Cytoarchitectonics of the Striate Cortex in Carnivores and Primates Following Optic Tract Transection

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Examination of brains from Old World monkeys and cats one year after optic tract transection showed a significantly reduced density of neurons in layer IV C of area 17 (striate cortex) in the projection of central vision on the transection side in the monkeys but not in the cats. It is concluded that peripheral vision is less vulnerable to deafferentation than central vision.

Key Words: *cytoarchitectonics; deafferentation*

Clinical and neurophysiological studies indicate that reparative processes proceed in the visual centers after their afferent inputs have been cut. The morphological basis of the reorganization which visual functions undergo following deafferentation has been studied inadequately, and the available information is contradictory. There have been no reports that take into account the retinotopic projection in considering structural changes in the visual cortex after deafferentation. We have shown [2] that neurons of the external geniculate body, which are associated with central vision, suffer more as a result of deafferentation (transection of the optical tract) than do those associated with peripheral vision, and that the consequent degenerative changes in monkeys are more profound (involve loss of neurons associated with central vision) than in cats.

In this study, we compared the cytoarchitectonics of the striate cortex in monkeys and carnivores (cats) after visual deafferentation.

MATERIALS AND METHODS

In cats and Old World monkeys (*Colobus morbus* and *Cercopithecus mitis*), the left visual tract was transected surgically [1]. One year later, strial sections of their brains stained by Nissl's method were studied visually taking into consideration the retinotopic projection of the retina to the visual cortex and counting cell numbers in layer IV C of area 17 of this cortex by the conventional procedure.

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RESULTS

In the cats one year after optic tract transection, the cytoarchitectonic pattern of the visual cortex on the side ipsilateral to the cut optic tract was essentially the same as that on the contralateral side (Fig. 1). In the monkeys the cytoarchitectonic pattern of the striate cortex in the projection area of central (macular) vision on the left (deafferented) side differed markedly from that on the right side. Thus, layer IV C in the intact hemisphere had a higher cell density than in the deafferented hemisphere (Fig. 2). In the projection area of peripheral vision, however, no decrease in cell density in layer IV C was observed.

Our visual observations were confirmed when nerve cells were counted (Table 1). In the cats, no significant differences in the number of these cells per 0.001 mm^3 in layer IV C of area 17 were found either between the sides ipsilateral and contralateral to optic tract transection or between the

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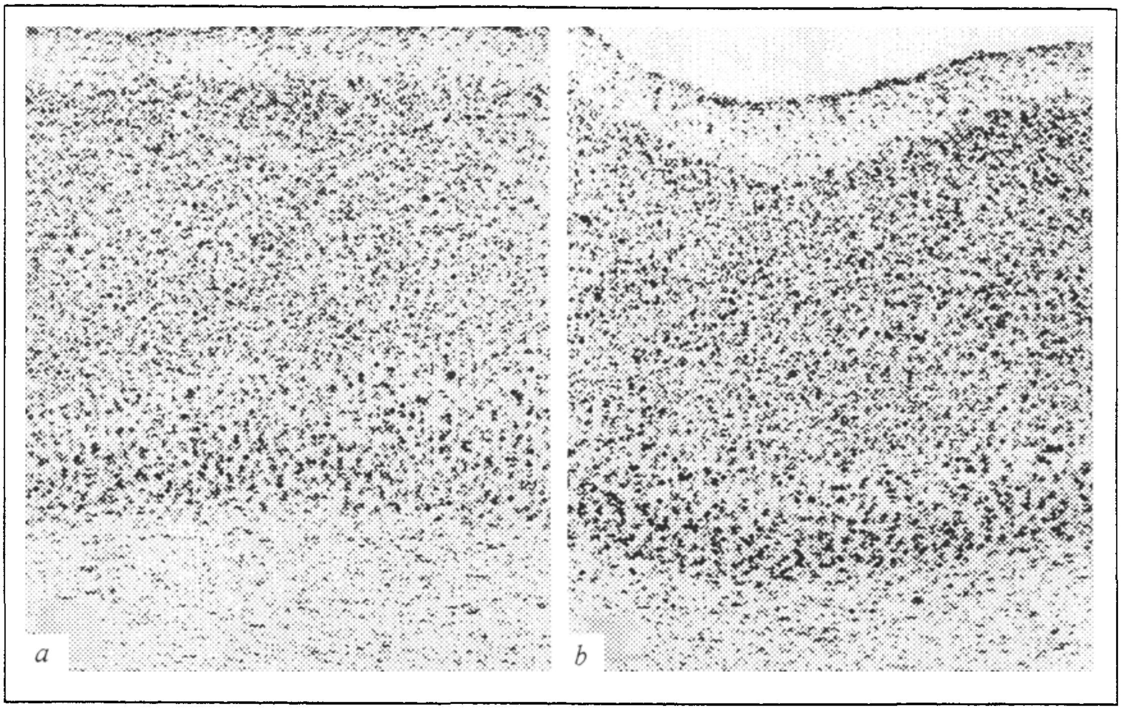

Fig. 1. Cytoarchitectonics of area 17 in cat brain in the projection area of the central zone of the retina. Here and in Fig. 2: *a*) on the side contralateral to the transected tract; *b*) on the operated side.

projections of central and peripheral vision. In the monkeys, by contrast, cell density in the projection of central vision on the operated (left) side was significantly lower than in the projection of peripheral vision, whereas on the side contralateral to optic tract transection, cell density in the projection of central vision was close to that in the projection of peripheral vision (Table 1). Nor were significant differences in cell density found between the two sides in the projection of retinal periphery.

These results indicate that differences exist in the structural changes undergone by the striate cortex in response to deafferentation — both between carnivores and primates and when the retinotopic projection is considered. In carnivores, as exemplified by cats, the cytoarchitectonic pattern of the striate cortex remains essentially unchanged, whereas primates (monkeys) show a reduction in the number of neurons in layer IV C, which mainly consists of stellate cells (small stellate cells) and in which axons of the retinogeniculate pathway terminate. The visual cortex of carnivores and that of primates, in particular area 17 (striate cortex), are homologous with respect to the visual projection areas. In the striate cortex, the central part of the visual field (the foveal portion of the retina) occupies a large area of the projection representation as compared to the retinal periphery — both in cats [4] and in monkeys [3]. We have tried to explain differences be-

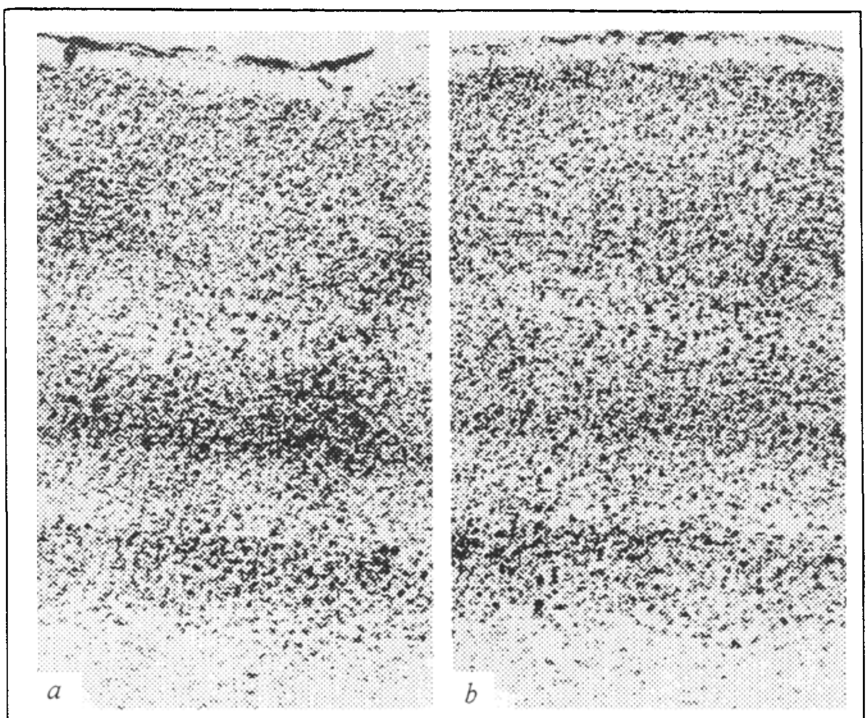

Fig. 2. Cytoarchitectonics of area 17 Old World monkey brain in the projection area of central vision.

tween primates (monkeys) and carnivores (cats) in the extent of structural changes in the striate cortex on the basis of what is known from the literature and taking physiological factors into consideration (monkeys are mainly diurnal animals, whereas cats are chiefly nocturnal). In our view, there exists, at the level of the subcortical visual centers and striate cortex, a morphological substrate for the two distinct parallel mechanisms of vision — central and peripheral. Peripheral vision is less vulnerable to insults such as deafferentation than central vision, and the stability of the mechanism of peripheral vision may play a substantial role in compensating for disorders of vision when structures of the visual analyzer are damaged.

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Correlation between the Temperature and Morphological Asymmetry of Human Ears and Its Relation to the Mnestic Pattern

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A correlation is found between the temperature and morphological asymmetry of human ears and the mnestic pattern. The temperature asymmetry at the anterior surface of the ear is more pronounced for brain injury.

Key Words: *biologically active points of the skin; psychology; temperature and morphological asymmetry of the ears; brain damage*

In previous study [2] we presented the results of experiments which showed that there is a correlation between the temperature at the biologically active points (BAP) of the ear and the results of psychological testing. We suggested that this phenomenon is associated with the regulation of the blood flow in the human brain and ear.

The aim of the present study was to compare the results of thermo- and morphometry of the ears with the mnestic pattern of human beings in health and pathology.

MATERIALS AND METHODS

A total of some thousand persons were examined, including 170 adults, 12 patients with brain injury, and 40 neonates, the remaining examinees being preschool- and school-age (300 and 450, respectively) children.

The mnestic pattern (left-brain or right-brain) was determined in the group of adults by psychological testing after Shalven-Hermann [3]. The temperature was measured at symmetrical BAP of

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