

Regeneron WESEF 2023 Finalist



Lauren Davidson

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The Effect of Copper (II) Sulfate Pentahydrate Concentration on Lifespan and Locomotor Ability of Transgenic Alzheimer's Model *Drosophila melanogaster*

Alzheimer's Disease (AD) is a progressive neurodegenerative disease believed to be caused by the abnormal breakdown of proteins creating toxic A β plaques. Copper is naturally occurring and is required for maintaining the health of neurons. Two conflicting theories on copper interaction with AD exist: 1. A β plaques absorb Cu $^{2+}$ ions, creating a Cu $^{2+}$ deficiency in neurons leading to decreased neuronal function that could be improved by supplementation. 2. Excess Cu $^{2+}$ in the brain binds to A β , increasing aggregation and causing an increase in neurodegeneration that could be improved by decreasing Cu $^{2+}$ levels. This study researched the effects of Cu $^{2+}$ concentration on transgenic *Drosophila melanogaster* expressing the human "Arctic" A β PP mutation to examine if supplementation could decrease AD-associated effects. A dose-response study was conducted where 0, 1, 10, 100, 500, and 1000 μ M copper (II) sulfate pentahydrate concentrations were added to Instant *Drosophila* Medium Blue. Male and female flies of each strain and concentration were tested separately. Because AD has age-dependent deterioration in movement coordination, a negative geotaxis assay was conducted on days 7, 8, and 9 of life. Probability of survival was documented using Kaplan-Meier curves. Only Arctic flies survived the 100 μ M conditions. Results show that as Cu $^{2+}$ concentration increased, both Arctic male and female flies performed significantly better than at 0 μ M ($p < .05$), whereas wildtype and Gal4 performance generally deteriorated, demonstrating improved locomotor ability and neurological function in AD flies as Cu $^{2+}$ is supplemented. Arctic males and females had a normalization of lifespan at 10 μ M with no significant difference in lifespan existing between 10 μ M Arctic and 0 μ M wildtype flies. Results show that copper supplementation may have an ameliorating effect on behavioral function and lifespan in AD *Drosophila melanogaster* and therefore could also have an ameliorative effect in AD patients.