

Continuation/Research Progression Projects Form (7)

Required for projects that are a continuation/progression in the same field of study as a previous project.
This form must be accompanied by the previous year's abstract and Research Plan/Project Summary.

Student's Name(s) Raheem Sheikh

To be completed by Student Researcher: List all components of the current project that make it new and different from previous research. The information must be on the form; use an additional form for previous year and earlier projects.

Components	Current Research Project	Previous Research Project: Year: <u>2019</u>
1. Title	Analysis of the Effect of the Herbicide, Glyphosate, on Parkinson's Disease Related Gene Expression in <i>Caenorhabditis elegans</i> and <i>Drosophila melanogaster</i>	Analyzing the Effect of the Herbicide, Glyphosate, on Parkinson's Disease Related Gene Expression in <i>Caenorhabditis elegans</i>
2. Change in goal/purpose/objective	Focused on the effect of a 2 doses, 0.75 mL and 1.00 mL, on the occurrence of Parkinson's Disease in the organism's genome. This was representative of the varying amounts of the chemical used by each consumer. Applied of such findings to a statistical analysis of Glyphosate usage and Parkinson's prevalence to further relate to humans.	Focus on the effect of a single 0.5 mL on the occurrence of Parkinson's Disease in the organism's genome
3. Changes in methodology	Utilization of two model organism, <i>C. elegans</i> and <i>D. melanogaster</i> , to observe effects of chemical. Added component of statistical analysis/observational study of trends. Two different amounts of RoundUp used.	Utilization of one model organism, <i>C. elegans</i> , to observe effects of chemical. 10 samples (trials) cultured.
4. Variable studied	The effect of different amounts of the weed killer, RoundUp, on PD related gene expression in <i>C. elegans</i> and <i>D. melanogaster</i> .	The effect of Glyphosate on PD related gene expression in <i>C. elegans</i> .
5. Additional changes	Used primers for genes homologous to <i>C. elegans</i> or <i>D. melanogaster</i> .	Used primers for two genes only homologous to <i>C. elegans</i> .

Attached are:

☒ Abstract and Research Plan/Project Summary, Year 2019

I hereby certify that the above information is correct and that the current year Abstract & Certification and project display board properly reflect work done only in the current year.

Raheem Sheikh
Student's Printed Name(s)

Signature



01/29/2020
Date of Signature (mm/dd/yy)

Raheem Sheikh-

Previous Research Project: 2019

Analyzing the Effects of the Herbicide, Glyphosate, in *Roundup* on Parkinson's Disease Related Gene Expression in *Caenorhabditis elegans*

Abstract:

The purpose of this experiment was to investigate the effects of the herbicide and weed killer, Glyphosate, in *Roundup* on Parkinson's Disease (PD) related gene expression in *Caenorhabditis elegans*. Glyphosate is a non-selective chemical agent used to destroy and inhibit plant growth. PD is a progressive disorder of the body's nervous system that heavily affects movement. In recent years, many people have become sick after being exposed to weed killers such as *Roundup* on their lawns (Bellon 2018). Due to its unpredictability, it is important to study this issue. Since many crops that feed the world's population are sprayed with herbicides it is important to confirm its ties to diseases like Parkinson's. *C. elegans* can be used as model organism to demonstrate how the weed killer affects Parkinson's related motor function, behavior, and gene expression. It could potentially affect or amplify the human genes homologous to the development of Parkinson's such as PINK1 and PARK7. *C. elegans* have a short life span and reproductive cycle and can be used to test such conditions using laboratory procedures. *C. elegans* can be monitored under a microscope and have their DNA/RNA extracted to test if their genetic expression changed in the presence of Glyphosate. By using *C. elegans* as a model organism to research this disease, rtPCR and gel electrophoresis can be conducted to show if Glyphosate is a definitive cause of PD or amplifies its gene expression. This experiment showed that after the RNA extraction and rtPCR reaction was performed, two samples were successfully amplified. Both genes were present in the gel electrophoresis. Due to the fact that other samples were not present on the gel electrophoresis, there is reason to believe there was some contamination from the Trizol reagent as RNA extraction is a very meticulous process. In future studies, *Drosophila melanogaster* can be utilized to obtain more RNA to test. Also, a census can be conducted to find if there was a correlation between an increased frequency of PD and *Roundup* sales.

Works Cited

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Research Plan:

Herbicides and pesticides are widely used across the world as a tool for harvesting food sources for human to eat. The agricultural revolution had substantial impact on the world and led to many people settling into cities that developed into the ones we live in today. Therefore, is it imminent to investigate and analyze if these modern herbicides are safe to use, come in contact with, and ultimately ingest. This experiment addresses the issues of haphazardly using herbicides, such as Glyphosate, found in common products such as *Roundup* in household gardens and lawns. Many have found that this act has led to them becoming very sick even developing cancer. Therefore, the purpose of this experiment is to investigate the effects of Glyphosate on Parkinson's Disease (PD) related gene expression in *Caenorhabditis elegans*.

A herbicide is a chemical agent used to destroy or inhibit plant growth. During the Vietnam War, an herbicide called Agent Orange was used to defoliate the battle grounds. However, in later years, it was found that veterans who fought in the Vietnam War developed Parkinson's Disease ("Environmental Factors" 2017). Now, the latest herbicide is Glyphosate in *Roundup*, which can possibly be linked to the development of illness. Glyphosate is a non-selective herbicide and it kills all plants it comes in contact with. Exposure to Glyphosate can be caused by physical contact or inhalation perhaps if a plant was recently sprayed with the herbicide. In a real world perspective, it is important to acknowledge a case from August 2017 involving a school groundskeeper, Dewayne Johnson, who sued Monsanto, the company that manufactures herbicides like the *Roundup* Brand, claiming that the use of the weed killer caused him to develop terminal cancer (Bellon 2018). In 2015, it was discovered that Glyphosate was "probably carcinogenic to humans," according to the World Health Organization (WHO). Therefore, it is imminent to handle it with proper laboratory safety procedure such as wearing gloves, face masks, and goggles. This uncertainty from the WHO is uncomfortable and provides incentive for studying this issue.

Caenorhabditis elegans are a nematode worm that are used in a laboratory setting as a model organism due to their short life span and short reproductive cycle which is advantageous over vertebrate organisms. The *C. elegans* genome is 100 million base pairs in length and contains a similar number of genes as humans, about 20,500 genes ("Why use the worm?" 2015). They can be utilized in microbiology because they provide examples of how neurological disorders, such as Parkinson's Disease works in humans. Parkinson's Disease is a progressive disorder of the body's nervous system that heavily affects movement. Many definite causes are unknown and there is currently no cure for the disease ("What Is Parkinson's?" 2018). PD entails the targeting of dopamine-producing or dopaminergic neurons in the brain. It begins as a tremor in a limb of the body, most commonly a tremor in the hand. The disease is caused by genetic factors and limited testing is being conducted to see if environmental factors also causes or progresses it. *C. elegans* have genetic homologies for PD and can be used to test its effects. By using, the N2, wild, strain of *C. elegans*, one of the genes involved in the development of the disease, LRRK2 (Cooper & Raamsdonk 2018), can be tested for amplification, after the *C. elegans* are exposed to a minute dosage of weed killer in their cultures, The SNCA and PARK7 genes are also genetic markers for the disease. The exposed *C. elegans* can be monitored under a microscope and observed genetically through a gel electrophoresis and polymerase chain reaction. Based on this research it was hypothesized that if *C. elegans* are exposed to the Glyphosate in the weed killer, *Roundup*, then the expression of the LRRK2 gene for Parkinson's Disease will be amplified and visible in a DNA fingerprint. The end goal of this experiment is to

show if Glyphosate is a definitive cause of PD or amplifies its gene expression. This could provide substantial evidence to stop the use of herbicides in agriculture and switch to safer alternatives.