

## Introduction and Background

The neurodegenerative disorder, Parkinson's disease (PD), is a debilitating disease that affects millions worldwide. Due to the complexity of the disorder, the etiology is still unknown. It is understood that PD degenerates dopamine neurons in the substantia nigra, effectively impairing motor movement. Caenorhabditis elegans is a free-living nematode that is a model organism due to its simplicity and shared molecular pathways and genomes with humans. Because of its simplicity, mutant forms can be used to study neurological diseases and pathological conditions, including PD. A variety of internal and external factors are speculated to be involved in the rate of degeneration of said dopaminergic neurons in the substantia nigra concurrently with PD. Nutrition intake is one of the external factors said to play a role in neuroprotection in neurological disorders such as PD. Polyphenols, of the phenol group of naturally occurring organic chemical compounds, are found in many superfoods and are presumed to have a positive impact on neurodegenerative disease.





# Rationale

Dietary Intake contributes to not only neuroprotection in neurological disorders, but also promotes adult neurogenesis. By disregarding this sector of health, the potential regeneration of neurons in those with PD is lost and the effects of the disorder will only be exacerbated.



## Hypothesis



Adding polyphenols to the growth medium of movement-impaired *C. elegans* will improve their movement.



### Methods

**O1**NGM PLATING

02

CHUNKING

03

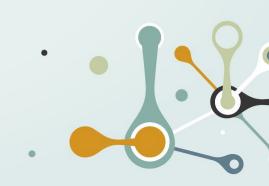
CHEMOTAXIS ASSAY<sub>1</sub>

O4
CHEMOTAXIS INDEX SCORING

RESULT ANALYSIS

05

. Some strains were provided by the CGC, which is funded by NIH Office of Research Infrastructure Programs (P40 OD010440).





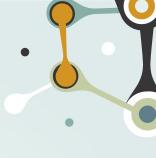
### Results - Chemotaxis Index



	Wild Type <i>C. elegans</i>	WLZ1 <i>C. elegans</i>
Without Polyphenols	0.456	0.363
With Polyphenols	0.338	0.255



## Results - Chi Square Goodness-of-Fit Analysis



	Expected	Observed	Chi Square	Total:
Without Polyphenols	68.238	64	0.264	0.534
With Polyphenols	81.699	77	0.270	

Chi Square: 0.534 (0.5 Probably of a larger value than X<sup>2</sup>

## **Analysis**

Upon observation, the behavior of the polyphenol-affected *C. elegans* in both strains was subjectively more vigorous than the behavior of the non polyphenol-affected *C. elegans*.

Furthermore, the chemotaxis indices of the polyphenol affected *C. elegans* strains (wild type and WLZ1) were more positive than those of the non polyphenol affected *C. elegans* in each strain.

### Results

Compatible with the hypothesis, polyphenols **do appear** to have a positive impact on the improvement of motor impairment in *C. elegans* with a weak statistical significance.

### **Extensions**

Potential extensions to this study could include:

- → Effect of varying quality of nutrition on the movement of Parkinson's-modeled *C. elegans*
- → Using CRISPR-based techniques for genome engineering of Parkinson's modeled *C. elegans*

A special thanks to Mrs. Sbarro, my advisor, as well as all of the cited researchers for their work that I was fortunate enough to build upon.

#### References

Abdullah R;Basak I;Patil KS;Alves G;Larsen JP;Møller SG;. (n.d.). Parkinson's disease and age: The obvious but largely unexplored link. Retrieved March 08, 2021, from https://pubmed.ncbi.nlm.nih.gov/25261764/

Libretexts. (2021, January 03). 1.19: Pouring agar plates. Retrieved March 08, 2021, from https://bio.libretexts.org/Bookshelves/Biotechnology/Lab\_Manual%3A\_Introduction\_to\_Biotechnology/01%3A\_Techniques/1.19%3A\_Pouring\_Agar\_Plates

Margie, O., Palmer, C., & Chin-Sang, I. (2013, April 27). C. elegans chemotaxis assay. Retrieved March 08, 2021, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3667641/

Parkinson's: Neurons destroyed by three simultaneous strikes. (2009, May 04). Retrieved March 08, 2021, from https://www.sciencedaily.com/releases/2009/04/090429132222.htm#:~:text=The%20studies%20found%20that%20neurons,in%20the%20cell%20over %20time.

Poulose, S., Miller, M., Scott, T., & Shukitt-Hale, B. (2017, November 15). Nutritional factors affecting adult neurogenesis and cognitive function. Retrieved March 08, 2021, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5683005/

Uttara, B., Singh, A., Zamboni, P., & Mahajan, R. (2009, March). Oxidative stress and neurodegenerative diseases: A review of upstream and downstream antioxidant therapeutic options. Retrieved March 08, 2021, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2724665/

W;, N. (n.d.). Cell death of dopamine neurons in aging and parkinson's disease. Retrieved March 08, 2021, from https://pubmed.ncbi.nlm.nih.gov/10656535/