Convergent input from the striate cortex (area 17) to the cortex of the superior temporal sulcus in the rhesus monkey

While studying the organisation of projections from the striate cortex in the rhesus monkey, degeneration could be seen in the posterior bank of the superior temporal sulcus regardless of the position of the lesion in the striate cortex. However, because of the small size of this field in the superior temporal sulcus, slight variations in the angle of sectioning made it difficult to determine with any certainty whether this was a highly specific field, receiving convergent input from all parts of area 17, or whether there was a condensed topographic organisation within this field. One possible way of eliminating this difficulty would be to make separate punctate lesions in the striate cortex of the same animal. With such a preparation, any discontinuities in the degeneration at the posterior bank of the superior temporal sulcus would be suggestive of a topographic organisation. Such an experiment is reported in this paper.

Two monkeys sustained lesions of the visual cortex. In one (Fig. 1A) 3 small lesions were distributed over the dorsolateral surface of the occipital operculum, the dorsalmost lesion being several millimetres away from the striate-prestriate boundary and the other two skirting this boundary. In the other animal (Fig. 1B), one lesion was placed in the dorsolateral surface and another just below the horizontal line. The lesions were effected by subpial suction and after survival periods of 9 and 11 days, the monkeys were perfused with formol–saline. The brains were sectioned horizontally at 30 μm and 3 sections in every 30 were stained by a slightly modified Fink–Heimer silver impregnation technique.

In both animals, whereas the degeneration in the areas 18 and 19, as previously defined, was widespread and showed discontinuities (as would be expected), only one field of degeneration was found in the posterior bank of the superior temporal sulcus, roughly 1.5 mm × 3.0 mm in size. No other region of degeneration in the posterior

Fig. 1. Diagram showing the distribution of lesions in the striate cortex in the two monkeys. In one (A) 3 lesions were distributed over the dorsolateral surface. In the other (B), one lesion was in the dorsolateral surface whereas the other was just below the horizontal line of the striate cortex. sl = lunate sulcus; io = inferior occipital sulcus; st = superior temporal sulcus.

Brain Research, 28 (1971) 338–340
Fig. 2. Diagrams of representative sections, taken at the levels indicated, from one of the two brains (B) shown in Fig. 1. Notice that only one field of degeneration appears in the cortex of the posterior bank of the superior temporal sulcus (section b), although there is widespread degeneration within the lunate sulcus (upper prestriate cortex, sections a and b) and the inferior occipital sulcus (lower prestriate cortex, section e). The degeneration in the lunate sulcus in section b appears almost to consist of two separate fields and the degeneration in the inferior occipital sulcus (section e) definitely consists of two separate fields, as would be expected. In the other monkey shown in Fig. 1A, the degeneration in the posterior bank of the superior temporal sulcus was again very limited although the distribution within the lunate sulcus was widespread. Abbreviations as in Fig. 1.

bank of the superior temporal sulcus was found in either monkey, as may be seen by reference to Fig. 2 which shows the picture of the degeneration in one of the two monkeys. It would seem, therefore, that this is an area of convergent input, receiving fibres from all parts of the visual cortex covered in the present study. If there is any topographic organisation within this field, it is certainly too fine to be detected by the present technique. Such a convergence of input would imply a specific cortical visual area, the receptive fields of whose cells are wide. Such an area could possibly represent
a step in the input to the so-called 'inferior temporal' area where cells with very wide receptive fields have been observed\(^3\).

Whether this is the only area in this region receiving a convergent input from visual cortex remains to be seen. In 4 animals, Cragg\(^1\) observed a field of degeneration in the inferior occipital gyrus following lesions in the striate cortex, in addition to the degeneration in the posterior bank of the superior temporal sulcus and that defining areas 18 and 19. We have also observed this projection in one monkey with a striate cortex lesion. In all other such animals we have observed degeneration in the posterior bank of the superior temporal sulcus only, in addition to the degeneration defining the areas 18 and 19. The reasons for this possible discrepancy are not clear. Nor is it clear why this field of degeneration in the posterior bank of the superior temporal sulcus should appear so much wider, dorsoventrally, following callosal section\(^6\). For the present, however, anatomical evidence is provided for a convergent input from the striate cortex to a specific area in the cortex of the posterior bank of the superior temporal sulcus.

This work was supported by the Science Research Council.

I am much indebted to Alex Campbell, Norma Morgan and John Shephard for excellent assistance.

M.R.C. Cerebral Functions Group, Department of Anatomy, University College London, London W.C. 1 (Great Britain)

S. M. ZEKI


(Accepted February 9th, 1971)