isotope techniques on kidney slices.

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Distribution of Cortical "Feedback" Fibers in the Nuclei Cuneatus and Gracilis.* (27019)

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In cat and monkey pyramidal fibers are distributed to the nuclei cuneatus and gracilis (1,2,3,4). The fiber distribution within these nuclei displays some degree of organization (3,4) which has been investigated further.

Experiments. A. In 2 cats the rostral pole of one hemisphere was removed, including the sensory-motor areas. Using the Nauta-Gygax impregnation technique(5), the degenerating cortical fibers were found to pass as recurrent bundles through the basal parts of the nucleus cuneatus, as previously reported(3). Similar bundles pass alongside the nucleus gracilis. At caudal levels, these degenerating fibers are distributed to the basal parts of the nucleus cuneatus (and gracilis) (Fig. 7,8). However, only few fibers are distributed to the characteristic dorsal cell clusters (Fig. 2, 3, 6, 7, 8). The fiber distribution in both the nuclei becomes more diffuse in passing from a few millimeters behind the obex rostrad. Some of the longitudinal fibers in the basal parts of the nucleus cuneatus move dorsally towards the surface (Fig. 6), thus cutting through the area of the cell clusters. This narrow fiber pathway widens rostrally at the expense of the clusters, resulting in a more widespread fiber distribution (Fig. 1, 4, 5). However, at rostral levels, some clusters persist, e.g., in the ventrolateral parts of the nucleus cuneatus and along its dorsal medial border (Fig. 5).

The cyto- and dendritic architecture of the nuclei, in Nissl and Golgi material (6-weeks-old kittens impregnated following Moliner(6)), likewise displays rostro-caudal differences, described by Cajal. The caudal cell clusters contain round cells, possessing short, repeatedly ramifying dendrites (Fig. 10, 11, 12). The diameter of the dendritic territories equals approximately 10 times that of the cell body. The dendrites in one cell cluster frequently interlace. The question arose whether this phenomenon could be related to the mutual inhibition characteristic for the cells at these levels (13). In the tail end of the nucleus gracilis these cells are more triangular, possessing longer dendrites (Fig. 13). The basal cells in the caudal part of the nucleus cuneatus are

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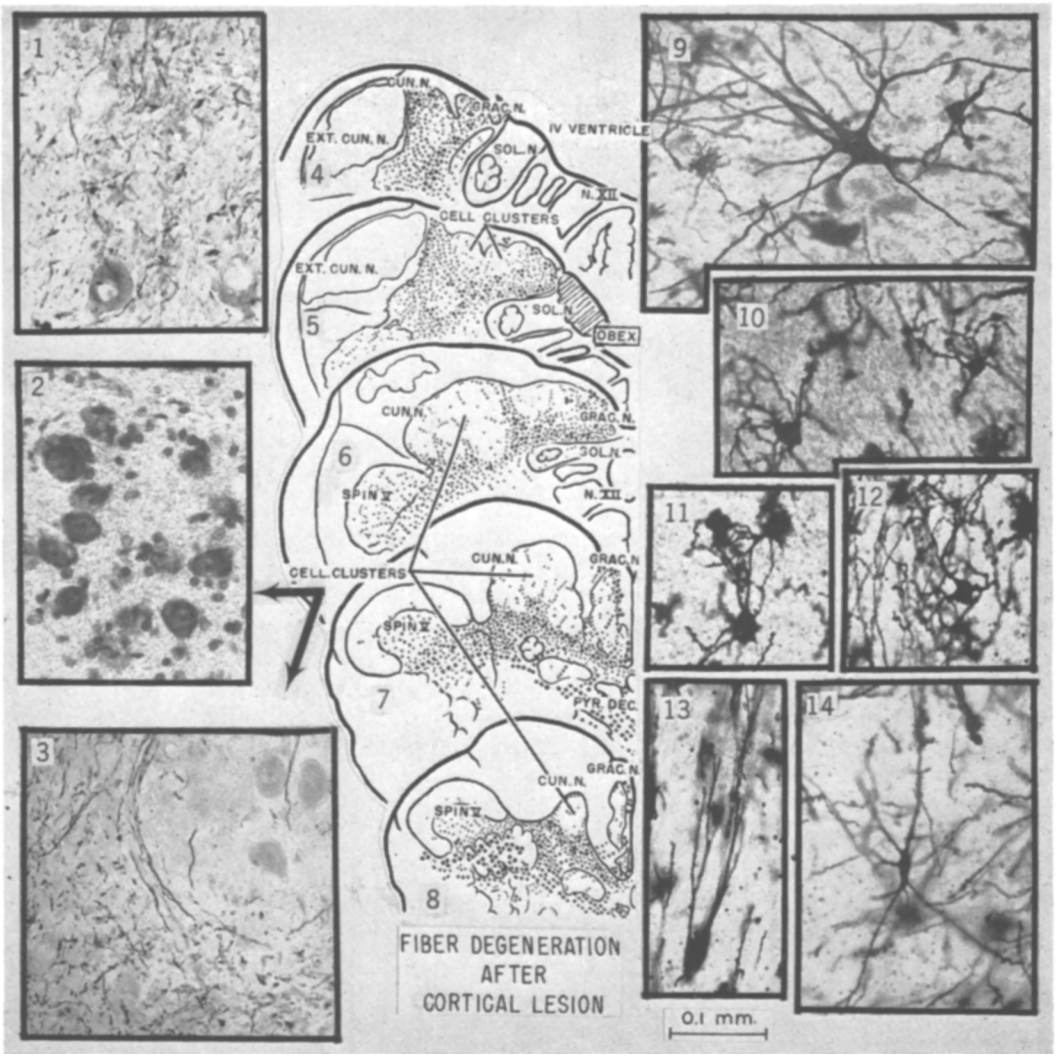

FIGS. 1 and 3. Fiber degeneration in rostral and caudal parts of nucleus cuneatus respectively. (Nauta-Gygax ±400X, and ±600X).

FIG. 2. Cell cluster in caudal part of nucleus cuneatus (cresyl violet, ±500 X).

FIGS. 4-8. Semidiagrammatic representation of fiber degeneration in nuclei cuneatus and gracilis, following lesion of the contralateral hemisphere. ⋰ degenerating bundles, ... degenerating fibers.

FIG. 9. Large multipolar cell in rostral part of nucleus cuneatus. (Golgi Cox).

FIGS. 10, 11, 12. Cells from cell clusters of nucleus cuneatus.

FIG. 13. Cell in tail end of nucleus gracilis.

FIG. 14. Cell taken from caudal base of nucleus cuneatus.

fusiform and triangular in shape, possessing long sparsely ramifying dendrites (Fig. 14). Somewhat similar cells are found within the nucleus gracilis and along the surface of both nuclei. Rostrally, the cell clusters largely are replaced by triangular and multiplolar cells (Fig. 9) possessing long, sparsely ramifying dendrites. The diameter of their dendritic territory is approximately 5 times larger than in the caudal clusters. Smaller cells are scattered between the multipolar cells (Fig. 9). The few rostral cell clusters resemble the caudal ones,

but the cells seem smaller and the dendritic trees less dense.

A comparison of the fiber distributions revealed that the cortical fibers are distributed primarily to those parts of the nuclei which contain triangular, fusiform and multipolar cells possessing long sparsely ramifying dendrites. The fiber distribution within these parts of the nuclei frequently seems to coincide with the orientation of the sprasely ramifying dendrites. However, only a few cortical fibers are distributed to the cells with small and frequently ramifying dendrites, present primarily in the cell clusters.

B. To judge the projection of the nuclei to the thalamus, the ventrolateral mesencephalon (medial lemniscus) was transected in 4 kittens at the age of 2 weeks. Following survival periods ranging from 2 to 16 weeks, many of the round cells in the caudal clusters—receiving very few cortical fibers—displayed only a nucleus with or without a thin rim of cytoplasm (Nissl stain). However, some of the basal cells in the caudal parts of the nucleus cuneatus and some of the rostral multipolar and triangular cells—receiving many cortical fibers—were less conspicuously affected. Their cell bodies were somewhat smaller, but some of them displayed normal Nissl substance. The smaller rostral cells were more severely affected.

Similar changes were observed in retrograde Golgi studies, in which the mesencephalic lesion at the age of 2 weeks was followed by Golgi impregnation at the age of 6 weeks. The caudal clusters were severely affected. Many of the impregnated cells were small, possessing thin dendrites. Their dendritic ramifications appeared more numerous than on the normal side, owing to sprouting or to better encrustation. Some of the rostral triangular and multipolar cells were less severely affected.

These findings suggest that the cells in the caudal clusters maintain less collaterals, uninterrupted by the lesion, than some of the triangular and multipolar cells in the caudal base of the nucleus cuneatus and in the rostral part of both nuclei. However, in many of the animals a few of the most medial bundles of the medial lemniscus carrying fibers from the rostral part of the nuclei(7), were spared. This renders the suggested differences in collateralization less than convincing. Nevertheless, such differences may exist, for in one kitten and in one adult cat a total transection of the medial lemniscus resulted in a somewhat similar distribution of retrograde cell reaction. Obviously, this point requires further investigation.

Discussion. The distribution of the pyramidal fibers as seen within the nuclei cuneatus and gracilis corroborates macroelectrode findings(8) which demonstrated that in the caudal parts of the nucleus cuneatus the pyramidal influence is exerted primarily on basal cells. On the other hand, microelectrode findings (9) indicate that a pyramidal influence is exerted also on the dorsally located cell clusters. The sparsity of the cortical fibers in these cell clusters suggests that this influence in part may be exerted indirectly, via other neurons. This might be suggested also by Waller's microelectrode findings(10) if they were obtained in caudal parts of the nucleus cuneatus.

The differences in dendritic architecture between dorsal cell clusters and basal cells in the caudal parts of the nucleus cuneatus seem to parallel differences in function. This is suggested by the fact that the dorsal cells—with short, frequently ramifying dendrites—apparently maintain small, cutaneous receptive fields located distally, while the basal cells—with long, sparsely, frequently ramifying dendrites—apparently maintain larger cutaneous receptive fields located proximally(11). These dorso-ventral differences in dendritic architecture within the caudal parts of the nucleus cuneatus resemble the rostro-caudal differences within the nuclei. The latter likewise may parallel differences in function. This is suggested by the fact that the rostral cells, many of which have long, sparsely ramifying dendrites, in general appear to maintain larger cutaneous receptive fields than the cells in the caudal clusters(13) and in part appear to transmit different sensory information(12, 14). In other words, this comparison suggests a possible correlation between the dendritic architecture of the cells and the size of their receptive fields, exemplified by the fact that the cells of Fig. 10, 11, 12, Fig. 13 and Fig. 9, respectively are found in the parts of the nuclei containing cells with increasingly larger receptive fields(13).

If these inferences are correct, the cortical fibers are distributed primarily to cells with

low resolution power (large receptive fields), while only a few cortical fibers are distributed to cells with high resolution power (small receptive fields). Therefore, the question arises whether the function of the cortical feedback might be related to the localizing resolution power of this sensory system.

Summary. The distribution of the cortical feedback fibers in the nuclei cuneatus and gracilis has been compared with the cyto-architecture and the dendritic architecture of these nuclei. This comparison revealed that the cortical fibers distribute primarily to those parts of the nuclei containing multipolar, triangular, and fusiform cells maintaining long, sparsely ramifying dendrites. The cells with frequently ramifying dendrites, on the other hand, receive only few fibers. Furthermore, preliminary evidence suggests that some of the former cells maintain more collaterals than the latter.

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Effect of Fat-Free Diets and Lipid Unsaturation on Rat Tissue Cholesterol Levels.† (27020)

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The degree of unsaturation of dietary fats and oils has been postulated as a factor which may influence cholesterol metabolism(1). Variations in degree of unsaturation have been commonly obtained by either partial hydrogenation of a given lipid or by the combination of lipids from different sources. Although such manipulation yeilds a lipid with a specific degree of unsaturation as defined by iodine value, the effect of positional and geometrical isomers produced by partial hydrogenation, and of short-chain fatty acid triglycerides, cannot be evaluated. Thus the effect on liver and blood cholesterol levels produced by a lipid from a single source, but differing in degree of unsaturation, is of interest. Three degrees of unsaturation were obtained by use of unhydrogenated oil, an aliquot of the same oil completely hydrogenated, and a simple mixture of these in equal proportion. Data for both corn oil and safflower oil are presented.

Methods. An experimental group of 8 male rats* each weighing ca. 100 g was housed 2 rats per metal, screen-bottom cage. Rats were allowed access to experimental diet and water *ad libitum*. Composition of the basal diet is given in Table I. Addition of 5% lipid and/or 2% cholesterol was made at the expense of potato starch. Lipids with different degrees of unsaturation, as determined by iodine number, were obtained by use of (a) commercially

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