Studying The Effects of Mojave Yucca on Drosophila With Huntington's Disease

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Huntington's disease (HD) is a hereditary neurodegenerative disorder that affects the brain. Huntington’s disease leads to the gradual degeneration and death of large numbers of neurons in the brain (National Institute of Health, 2023). Huntington’s disease is usually most prevalent in the late 30-40 age group. Along with this, HD is created by a mutation in the gene that contains the encoding for the HTT gene. The HTT gene, also known as the huntingtin gene, is expressed in every single person. The HTT mutation leads to the 3 main pillars of DNA (cytosine, adenine, guanine) (CAG) repeating at a much faster and larger rate as compared to CAG repeats without the HTT mutation. Patients with around 36 and more CAG repeats are in the target zone for developing HD. The genetic mutation responsible for Huntington's disease is inherited by something called an autosomal dominant pattern, which means that an affected person has a 50% chance of passing this mutation down to their offspring. In rare cases. In rare cases, people may develop Huntington’s disease without a hereditary past and often with a genetic mutation.

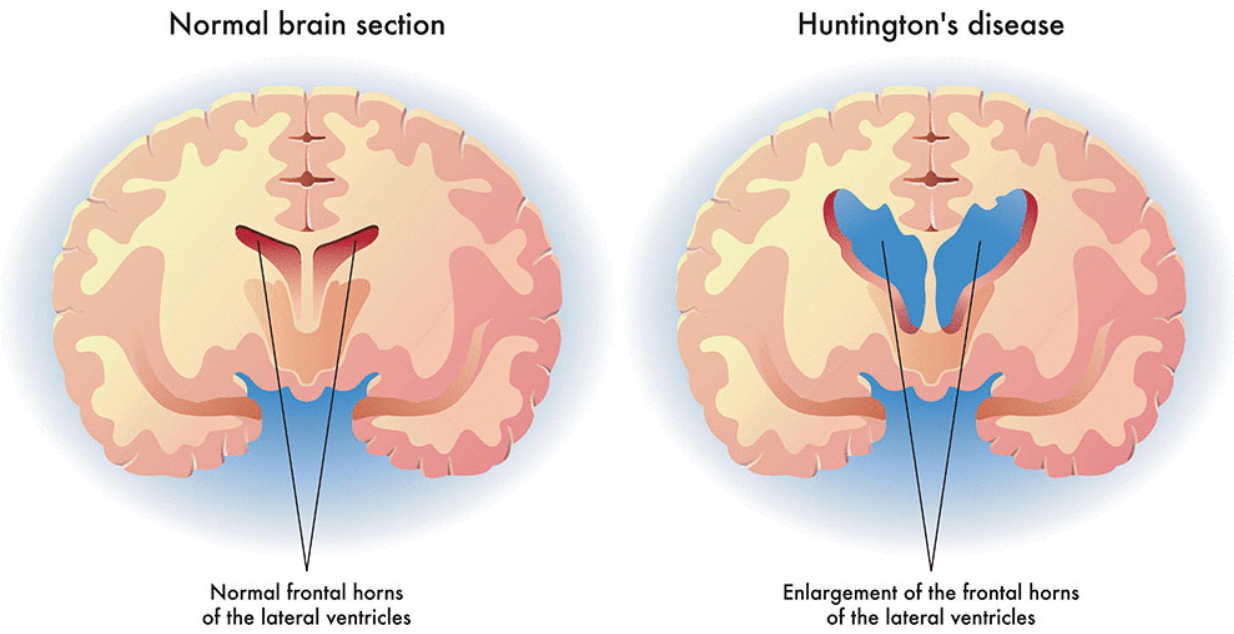

Figure 1: Figure representing the change in the brain post-HD The image on the right shows the death of neurons.

One main cause of Huntington's disease is increased mitochondrial dysfunction and oxidative stress. Mitochondrial dysfunction refers to the weakened function of the mitochondria, which are known as the "powerhouse" of a cell and are responsible for creating energy. Oxidative stress, on the other hand, occurs when there is an imbalance in reactive oxygen species production (Pizzino et al., 2017). With the imbalance, the body is not able to detoxify the production, leading to increased stress within the cells and the brain. These two concepts are related because mitochondrial dysfunction leads to an increase in ROS production, which goes on to create a large amount of increased oxidative stress. The oxidative stress that results can lead to increased mitochondrial dysfunction, leading to a never-ending and dangerous cycle consisting of increased neurological issues.

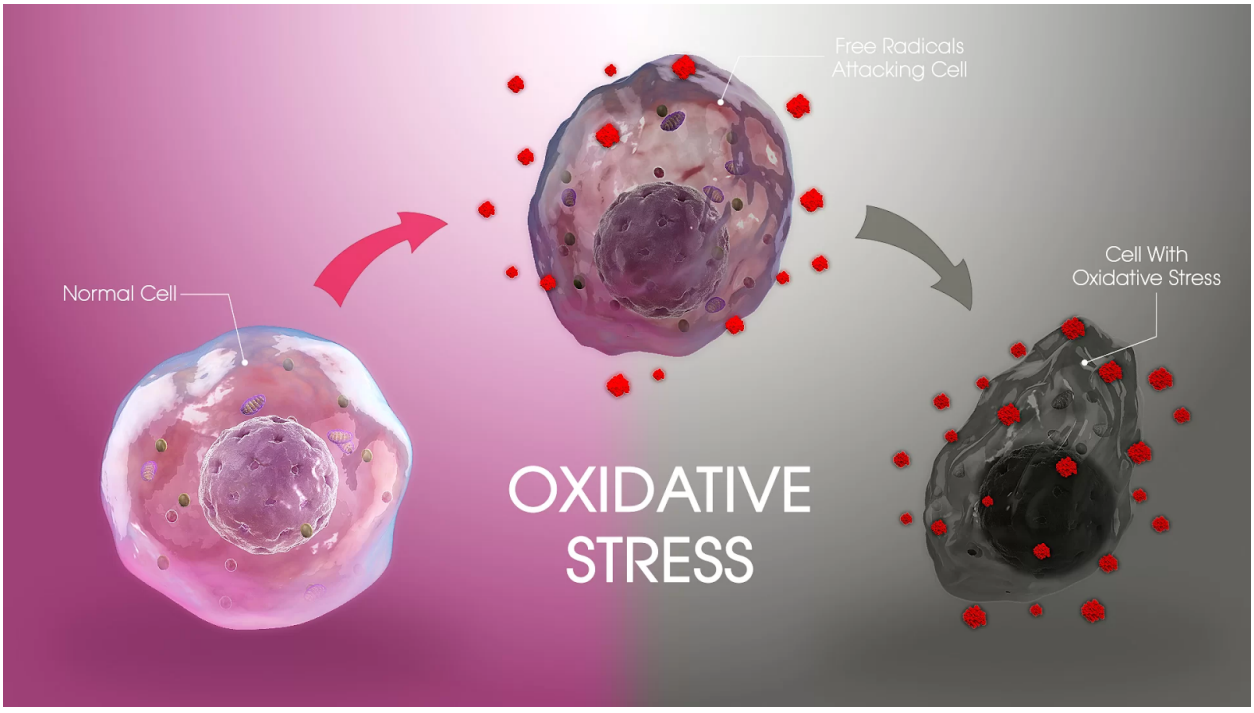

Figure 2: Representations of oxidative stress in a cell

The effects of Huntington's disease vary from person to person but usually hold the same effects. The most common issues are movement-based issues such as chorea (involuntary movements), bradykinesia (slowness of movement), difficulty with coordination, and trouble with balance and walking. Additionally, Huntington's disease patients experience issues such as cognitive decline, memory issues, locomotive decline, and more (National Institute of Health, 2023).

Right now, there is no cure for HD, but there is a large amount of current research. One main study that was conducted was by Steven Hersch and others in 2017 to study the effects of creatine on humans with HD (Hersch et al., 2017). A large group of people were tested with creatine over a long period of time. This research was conducted, and the results showed that creatine did not have any preventive effects on HD. Creatine was used because it was said to slow down neurodegenerative disease rates and help rebuild neurons. Similar to this, many other studies have been conducted. The issue with this study was that the test group consisted of patients who had already developed HD for a long period of time. This would mean that the disease progression is already very strong, and it would take a large resisting force to slow it down.

Mojave Yucca, also known as *Yucca Schidigera*, is an herb that has been known to have neuroprotective abilities. A study done by researcher Lukascz Pecio and others in 2022 studied the neuroprotective effects of Mojave Yucca on zebrafish that had anxiety. One main trigger of anxiety is increased oxidative stress and mitochondrial dysfunction. The spatial memory function

was measured with the implementation of Mojave Yucca. A Y-maze assay was conducted, and it found that Mojave Yucca improved memory by great amounts. Further anti-oxidative tests conducted resulted in the conclusion that Mojave Yucca decreased both oxidative stress and mitochondrial dysfunction greatly. When all studies were put together and analyzed, it was determined that Mojave Yucca helped decrease anxiety levels significantly and also decreased oxidative stress and mitochondrial dysfunction while simultaneously improving memory. This study provides stable research that can be used as a justification for why Mojave Yucca can be tested for Huntington's disease

In this research, there are two main assays that will be utilized. The first assay is a climbing assay. The climbing assay measures the locomotive strength of the drosophila with HD to see if the herb has a positive effect on their motor performance (Madabattula et al., 2015). The next assay that will be conducted is the Aversive Phototaxic Assay (APA). This assay studies the memory aspect of flies (Seugnet et al., 2009). The natural tendency of flies is to go towards the light. By testing if they are able to associate light with a foul taste, this assay measures how strong their memory is and if the herb has any positive effects on their cognitive strength.

Taking into consideration all the previous research that has been conducted, this individual project will be far different and more efficient. Firstly, the herb Mojave Yucca will be used on flies with Huntington's Disease. Along with this, the research will focus on tackling early-stage HD. Early-stage HD is near the beginning of the disease's lifespan, when it is still growing and becoming stronger. Along with this, a motor-based and a memory-based assay will be conducted to truly analyze the effects of HD and determine if the Mojave Yucca herb is effective or not. Overall, this research addresses all the issues while taking a new approach to studying HD with the use of Mojave Yucca.

Works Cited

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