

# **Investigating the Role of Psychostimulants In Inducing Parkinson's Disease via *Drosophila melanogaster***

## **Introduction:**

Parkinson's disease (PD) is a progressive and neurodegenerative disorder that is caused by the loss of dopamine-producing nerve cells in a part of the brain called the substantia nigra and thus leads to a reduction in the chemical called dopamine[2,3]. Dopamine specifically is a neurohormone that plays a vital role in regulating the movement of the body, and when decreased, tremors, inflexible muscles, and secondary chronic psychological symptoms, such as depression, vertigo, and loss of memory, are very likely to occur[2,3]. These symptoms appear differently for everyone, and at first they can be mild or even go unexpressed, however as time progresses, PD will spread across the entire nervous system and begin to produce great abnormalities in the brain, leading to the inferred dysfunction of the body[2].

Furthermore, what exactly causes the loss of the dopaminergic nerve cells in the first place is unclear, however most experts believe that a combination of pre-disposed genetic and environmental factors, including sex and exposure to toxins respectively, are responsible[2]. Because of this thinking, the creation of many new therapy options to combat PD, and neurodegeneration as a whole, have become paramount in the medical field, for example the survival, growth, and regeneration of dopaminergic neurons is regulated by a chemical produced in the body called retinoic acid, and in PD, both the production of retinoic acid and the communication with its receptors is impaired and contributes to the loss of dopaminergic nerve cells. Thus, the use of synthetic retinoids to replace the depleted retinoic acid has been proposed as a therapy option for PD, however due to the many risk factors that lead to the many different models of PD, I believe that one particular therapy, such as using synthetic retinoids, is unlikely to be a definitive cure for said range of ailments, and instead targeted treatments for each model should be more heavily researched. One such model includes drug-induced PD, which has gained increased interest in the scientific community, as the American Academy of Neurology reported research that shows people who have abused amphetamines, like Benzedrine and Dexedrine, appear to be at an increased risk of developing PD[1]. This research has been continued by Dr Vincent Croset at Durham University's Department of Biosciences and it is my intention to join this academic research. Or to be explicit, based on the findings within the scientific community, myself and my academic supervisor, propose an investigation to clarify the role of psychostimulants, in particular amphetamines, in provoking the neurodegeneration typical of Parkinson's Diseases.

## **Research hypothesis and aims:**

**We hypothesize that the prolonged abuse of psychostimulants leads to PD, or at least induces PD-like neurodegeneration, and subsequently creates the homeostatic dysfunction seen in patients suffering with Parkinson's.**

To disprove or prove this proposed research question, we intend on utilizing the brain and nervous system of a fruit fly, which is scientifically called *Drosophila melanogaster*, and perform various behavioural tests with accompanying genetic tools. For clarity, they would respectively be climbing assays and knockout mutations. The expectation is that via these tests and tools we can achieve the following aims:

- a. **Understand the effect of psychostimulants on varied types of memory (e.g. explicit memory).**
- b. **Understand the effect of psychostimulants on movement.**

Finally, the hope is that by understanding the aforementioned effects on *Drosophila*, there will be a greater understanding of PD through a new perspective/diagnostic model, and further tests on the more newly dissected gut microbiome, which is a pool of helpful bacteria in the stomach, will then be conducted to corroborate our findings, as the overall goal of this project is to further understand PD, but to also pave the way for a new diagnostic tool that can be further discussed and eventually, long after the six allocated weeks for my own proposal, be applied in patients.

### **Concluding statement:**

In conclusion, over the six weeks between the 11th of July 2022 and the 22nd of August 2022, I intend on working with Dr Vincent Croset to further understand the behavioural and molecular aspects of PD and I hope to add to the scientific understanding of said disease by assisting in the development of a new diagnostic model. If accepted, at the end of the allocated period a reflective overview, in the form of an accessible presentation, and a journal-style report, would be subsequently produced and would reflect on the findings of this proposed research. Thank you for your consideration.

### **Bibliography:**

**[The referencing style used for the proposal above is Vancouver, however since pebblepad did not allow superscript numbers to be implanted in there allocated space, the corresponding numbers are encased in square brackets instead.]**

1. American Academy of Neurology. *USING AMPHETAMINES MAY INCREASE RISK OF PARKINSON'S DISEASE*. Available from: <https://www.aan.com/PressRoom/Home/PressRelease/904#:~:text=%2D%20New%20research%20shows%20people%20who.9%20to%20April%2016%2C%202011>. (Accessed on 28th January 2022).
2. Mayo clinic. *Parkinson's Disease*. Available from: <https://www.mayoclinic.org/diseases-conditions/parkinsons-disease/diagnosis-treatment/drc-20376062> (Accessed on 28th January 2022).
3. NHS. *Parkinson's Disease*. Available from: <https://www.nhs.uk/conditions/parkinsons-disease/> (Accessed on 28th January 2022).