MedicalXpress

A novel computational model -- how Parkinson's medications affect learning and attention

January 20 2010

A new brain-based computational model is helping to understand how Parkinson's disease and dopamine medications—used to treat motor symptoms caused by the disease— can affect learning and attention.

As reported in a forthcoming article in the *Journal of Cognitive Neuroscience*, a new computational model, developed by Drs. Ahmed Moustafa and Mark Gluck, at the Center for Molecular and Behavioral Neuroscience at Rutgers University, Newark, has shown how Parkinson's disease affects attentional performance during learning.

The same model also shows that dopamine medications enhance attentional performance in Parkinson's patients in agreement with past observations. Future lab experiments with Parkinson's patients will be conducted by Moustafa and Mark Gluck to test further model predictions.

Parkinson's is a disease that mainly affects dopamine levels in a brain area known as the basal ganglia, which is important for motor control. Hence, damage to this area leads to movement disorders, including shaking and difficulty moving--key symptoms of Parkinson's disease.

Over the past two decades, it became known to neurologists and experimental neuroscientists that Parkinson's disease also affects non-motor functions, including memory, learning, and attention. Impairment

in these processes affect the quality of life of the patients, thus, understanding the neural basis of motor and non-motor dysfunction in Parkinson's disease is equally important.

Dopamine is also projected to other parts of the brain, including the prefrontal cortex, an area important for higher-level thinking, decision making, and attention. Dopamine projected to the prefrontal cortex is also reduced in Parkinson's disease, as reported in many experimental studies with humans and animal models of Parkinson's disease.

According to Moustafa and Gluck, until recently, existing computational models of Parkinson's disease ignored any role played by dopamine in the prefrontal cortex. Moustafa and Gluck have designed a new computational model that shows how dopamine in the prefrontal cortex is important for attentional performance, and how dysfunction of dopamine in the prefrontal cortex can explain many of the non-motor deficits seen in Parkinson's patients.

"Computational models are increasingly being used in the neurosciences and neurology to understand how neurological disorders affect brain and behavior," said Moustafa. "This relatively new field—known as computational neuroscience— is promising to aid in designing new pharmacological and surgical intervention tools to treat neurological and psychiatric diseases."

More information:
http://www.mitpressjournals.org/doi/pdf/10.1162/jocn.2010.21420

Provided by Rutgers University

Citation: A novel computational model -- how Parkinson's medications affect learning and