RIBAK,C.E., R.T. ROBERTSON, J. CHU*, and W.H. OERTEL*, Dept. of Anatomy, Univ. of Calif., Irvine, CA and Dept. of Neurology, Technical Univ., Munich, FRG. The effect of neonatal monocular enucleation on the development of the GABAergic system in rat visual cortex.

Previous studies have demonstrated the presence of GABAergic neurons in the visual cortex and their inhibitory role in the processing of visual information. The present study was undertaken to determine the effects of partial denervation on the development of the GABAergic system. Long-Evans hooded rats were monocularly enucleated on the day of birth and were sacrificed by intracardiac perfusions of aldehyde solutions at ages 14-90 days. Sections through the visual cortex were incubated in anti-glutamate decarboxylase (GAD) serum to demonstrate GABAergic axon terminals. GAD-positive axon terminals and preterminal plexues were only rarely seen in area 17 of 14 day old rats. On day 16, GAD-positive axons and terminals were observed consistently throughout all cortical layers of area 17. The monocular portion of area 17 contralateral to the removed eye contained fewer GAD-positive elements. In older (19-90 day) animals, only GAD-positive terminals were stained whereas the preterminal axons were not apparent. A quantitative analysis of the number of GAD-positive terminals showed that area 17 contralateral to the enucleated eye had 30-40% fewer terminals than area 17 contralateral to the normal eye. This quantitative difference in the number of terminals was slightly less in the older (60-90 day) animals. A difference in the number of terminals was not found in other cortical areas, including the adjacent retrosplenial cortex. The number of GAD-positive terminals in visual cortex from normal control rats was similar to the number found in the enucleated rats' cortex contralateral to the intact eye. Previous studies in the visual cortex from enucleated rats have indicated certain changes in the dendritic spine density and stellate cell dendritic domains in layer IV of visual cortex. However, no major cell loss was demonstrated in these previous studies. Our findings suggest that a normal excitatory stimulation of the visual cortex is required for the development of a normal number of GABAergic terminals. These findings together with the known fact that GABAergic neurons provide a major inhibitory function in the visual cortex suggest that the amount of cortical stimulation has a direct effect on the development of inhibitory GABAergic terminals. Supported by NIH Grant NS-15669.