol and in the other with pyridine. In the longitudinal section one can see the filamentous fine structure of the central axon and the more "opaque" lamellar texture of the nonlipid portion of the enveloping myelin sheath. The neurilemma outside this and the absence of an axilemma of similar structure between axon and myelin are apparent. The same structures are visible in Fig. 2, which also gives an idea of the relation of a nerve fiber to the connective tissue elements with which it is associated in a complete nerve bundle. This photograph likewise brings out the fact that in many parts of nerve fibers the texture of the lamellae of the myelin is less coarse in the region immediately enveloping the axon. Other photographs we have made both at these and at higher magnifications show the fine details of the structures, the kinds of alteration in these details that result from the use of other fixatives, and the nature of such other optically recognized structures as the clefts of Schmidt-Lantermann and the nodes of Ranvier.

References

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2. NEWMAN, S. B., BORYSKO, E., and SWERDLOW, M. *Science*, 1949, **110**, 66.
3. ROZSA, G. *et al.* *Biochim. Biophys. Acta*, in press.