

**2019 PSBR High School Essay Contest**  
**Grand Essayist**

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Research on Rabbits and Monkeys advance Parkinson's treatment

Parkinson's is one of the most common neurodegenerative diseases affecting seven to ten million individuals worldwide. If left untreated, those affected suffer muscle stiffness, tremors, decreased mobility, and premature death. My family has multiple generations suffering from this condition. For years, there were no breakthroughs. However, in the late 1950's, a Swedish pharmacologist named Arvid Carlsson decided to focus only on dopamine. Dopamine is a neurotransmitter that relays messages between neurons in the brain. It is now known to control motor function, however, in the 1950's, many scientists believed it was an insignificant neurotransmitter. Dopamine is located inside the substantia nigra, a region of the basal ganglia found inside the brain. The basal ganglia is the part of the brain responsible for movement. Unlike most of his colleagues, Carlsson thought that there was something more to dopamine's function.

This idea started Carlsson's experiments with rabbits. Since rabbits cannot genetically get Parkinson's, Carlsson needed to find a way to mirror the symptoms in them by injecting the rabbits with a dopamine antagonist, referred to as reserpine, and the rabbits entered a coma-like state. While in the coma-like state, the rabbits developed abnormal involuntary movements, similar to someone who has Parkinson's. This allowed Carlsson's to conclude that Parkinson's is linked to low dopamine levels.

Carlsson was also able to find a treatment for Parkinson's by reversing the effects of reserpine on rabbits. He eventually found the solution in a dopamine promoter (levodopa) which converts into dopamine in the brain. When the rabbits were injected with levodopa, the rabbits returned to their original state. Carlsson believed that since levodopa, also known as L-Dopa, works in reversing the effects on reserpine in rabbits, it could also work in reversing Parkinson's in humans. The problem with giving levodopa to humans is that the decarboxylase enzyme rapidly metabolizes levodopa so the benefit of L-Dopa would be brief. Carlsson added an enzyme inhibitor (carbidopa) to prevent the breakdown of levodopa so more could enter the brain. Doctors today use this combination of levodopa and carbidopa to help treat Parkinson's disease, but this only decreases the symptoms. Carlsson, along with two American scientists, won the 2000 Nobel Prize for Medicine for their contribution to advancements in neurological and psychiatric drugs.

Carlsson's work inspired two other scientists. In 1987, Alim Louis Benabid and Pierre Pollak found another treatment for advanced Parkinson's, deep-brain stimulation. The subthalamic nucleus and the globus pallidus comprise most of the cells in the basal ganglia.

Benabid and Pollak realized when observing monkey's brains, these regions of the brain were hyperactive when there were low levels of dopamine. They decided that the way to quiet the hyperactivity and relieve the symptoms of Parkinson's was through a current of electricity. Through surgery, a device is implanted in the collarbone of monkeys that acts as a generator for electrodes that are placed deep inside the brain. The device then transmits electrical pulses to the electrodes to regulate brain activity and reduce symptoms of Parkinson's. Since then, deep brain stimulation, levodopa, and carbidopa have improved the lives of over 40,000 people with Parkinson's.

Parkinson's has affected my family for generations. My grandfather, uncle, and great-grandfather all have had Parkinson's. This disease has taken a toll on each of their lives, increasing falls and decreasing mobility, limiting their freedom to do the things they enjoy. My great-grandfather benefited from the research from Dr. Carlsson since he took carbidopa-levodopa combination to live comfortably fifteen years after his diagnosis. Thanks to animal research with rabbits and monkeys, people with Parkinson's have a hope for a normal life. Future experimentation with animals could lead to a possible cure for this degenerative disease; a disease once thought untreatable could be history.

#### Works Cited

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