edge of the world of nature (not of experiment), the more insecurely founded they appear to be.

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THE IMPORTANCE OF DIAMETER AS A FACTOR IN MYELINATION

IT is believed that the close relationship existing between diameter of the axone and whether or not it shall possess a myelin sheath has not received sufficient attention. Due to the present interest in the physiology of nerve fibers, a brief presentation of the main facts seems to be desirable.

The bearing of diameter on myelination has been stated by Vogt,[1] who says that myelination of the tracts is not related to the acquisition of conducting power, but to the number and size of the component fibers. Speidel[2] states that myelination is preceded by a characteristic thickening of the axone. Ranson *et al.*,[3] speaking of the vagus rootlets proximal to the nodose ganglion, say that the number of fine myelinated fibers varies considerably in different animals, and further when the number of fine myelinated fibers is large the number of unmyelinated fibers is correspondingly reduced. In another part of the same paper they say that the unmyelinated fibers are always smaller than the myelinated fibers; however, the exact nature of the relationship is not emphasized.

From observations carried on in this laboratory, the author has become convinced that in mammals there exists a critical diameter, above which all axones are myelinated and below which all are unmyelinated. This diameter is tentatively stated as 1.5 μ, including the myelin sheath. Myelinated axones of 1 μ diameter can be seen in cross-sections of nerves containing large numbers of small fibers, but teased preparations show these to be constricted portions of slightly larger axones. These constricted regions are found principally opposite the sheath cell nuclei, but occur in other places in some of the fibers. Preliminary measurements indicate that a critical myelination diameter also occurs in birds, reptiles and amphibia, but that the value of the constant may be slightly less in birds and slightly greater in the cold-blooded animals. The relationship holds only for true neurones; *i.e.*, the neurosensory cells and protoneurones are excepted.

The above principle is based on measurements of the diameters of fibers in the dorsal and ventral roots of the cow, cat and rat. The thoracic ventral roots of the cat and rat contain two distinct groups of fibers—the somatic efferent and preganglionic efferent. The somatic motor group is entirely myelinated and the preganglionic efferent is partially myelinated in both animals. In the cow both groups are completely myelinated, and the fibers of each group are distinctly larger in this animal. In the dorsal roots of the cat and rat three fiber groups may be distinguished. In the rat the smallest group approaches the myelination limit and is believed to be partially unmyelinated. In the cat the smallest group is distinctly beyond the myelination limit, corresponding to the preganglionic efferent group in the cow as to size. In the dorsal root of the cow a fourth group of myelinated fibers has appeared. This group is entirely below the myelination limit in the cat and rat, and gives rise to the C wave in oscillograph records. In all three animals the smallest myelinated fibers are 1.5 μ, while the upper limit of size varies, the largest fibers occurring in the cow, the smallest in the rat.

Two other related principles of nerve fiber size are suggested: (1) Nerve fibers myelinate in the order of their appearance as specifically stainable axones and the first fibers to myelinate are the largest fibers in the adult; (2) the order of fiber size for the various functional groups is the same in different mammals. The two principles are known to hold true for all components of the spinal roots, for the median longitudinal bundle, the rubrospinal fasciculus and the corticospinal tracts. No exceptions to these rules are known to the author.

Given the above principles, the following are some of the known facts readily explained.

(1) The variations from animal to animal in the amount of myelination of the pre- and postganglionic visceral efferent fibers.

(2) Variations in the time of myelination of the tracts in the various species.

(3) The distal excess of myelinated fibers in the trunk over the sum of those in the spinal roots and the differences in the amount of this excess in different spinal regions and animals.

(4) Differences in the time of cessation of myelinated fiber increase in the spinal roots and nerves.

This statement is offered in advance of *in extenso* publication, because it is believed that a point of view is offered which will be valuable to many engaged in research on nerve fiber physiology and histology.

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[1] O. Vogt, *Neurol. Centralbl.*, 27: 137, 1908.
[2] C. C. Speidel, *Jour. Exp. Zool.*, 61: 279, 1932.
[3] S. W. Ranson, J. O. Foley and C. D. Alpert, *Am. Jour. Anat.*, 53: 289, 1933.

A NEW TERM FOR THE YOUTHFUL STAGE OF FORAMINIFERAL SHELLS[1]

IN the terminology of foraminifer shells no generally acceptable or appropriate name exists for the

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