A Novel Approach to the Characterization of Toxoplasma gondii Infected Neurons

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Toxoplasma gondii is an obligate intracellular parasite with seropositivity exhibited in 2 billion humans globally. There are three canonical strains of T. gondii which infect the Central Nervous System of all warm-blooded animals, with only Type II and Type III persisting as a chronic infection and developing cysts. Changes triggered by the parasite in infected neurons have been associated with HIV/AIDS, Chorioretinitis, and Schizophrenia. However, these cellular relationships have not been adequately studied due to traditional methods which have often led to data losses. As a result, the purpose of this blind-study was to utilize novel techniques involving thicker coronal Mus Musculus brain sections, optical clearing, and 3-D analysis to characterize the spatial relationship between encysting parasites and infected neurons. It was hypothesized that the more virulent Type II strain will exhibit different cyst diameters and proximity to the neuron as opposed to the Type III strain. Cysts were also thought to be predominantly found where neurodegenerative diseases typically cause decay, which was verified by this research. Type II cysts were found, on average, 30 microns closer to the infected neurons, rendering the change in distance statistically significant. Changes in cyst diameters were also found statistically significant, with Type II cyst diameters, on average, 25.76% greater than Type III cysts. This innovative approach to cellular neurology will allow future research to be conducted with greater ease and precision than before as well as aiding in the development of a mechanistic view of how Toxoplasma gondii affects the brain.