The Correlation Between Peroxisome Levels and Short-Term Memory Loss in a PINK1-/- Rat Model of Parkinson's Disease

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Parkinson’s disease (PD), a progressive brain degenerative disease, affects over 10 million people globally leading to neurological deficits associated with tremors, rigidity, imbalance, and memory loss. Studies show PD results from neuronal death of dopaminergic neurons, possibly due to excess reactive oxygen species (ROS). It is hypothesized that dysfunctional/altered peroxisomes, membrane-bound organelles associated with ROS scavenging, may be implicated in ROS imbalance in PINK1 -/- rat models of PD which leads to the short-term memory deficits. Fixed tissue was obtained from 12.5 month old Long Evans rats previously evaluated on the novel object recognition paradigm, a test evaluating memory. The results suggested PINK1 -/- rats exhibit short-term memory loss. In this study, peroxisomes from cortical regions of fixed PINK1 -/- rat brain tissue were immunostained for PEX14 expression, a known peroxisome membrane protein. To evaluate peroxisome presence in brain regions involved in memory and motor control, over 45,000 data points from pyramidal cells present in 3 brain regions, prelimbic cortex (PrL), primary motor cortex (M1), and somatosensory cortex (S1), were analyzed for intensity using ImageJ. When examining peroxisome levels of PINK1 -/- and wildtype control rats (WT), no significant difference in peroxisome levels was found in either the PINK1-/- or WT rats across the three brain regions investigated. While these findings support the null hypothesis (peroxisome levels did not differ), further investigation into peroxisome functionality is prompted, with the use of a spectrophotometric assay with catalase. Use of animal models to study debilitating effects of PD enables scientists to delve deeper into associated neurological deficits.

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