

This is a general mechanism which is equally satisfactory for the dealkylation of amines, arylothers, amides, carbamates, and barbiturates.

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Gamma aminobutyric acid and 5-hydroxytryptamine concentrations in neurons and glial cells in the medial geniculate body of the cat

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GAMMA aminobutyric acid (GABA) results from the decarboxylation of glutamic acid and is transaminated to succinic semialdehyde. Both GABA and the enzymes accounting for its turnover have been measured in different brain structures and in different fractions of ultracentrifuged brain cells.^{1, 2} However, which type of cells in the brain contains GABA has been in question.

5-Hydroxytryptamine (5-HT), similarly, has been assigned its place in certain brain structures and in certain fractions of ultracentrifuged brain cells;^{3, 4} some of the enzymes accounting for its formation and degradation have a characteristic distribution.^{5, 6} Which type of cells in the brain contains 5-HT has also been in question.

In the cat each medial geniculate body weighs about 28 mg and protrudes from the brain stem so that it is easily dissected free. Removal of cortical areas known as AI, AII, Ep, SII, temporal, and insular results in retrograde degeneration and gliosis in all portions of the principal division of the medial geniculate body.^{7, 8} The degenerative process requires 6 weeks and leaves about 17 mg of tissue consisting of glia, presynaptic axon tips from the neurons of the inferior colliculus, and an insignificant number of neurons. This technique of obtaining a large sample of glial cells without intact neurons seemed useful in answering the above questions.

Cats were anesthetized and under aseptic conditions the proper cortical areas were removed by suction. The hole in the skull was covered by a thin sheet of dime silver so that compression by the

temporal muscle would not flatten that hemisphere and medial geniculate body. The operation was done unilaterally in all cases and the unoperated side served as control tissue. After 6, and in one case, 10, weeks the animals were killed by electrocution, their brains removed and immediately chilled. Experiments on rats show that this method of sacrificing animals does not affect brain 5-HT levels. This procedure took less than 5 min. Dr. Anna Ottolenghi of the Duke University Pathology Department verified the cellular constitution of control and experimental tissue. Gliosis consisted mainly of fibrous astrocytes.

The entire extract of each medial geniculate body was chromatographed and the GABA content determined.⁹ The degenerated medial geniculates from two animals were combined for fluorometric estimation of 5-HT as were the two control medial geniculates. A modification of Kirshner's method for 5-HT estimations (personal communication) was made for use with tissue. Three quick extractions with 0.4 N perchloric acid were made and adjusted to pH 6.0 with 5 N K_2CO_3 , and followed by centrifugation of the resultant $KClO_4$ precipitate. Passage of the extract through 10 mm \times 10 mm CG-50 at pH 6.5 was followed by 3 N HCl as an eluant. Reagents were reduced to volumes appropriate to the amount of tissue used.

Results of GABA estimations are shown in Fig. 1.

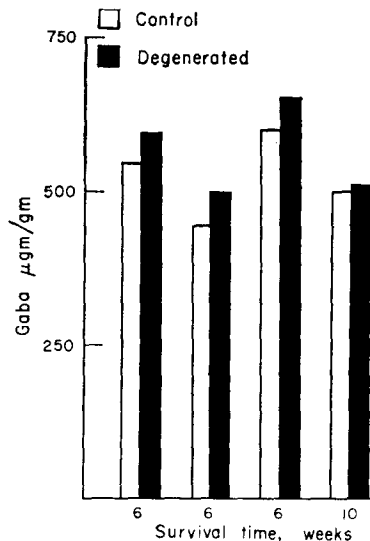


FIG. 1. GABA levels in medial geniculate bodies of cats operated unilaterally. Each pair of columns represents medial geniculates from one cat.

Slightly more than 500 μ g of GABA normally occurs in 1 g of medial geniculate tissue and is concentrated only about 10 per cent by allowing intact neurons to degenerate. GABA is apparently distributed equally between neurons and glia.

Results of 5-HT estimations are shown in Fig. 2.

About 1.20 μ g of 5-HT occurs in 1 g of medial geniculate tissue, and removal of neurons concentrates it by 72 per cent. 5-HT may thus be contained in either glia or the afferent axon tips which are not affected by cortical lesions. Therefore lesions of the brachium of the inferior colliculus were made in animals with cortical lesions to destroy axon tips also. Figure 2 shows that when neurons and axon tips are removed the 5-HT is still concentrated in the medial geniculate. This result is interesting since Michaelson and Whittaker find 5-HT in cell fractions consisting mostly of synaptic vesicles.⁴ Preliminary results in this laboratory indicate that lesions of the brachium of the inferior colliculus

only do not alter the 5-HT concentration in the medial geniculate body. Most of the 5-HT is apparently contained in the glial cells.

These results differ from measurements of GABA and 5-HT in glial cell tumors and stress the difference in the two types of tissue sample.^{10, 11}

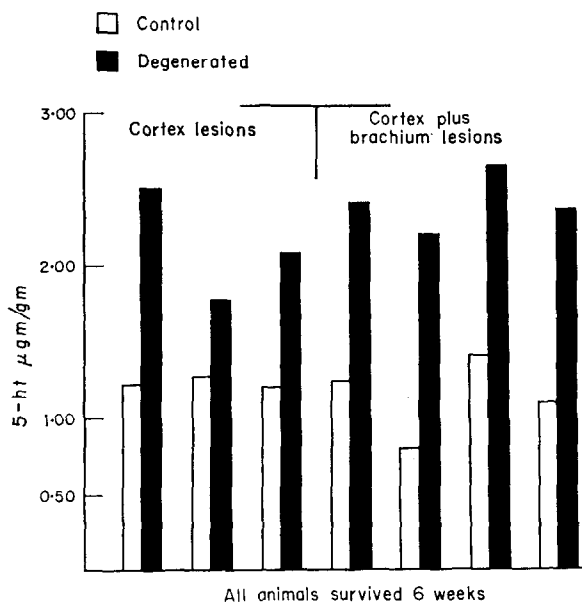


FIG. 2. 5-HT levels in medial geniculate bodies of cats operated unilaterally. Each pair of columns represents pooled medial geniculates from two cats.

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