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*EFFECTS OF VARYING STIMULUS SIZE AND COLOR ON SINGLE LATERAL GENICULATE CELLS IN RHESUS MONKEYS**

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In the visual system of primates, mechanisms exist for the analysis of both spatial and chromatic qualities of a retinal image. The present study was designed to examine these processes at the lateral geniculate level in the rhesus monkey. Extracellular recordings were made from 224 cells while stimulating the retina with spots of light of various sizes and wavelengths, and in various states of light and dark adaptation.

In the four dorsal (small cell) layers, three types of cells were distinguished. Type I cells were by far the most common. In the light-adapted state they had concentrically arranged receptive fields which were divided into an excitatory or inhibitory center and an opponent surround, the center and surround having different spectral sensitivities. With diffuse light stimuli they showed opponent-color responses, giving on-responses to one set of wavelengths, off-responses to another set, and no response at some intermediate wavelength—the "neutral point." Chromatic-adaptation studies suggested that the cell had connections with one of the three types of cones in the field center, and another in the surround. Five varieties were seen, in order of frequency: (1) red on-center, green off-surround; (2) red off-center, green on-surround; (3) green on-center, red off-surround; (4) green off-center, red on-surround; (5) blue on-center, green off-surround. All type I cells reacted in the same way to white light, showing the usual center-surround arrangement seen in the retina or geniculate in the cat. On-off responses were rare or absent.

Type II cells made up a small minority of the dorsal layer cells. They lacked any center-surround receptive-field arrangement, but gave opponent-color responses over all regions of the receptive field and had a 500-mμ neutral point that was independent of stimulus geometry. These cells behaved as though they received opponent inputs from two sets of cones with identical distributions over the retina. Two types were seen: green-on, blue-off, and green-off, blue-on. A few cells seemed to have opponent connections with green and red cones. Here the two cone types were distributed over overlapping regions, but one set of cones seemed to predominate in the field center and the other in the surround.

Type III cells had concentrically arranged on-center or off-center receptive fields, the center and surround having identical spectral sensitivities. A large spot evoked a weaker response than a small one regardless of wavelength. These cells probably received input from cones of several types, the proportions of the three types being the same for the field center as for the surround.

A number of cells with fields outside the fovea were studied also in the dark-adapted state. Some type I cells behaved as though they had no connections with rods, while others showed clear evidence for rod input, giving a 2–4 log unit increase in sensitivity with a shift in the peak sensitivity to a point near 500–520 mμ. Opponent-color effects were no longer seen, and center-type responses occurred over the entire spectrum, except in some cells at high stimulus intensities in the red. At threshold levels of intensity, these responses were evoked from the field center only, so that whether they receive input from rods in the field periphery is still uncertain. Two type II cells examined in dark adaptation showed no evidence for rod connections. Out of four type III cells, two lacked a rod input, and the other two had rods feeding in from center and surround, forming opponent systems just as in the light-adapted state; for these cells, scotopic thresholds were practically the same for center and surround.

All of the cell types were seen in both pairs of dorsal layers, and there were no differences in distribution of cell types in these four layers, except for a suggestion that red on-center cells were commoner in the two dorsal layers than in the two middle, and red off-center cells less common. Field-center sizes were generally smaller for type I cells than for type III, and among type I cells on-centers tended to be smaller than off-centers. Field centers were smaller, the closer they were to the fovea; the largest were around 1°. Fields of type II cells ranged in diameter from $^1/_4$° to 1°.

Ventral layer cells were of two kinds. The first seemed similar to type III as described above. The second, termed type IV, had concentrically arranged on-center fields with a very large off-surround whose spectral sensitivity was displaced to the red with respect to the center. With red light, and generally also with white, the receptive-field periphery prevailed over the center, so that diffuse light produced a well-maintained suppression of the background firing.

In summary, a wide variety of cell types are present in the monkey geniculate. Some are concerned mainly with spatial variables, others with color, but most are able to handle both variables. Some have connections both with rods and cones, and others with cones only.

* This represents a summary of material to be published *in extenso* in the *Journal of Neurophysiology.*