

LATE SEGREGATION OF GENICULATE AFFERENTS TO THE CAT'S VISUAL CORTEX AFTER RECOVERY FROM BINOCULAR IMPULSE BLOCKADE.

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In the developing visual cortex of monkey (Hubel et al, Rakic, PRSB 278, 1977) and cat (LeVay et al, JCN 179, 1978), ocular dominance columns appear to form by a progressive segregation within layer IV of geniculate afferents serving the left and right eyes. In kittens younger than 2 weeks of age, physiological and several types of anatomical evidence suggest that afferents serving the two eyes make intermingled connections (LeVay & Stryker, Soc Neurosci Symp 4, 1979). By 6-8 weeks of age the segregation process appears from similar evidence to be complete or nearly so.

Last year at this meeting, I reported that blockade of all impulse discharge in the two optic nerves (by repeated intravitreal injections of tetrodotoxin) between 2 and 8 weeks of age prevents the segregation process. In such animals autoradiographic studies disclosed no periodic variation in labelling density within layer IV. Following brief recovery from the blockade, microelectrode recordings revealed nearly all cells within layer IV to be driven well by both eyes, suggesting that intermingled left and right eye afferents had maintained intermingled functional connections. In contrast to these effects of binocular impulse blockade, dark-rearing, binocular lid-suture, systemic infusion of TTX, or repeated intravitreal injections of vehicle solution all allowed the segregation process to occur.

The present study asked two questions. (1) At what time during normal development is the arrangement of the geniculocortical afferents no longer plastic? (2) If binocular impulse blockade is maintained up to this time, will the geniculocortical afferents then be able to segregate to form ocular dominance columns?

The first question was addressed by studying the effects of several months of monocular deprivation begun at progressively later ages. Deprivation beginning at or after 8 weeks of age produced no obvious effects on the cortical labelling pattern following injection of one eye, suggesting that the geniculocortical afferents were no longer plastic. To answer the second question, 5 cats were raised with binocular impulse blockade between 2 and approximately 8 weeks of age and were then allowed binocular visual experience for an additional 8-12 weeks. After this recovery period, microelectrode recordings revealed that many cortical neurons were monocularly driven, and autoradiography in every case showed apparently normal ocular dominance columns.

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