

Title: Gamma-aminobutyric acid in the Midbrain: Role in Sensation, Perception, and Neurological Disorders

Authors

Le, T. (1), Botello, C. (2), VandeBerg, J. (3), (4), PhD, and Gil, M. (2), (5), (6), PhD

Affiliation Details

(1) Department of Health and Biomedical Sciences, College of Health Professions, UTRGV, Brownsville (2) Department of Psychological Science, College of Liberal Arts, UTRGV, Brownsville (3) South Texas Diabetes and Obesity Institute, (4) Department of Human Genetics, School of Medicine, UTRGV (5) Department of Neuroscience, (6) Institute of Neuroscience, School of Medicine, UTRGV

Background

Altered GABA expression in the midbrain is associated with neurological conditions like epilepsy and Parkinson's Disease. In the genetically epilepsy prone rat, an increase in GABA neurons in the inferior colliculus increases seizure susceptibility. In contrast, Parkinson's Disease is associated with altered GABA expression in the substantia nigra. The purpose of this study is to identify patterns between the sensory and motor regions of the midbrain and to quantify a baseline of GABA neurons in these areas.

Methods

The Allen Institute's reference atlas of the mouse and BrainMap.org was used to identify the sensory and motor areas of the mouse's midbrain. Using the ISH tool in Allen Institute, a prior study on the GAD-1 gene was used to quantify GABA neurons in the midbrain. Midbrain images were obtained from a 56-day old C57BL/6J mouse strain. The total count of GABA neurons in each major sensory and motor areas were recorded. Samples of the *Monodelphis domestica* midbrain tissues were obtained from the laboratory and used for comparison.

Results

The combined motor areas of the midbrain were significantly larger than the combined sensory areas. High density of GABA expression was found in the superior colliculus. Clustering and higher quantity of larger GABA neurons were most prominent in the superior colliculus. The sensory midbrain areas of the *Monodelphis* were larger in size compared to the mouse. The total count for the superior colliculus was estimated to be 1674 neurons, while the inferior colliculus had a total count of 375 neurons. The total count of GABA neurons in the motor related areas of the midbrain was 3,690.

Conclusion

In the *Mus musculus*, there was a greater density and quantity of larger GABA neurons within the sensory area of the superior colliculus. The total area of the motor areas of the midbrain was significantly larger than the sensory areas in the *Mus musculus*. When comparing the two midbrains, it appeared that the *Monodelphis domestica*'s sensory areas of the midbrain were distinctly larger than the mouse. Deviations from our baseline could help indicate whether abnormal GABA expression in the midbrain is linked to neurological conditions.