

:: NEUROSCIENCE | by Philip Barnes

Bright future

How fruit flies and light might reveal a treatment for Parkinson's disease

Scott Varga's quest to understand Parkinson's disease begins in an unexpected place: inside the brain of a fruit fly. But maybe it isn't so unusual. Two-thirds of all human genes are found in fruit flies, and according to Varga, genes hold all of the answers.

"There are striking similarities between the disease in humans and fruit flies," he says. "And with the short lifespan of flies, I can study the effect of Parkinson's on them in a short time."

Parkinson's, which occurs in 33 percent of people over age 85, stems from the degeneration of dopamine-producing neurons, causing its victims to lose motor function, eventually resulting in stiff movement, uncontrollable shaking, and cognitive disabilities such as memory loss and dementia. The disease usually shows up in humans between ages 50 and 60. For fruit flies (which usually live around two months), it takes just 20 days.

Currently, one of the more promising treatments for advanced Parkinson's disease is deep brain stimulation. A battery implanted in the patient's chest is hooked up to small wires that stretch up into the brain. Electrodes at the tips of the wires emit a constant electric pulse. The technique has been shown to alleviate symptoms, but treatment is costly and the reason for its success remains a mystery.

"No one knows why deep brain stimulation works," Varga says. "So, I'm trying to pinpoint the pathways of the brain that are affected by it to see if I can find anything."

Varga's special fruit flies allow him to do just that. At birth, each one is inserted with a light-responsive gene. Using a lamp-like apparatus that he built from scratch, he shines different colors of light on the flies.

Blue light causes DA-producing cells (which are affected in Parkinson's) to become hyperactive, while orange light makes the same cells dormant. This combination of gene manipulation and light, also called optogenetics, will allow him to link behavioral changes in the flies with specific areas of the brain. From there, he hopes to identify which pathways are targeted by deep brain stimulation.

"This is the first time optogenetics has been used for Parkinson's," Varga says. "Since blue light causes the flies to curl up, we know that the science behind it is working."

Over the past year, Ohio University's Life Sciences building has become Varga's second home—the Honors Tutorial College senior logs around 30 hours per week in the lab. But it's time well-spent. His experiments and thesis will be completed in the spring, and his mentor, Daewoo Lee, couldn't be happier with his progress.

"Scott is one of the best students we have," Lee says. "I let him be in total control of his experiments. It's pretty much hands-off for me."

Although a treatment for the debilitating disease they study may be a long way off, Varga is motivated by the search for new knowledge.

"A potential cure is the reason why I study Parkinson's," he says. "It's always in the back of my mind. But you can't just jump to a cure for a disease; you need to understand it first."



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SCOTT VARGA
neuroscience student



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