



**CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY**

Name(s) Braeden C. Benedict	Project Number S1205
Project Title Pathology and Chemistry of the Brain in Sanfilippo Syndrome Type B	
Abstract Objectives/Goals The effects of Sanfilippo syndrome type B, a rare genetic lysosomal storage disease, on the mouse brain were studied. It was hypothesized that affected mice would have decreased volume and/or neuron counts in the amygdala, a region of the brain previously observed to have been affected in humans. Also, it was hypothesized that the activities of choline acetyltransferase (ChAT) and acetylcholinesterase (AChE), enzymes involved with the acetylcholine neurotransmitter pathway, would be lower in diseased mice. Methods/Materials Using stereology software, volume and cell count measurements of the amygdala region were made using snap-frozen brain tissue samples of both carrier (healthy) and mutant (diseased) mice treated with both a Nissl stain and an AChE activity stain. The activities of both AChE and ChAT throughout the brain were quantified by performing enzyme activity assays using brain tissue homogenate from carrier and mutant mice. ChAT immunohistochemistry (IHC) staining was also performed to locate specific affected regions. Results While there was no significant difference in volume or cell counts, it was observed that the intensity of AChE staining was lower in the diseased brains. It was measured that the activity of AChE was lower by 25% in the region of the brain containing the amygdala and by 12% throughout the brain. Likewise, the ChAT activity was lower by 14% in the amygdala region. IHC staining for ChAT yielded a surprising result, with mutant animals having a higher number of cholinergic neurons stained in a region near the brainstem than the carriers. A corresponding increase in AChE activity was also observed in this region. Conclusions/Discussion Although the hypothesis regarding amygdala volume and cell density was disproved, observations made during that study led to discovering significant changes in the activities of AChE and ChAT. The enzyme activity changes can provide an indicator of disease progression and could provide an indicator of the success of an attempted therapy. This knowledge will aid in the development of treatments first in animal models, then in human patients.	
Summary Statement The effects of Sanfilippo syndrome on the mouse brain were studied, and it was discovered that the activities of AChE and ChAT enzymes are significantly reduced, especially in the amygdala region.	
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