Parkinsons' drug helps older people to make decisions

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A drug widely used to treat Parkinson's Disease can help to reverse age-related impairments in decision making in some older people, a study from researchers at the Wellcome Trust Centre for Neuroimaging has shown.

The study, published today in the journal *Nature Neuroscience*, also describes changes in the patterns of brain activity of adults in their seventies that help to explain why they are worse at making decisions than younger people.

Poorer decision-making is a natural part of the ageing process that stems from a decline in our brains' ability to learn from our experiences. Part of the decision-making process involves learning to predict the likelihood of getting a reward from the choices that we make.

An area of the brain called the nucleus accumbens is responsible for interpreting the difference between the reward that we're expecting to get from a decision and the reward that is actually received. These so called 'prediction errors', reported by a brain chemical called dopamine, help us to learn from our actions and modify our behaviour to make better choices the next time.

Dr Rumana Chowdhury, who led the study at the Wellcome Trust Centre for Neuroimaging at UCL, said: "We know that dopamine decline is part of the normal aging process so we wanted to see whether it had any effect on reward-based decision making. We found that when we treated

older people who were particularly bad at making decisions with a drug that increases dopamine in the brain, their ability to learn from rewards improved to a level comparable to somebody in their twenties and enabled them to make better decisions."

The team used a combination of behavioural testing and brain imaging techniques, to investigate the decision-making process in 32 healthy volunteers aged in their early seventies compared with 22 volunteers in their mid-twenties. Older participants were tested on and off L-DOPA, a drug that increases levels of dopamine in the brain. L-DOPA, more commonly known as Levodopa, is widely used in the clinic to treat Parkinson's.

The participants were asked to complete a behavioural learning task called the two-arm bandit, which mimics the decisions that gamblers make while playing slot machines. Players were shown two images and had to choose the one that they thought would give them the biggest reward. Their performance before and after drug treatment was assessed by the amount of money they won in the task.

"The older volunteers who were less able to predict the likelihood of a reward from their decisions, and so performed worst in the task, showed a significant improvement following drug treatment," Dr Chowdhury explains.

The team then looked at brain activity in the participants as they played the game using functional Magnetic Resonance Imaging (fMRI), and measured connections between areas of the brain that are involved in reward prediction using a technique called Diffusor Tensor Imaging (DTI).

The findings reveal that the older adults who performed best in the gambling game before drug treatment had greater integrity of their

dopamine pathways. Older adults who performed poorly before drug treatment were not able to adequately signal reward expectation in the brain – this was corrected by L-DOPA and their performance improved on the drug.

Dr John Williams, Head of Neuroscience and Mental Health at the Wellcome Trust, said: "This careful investigation into the subtle cognitive changes that take place as we age offers important insights into what may happen at both a functional and anatomical level in older people who have problems with making decisions. That the team were able to reverse these changes by manipulating dopamine levels offers the hope of therapeutic approaches that could allow older people to function more effectively in the wider community."

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