Computer modeling shows how medications play a part in the Parkinson's experience

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(Medical Xpress)—A University of Western Sydney researcher has developed a new computational model, which will improve our understanding of how Parkinson's disease (PD) medications affect the brain and cognition.

Dr Ahmed Moustafa, from the School of Social Sciences and Psychology and the MARCS Institute at UWS, says the primary symptoms of PD are thought to be the result of the insufficient formation and action of Dopamine.

"Dopamine is one of the neurotransmitters responsible for the way the human brain processes information," says Dr Moustafa.

"When Parkinson's patients experience symptoms of motor skill and cognitive dysfunction – such as muscle rigidity, tremors and a slowing of physical movement – it is believed that the disease has impaired the ability of their brains to produce this important chemical that led to the motor and cognitive dysfunction."

Along with colleagues Dr Mohammad Herzallah and Dr Mark Gluck from the Center for Neuroscience at Rutgers University, Dr Moustafa has devised a method of tracking the various affects of key Dopamine replacement therapies – such as Levodopa, Pramipexole and Ropinirole.

The 'computational model', to be published in the Neurodegenerative Diseases journal, provides a mechanistic account of several positive and

negative effects of PD treatments.

Dr Moustafa says the key effect appears to lie within the activation of the D1 and D2 receptors.

"It appears that that the differential effects of dopamine medications are related to their binding to D1 and D2 receptors. It seems that these medications have variable effects on D1 receptors," says Dr Moustafa.

"By tracking how these different treatments affect different parts of the brain, we have been able to explain why some PD patients experience some very different cognitive effects."

Dr Moustafa says treatments such as Levodopa, which produce added Dopamine by over stimulating the motor neurons, appear to have a higher affinity with these D1 receptors.

"Clinical research shows that the chronic administration of Levodopa can enhance PD patients' cognition, but can also lead to a phenomenon known as Levodopa-induced Dyskinesia – a disorder which causes patients to have involuntary movements, most commonly in the upper body," he says.

"Other treatments, which do not activate the D1 receptors, do not have the same effects."

Dr Moustafa's computational model will have wide-ranging implications for understanding the varied physical effects of Parkinson's disease, as well as the potential side-effects of Parkinson's medications.

"Clinical research also shows that a subset of Parkinson's patients develops what is known as impulse control disorders, which involve pathological gambling, hypersexuality, and binge eating," says Dr

Moustafa.

"Basically, the brain's difficulty in processing information eventually impairs the patient's ability to learn to avoid negative outcomes – including gaining weight, and losing jobs, money and relationships.

"If the development of these impulse control disorders can be conclusively traced to the overstimulation of D2 receptors, it may be possible to understand why some Parkinson's patients develop impulse control disorders, and others do not – and then to regulate the medications that stimulate these specific receptors."

Provided by University of Western Sydney