

# New findings on Parkinson's disease and effect on patient behavior

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A new neuropsychological memory test is helping to uncover how Parkinson's disease can alter people's ability to learn about the consequences of the choices they make. The test was developed by Dr. Mark Gluck, professor of neuroscience at the Center for Molecular and Behavioral Neuroscience at Rutgers University, Newark, working with co-researchers at Rutgers, New York University, and in Hungary.

As reported in a forthcoming article in the journal *Brain* (advanced access published May 4, 2009 -- doi:10.1093/brain/awp094), Gluck and co-researchers Nikoletta Bodi and Szabolcs Keri of Semmelweis University, Hungary, found that non-medicated patients in the early stages of Parkinson's were selectively impaired at learning from reward.

Patients in Hungary were tested using a novel feedback-learning task developed by Gluck and his colleagues: Catherine E. Myers, research professor, Rutgers University, Newark; and Nathaniel Daw, assistant professor, New York University. The research was supported by a Dekker Foundation Award from the Bachman-Strauss Dystonia and Parkinson Foundation.

"What we are seeing in recently diagnosed patients is that prior to being put on any medications, they exhibit a selective impairment in their ability to learn from positive (rewarding) outcomes while their sensitivity to learning from negative (or punishing) outcomes is normal," says Gluck, director of Rutgers' Center for Collaborative Research on Cognition and Parkinson's Disease.

This selective deficit in learning from reward is not surprising, says Gluck, because scientists have long known that dopamine is used to carry reward information throughout the brain. Parkinson's patients, however, have lost most of their dopamine-producing cells by the time they are first diagnosed with the disease. This decrease in their ability to process rewarding outcomes could be one reason why many Parkinson's patients experience depression, says Gluck. "It's not just that they have an awful disease, but they have lost the ability to process the rewarding aspects of life."

Gluck and colleagues found that this reward-learning deficit in un-medicated Parkinson's patients is in direct contrast to what is seen in patients once they begin treatment with dopamine agonists, a standard therapy for treating the disease's motor symptoms. On dopamine agonists, a patient's ability to learn from positive rewarding outcomes improved to normal levels. But there was a catch - their ability to learn from negative (or punishing) outcomes, which had previously been normal, was now impaired.

Gluck explains that an increased sensitivity to learning from events that results in positive outcomes, coupled with a decrease in the ability to learn from negative outcomes, could explain why some Parkinson patients treated with dopamine agonists develop impulse-control disorders, including pathological gambling, hypersexuality, alcoholism, and compulsive eating and shopping. All of these behaviors can be understood as reward-seeking behaviors in the absence of appropriate sensitivity to their negative consequences.

"For example," notes Gluck, "if your ability to learn from negative outcomes is reduced and you play the slot machines and win \$10 for a few rounds but lose many more times in between, what you may recall best is the thrill of winning. As such, you will be hampered in your ability to learn that gambling can also have negative consequences."

The ability to test the effects on feedback learning in early onset Parkinson's disease could provide additional insight into the impact of dopamine loss on cognition and behavior. It also could pave the way for identifying which Parkinson's patients are most likely to experience agonist-related feedback problems so they can be treated with alternate medications.

Other ongoing research by Gluck and his clinical collaborators in New Jersey, New York, Europe and the Middle East aims to further understand how and why learning and decision making is impaired by Parkinson's disease and how the medications used to treat motor symptoms can impair or remediate these essential cognitive abilities.

## **Feedback Learning, Dementia, Depression and Drug Addiction**

In addition to providing new insight into the effects of Parkinson's disease and dopamine agonists on learning and personality, the new feedback-learning tasks developed at Rutgers University are being used to study learning and decision-making deficits in people suffering from fronto-temporal dementia (FTD), a degenerative condition involving the front part of the brain's cortex. FTD is associated with dramatic changes in personality, behavior and thought processes, which can include inhibition, social withdrawal and compulsive behaviors.

With co-investigator Murray Grossman of the University of Pennsylvania, Gluck is studying changes in positive and negative feedback [learning](#) in those diagnosed with FTD. That research, funded with a grant from the Association for Frontotemporal Dementia, has the potential to help in identifying methods to aid in correcting behavior for FTD patients.

"If, for example, FTD patients learn better from reward than punishment, this would mean caregivers might be advised to avoid reacting negatively to inappropriate behaviors and to focus instead on rewarding patients for not engaging in inappropriate behaviors," says Gluck.

More information: [brain.oxfordjournals.org/cgi/c ...  
nt/abstract/awp094v1](https://brain.oxfordjournals.org/cgi/content/abstract/awp094v1)

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