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Jackpot hopes in brain research

Wendy Zukerman | *April 25, 2009*

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ELLEN Johnson was diagnosed with Parkinson's disease four years ago.

She was 54 years old, and quickly medicated. Soon after taking medication Johnson started gambling. "I started off on a low dose, but when the dose increased, the gambling got heavier," says Johnson. In just over 12 months she spent $40,000 on the pokies. Her medication was changed, and she was able to wean herself off gambling.

A study released this month reports that more than 18 per cent of Parkinson's patients taking specific medications developed the compulsive behaviours of pathological gambling or hyper-sexuality. This study provides insight into the science behind gambling addictions for Parkinson's and non-Parkinson's patients.

It is predicted that 2.2 per cent of Australians will suffer some form of pathological gambling at one point in their lives. This is 400-500 per cent higher than the US.

Last year the average Australian spent more than $1100 on gambling. And a recent comparison of 21 industrialised countries found Australians had the most individual expenditure on gambling. Understanding the brain science behind gambling addictions could assist with therapies to encourage people away from casinos and poker machines.

Andrew Evans, a neurologist and head of the Movement Disorders Program at the Royal Melbourne Hospital, believes a dopamine irregularity in the brain is partly to blame for addictive behaviour such as gambling. "Recently addictive syndromes have been noticed in certain Parkinson's patients, such as addiction to medication, and pathological gambling," says Evans.

Parkinson's disease is caused by a deficiency of a chemical in the mid-brain called dopamine. Dopamine affects both the motor and emotional parts of the brain. In Parkinson's patients dopamine deficiency leads to patients losing control of their motor functions. To relieve these symptoms, patients are given drugs that are converted into dopamine in the brain. While relieving Parkinson's symptoms, the increase of dopamine also leads to addictive personality traits developing in patients with no family history of addiction. But why blame dopamine?

Dopamine controls our ability to experience pleasure and pain. "When any individual sees a rewarding stimulus -- food, sex and consumer rewards -- they get a dopaminergic response in the nucleus acumbans and that has a rewarding effect," says Evans. The nucleus acumbans also makes the rewarding stimulus more salient, so we are more interested in it.

Dopamine surges into other parts of the brain that are responsible for learning and memory. Irregularities in dopamine throughout the brain may also affect how our brain learns about gambling. Dopaminergic drugs reduce sensitivity to punishment and enhance reward, says Evans. So, a person playing the pokies would not learn from the recurring negative experience of losing money, but focus on the occasional wins.

Genes related to dopamine may make people susceptible to pathological gambling. The gene TAQ-1A controls the number of dopamine receptors in the brain. A recent review proposed that people with a variation of TAQ-1A might be better at learning from positive feedback (such as a win), but worse at learning from negative feedback. If true, people with the genetic variation would be susceptible to the already enticing nature of the pokies.

"Poker machines are thought to be one of more addictive forms of gambling because it taps into number of learning mechanisms. Repeated punishment, through losing, combined with incremental reward," says Evans.

A study published from the University of Cambridge found more evidence blaming dopamine for pathological gambling (Neuron 2009 61, 481-490). Researchers scanned the brains of 40 recreational gamblers as they played a gambling task. The task was rigged, so the players occasionally won money, but mostly lost and near-missed.

"You get a near-miss when you are playing on a slot machine and you get two cherries and the third cherry is coming into view, or your horse comes second," says Luke Clark, a lecturer at the Department of Experimental Psychology at the University of Cambridge, and lead author on the paper. "We found that when a recreational gambler loses their bet on a near-miss, the same areas of the brain light up as they did in a win," says Clark. "Near-miss responses were reported in two areas of the brain, the ventral striatum, where there is a lot of dopamine, and the insula cortex."

The insula cortex is another part of the brain implicated in addictive behaviour; it receives information from many chemicals, not just dopamine. This tells us that dopamine might not be the only chemical responsible for gambling addictions.

In Clark's study players whose insula cortex lit up brightly under the MRI scored higher on a questionnaire with statements often endorsed by pathological gamblers, such as "losses when gambling are bound to be followed by a series of wins".

A recent paper in Science showed that smokers who had a stroke damaging their insula cortex spontaneously gave up smoking, while smokers who had a stroke without damaging this part of their brain continued to feel the desire to smoke.

Alex Blaszczynski, head of the School of Psychology at the University of Sydney, and editor of the journal International Gambling Studies sees no benefit of calling gambling an addiction. "Addiction is really a descriptive term, it doesn't say more than a person engages in a serious of repetitive behaviours that leads to adverse consequences," he says. "The question is: to what extent does a person have the capacity to make decisions in their own interest?"

He believes that like learning any new task, gambling causes changes in the brain, and while some individuals might have a susceptibility to learn addictive gambling behaviours, people have choices. Therefore, while dopamine urges us to carry out certain behaviour because it gives us enjoyment, "whether a person chose to act on those emotions depends on the frontal lobe," Blaszczynski says.

He also asserts that there are different personality types and circumstances that increase a person's vulnerability to become a pathological gambler. "The error is in trying to bring everyone down to one excessive gambling behaviour," he says. One type is those who make poor decisions leading to a habit developing. "They have the erroneous belief that gambling is a way to get money, and they then chase their losses," he explains.

"The second are those who gamble with money for an emotional escape; it is used as a coping mechanism." According to Blaszczynski, this group often have anxiety and/or depression before they start gambling, and a history of poor coping and problem-solving skills.

Blaszczynski believes a third level of individuals, with a background history of impulsivity and other attention deficit disorders, are the most diagnosable as 'addictive gamblers'. Their behaviour is more likely to be caused by dysfunctional structures and chemicals in the brain and, according to Blaszczynski, "These people have more difficulty making decisions (than the other types)."

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In addition to biology, public policy and regulatory legislation creates pathological gamblers. According to Blaszczynski, where gambling is socially acceptable, it is more likely to produce recreational, and later, pathological gamblers. Combining such insights with increased understanding of the neurochemistry of gambling promises effective treatments for gambling addicts such as Ellen Johnson. As she says of the lure of the pokies: "(It's) like when you get a song in your head and you can't get it out." New therapies could help turn down the volume.

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