THE PREMED SCENE - Virtual Research Competition

PROMPT

The year is **2043**. Neurologists have discovered a new, progressive neurodegenerative condition that has put the world on notice. It is your job to **devise a solution to approaching such a disease and mitigate its effects.**

You may **only** consider the information stated below when creating your solution. **Your solution may be a biochemical, biomedical, engineering, public health, or political/legal solution.** You can build off of current research and knowledge of Alzheimer's and Parkinson's Disease, for this disease is **similar** in nature to Lewy Body Dementia, which gives way to both (more information below).

Your results will be different per team, because this condition is not on Google. You may refer to it as **Mochado's Disease**.

DISEASE DETAILS

Mochado's Disease is a pediatric neurodegenerative disease notably characterized by symptoms of both Alzheimer's and Parkinson's disease. Mochado's is caused by abnormal deposits of a protein called alpha-synuclein in the brain. These deposits are also known as Lewy bodies. Accumulation of these Lewy bodies within nerve cells are known to affect neurons that produce two major neurotransmitters: dopamine and acetylcholine. Dopamine plays a large role in movement, motivation, sleep, and cognition, while acetylcholine is important for learning, memory, and processing.

Lewy bodies have a tendency to form in the substantia nigra, a region within the basal ganglia responsible for dopamine production and controlling movement. Consequently, early onset forms of Mochado's Disease are characterized by symptoms similar to that of Parkinson's Disease: tremor/shaking in hands, arms, legs, and jaw, muscle stiffness/rigidity, slowness of movement, disrupted sleep cycles, stooped posture, and impaired balance and coordination, oftentimes leading to falls.

Larger buildups of protein in the brain eventually lead to signs of Alzheimer's Disease, most notably demonstrated by a loss of memory, both retrograde and anterograde amnesia. More subtle symptoms include increased confusion, difficulty organizing thoughts, noticeable decrease in attention span, difficulty making decisions, and frequent mood swings. While the effects from Parkinson's are highly disruptive to the patient, It is typically the dementia brought on by Alzheimer's that proves to be fatal.

Neurologists have been able to organize Mochado's Disease into four distinct stages:

> Stage 1 (Mild) : early symptoms of Parkinson's Disease, but minimal enough that it is hardly noticed by others; typically affecting one side of the body
>
> Stage 2 (Moderate) : worsening symptoms of Parkinson's; affecting both sides of the body; daily tasks can be slow or difficult; posture and coordination are impacted; symptoms of Alzheimer's develop: may range from simple forgetting to changes in mood and disturbed sleep
>
> Stage 3 (Severe) : profound impairment of voluntary movement, requiring a walker or other assistance to stand and walk; increased impairment in short and long term memory; problems with speech; increasing disorientation and confusion
>
> Stage 4 (Very Severe) : unable to walk, relies on a wheelchair, or may be bedbound; complete loss of speech; loss of awareness of surroundings, most cognitive effects are substantial

Stage 1 and stage 2 may extend for a number of years, as the symptoms tend to be less impactful in daily life. On the other hand, stage 3 and stage 4 are shorter and considered the final stages of the disease. By stage 4, the cognitive disruptions of dementia are detrimental and thus, fatal. Most patients will spend less than two years in stage 3 before being diagnosed with stage 4 Mochado's, which may lead to death within six months.

While the distinction of stages imply a progressive onset of symptoms, Mochado's Disease differs from Parkinson's, Alzheimer's, and Lewy Body Dementia (LBD) in the fact that symptoms arise early in age, with most cases originating in children all across

the world. 85% of patients with Mochado's Disease first reported symptoms before the age of 10. Since its official recognition in 2038, there have been an estimated 59 million diagnosed cases globally, implying that a staggering 9% of children born per year develop Mochado's Disease. On average, a person with Mochado's lives six to ten years after diagnosis, and all cases thus far have resulted in death. No child diagnosed with Mochado's Disease has made it past the age of 20.

Due to the nature of this disease, experts believe that changes in the brain due to Mochado's begin several years before symptoms show up. Considering that the disease is usually found during adolescence, it is assumed that there is a strong disruption of development of the brain during childhood, or perhaps even infancy. The biological cause of early protein accumulation within the brain is unknown and does not appear to be caused by genetic factors.

Recent preliminary research into Mochado's has found a potential correlation between patients bearing the disease and stress levels in their mothers while pregnant. Based on surveys and accounts from patients' mothers, high levels of emotional stress, anxiety, depression, and/or irritability during pregnancy are common reports. World leaders have pointed fingers at the global COVID-19 pandemic that dominated the early 2020s. The lingering effects of the pandemic, economically and socially, have driven the global population to ever-increasing levels of stress, depression, and substance use disorder. While research is just starting to ramp up, data suggests that Mochado's Disease is the culprit of a post-COVID-19 society haunted by glaring mental health issues, with children who were born during/shortly after the pandemic bearing the worst of it. As with Alzheimer's and Parkinson's, there is no cure for Mochado's in sight, as nations and their leaders struggle to find a way to comprehend what dangers lie ahead for this generation of children.