Discovery of differences in the brains of rats classified as workers vs. slackers

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A team of researchers led by Dr. Catharine Winstanley at the University of British Columbia have uncovered a network of regions in the brain that are involved in determining the choice of working harder to get a bigger reward, or putting in a lesser effort and receiving a smaller reward. Understanding how the brain makes such decisions is one of the most fundamental questions in neuroscience and psychology, and sophisticated animal behavioural testing, coupled with advance brain imaging and stimulation techniques are shedding light on this important

process. These results were presented at the 2018 Canadian Neuroscience Meeting, in Vancouver, May 14th, 2018.

Dr. Winstanley and her team have gained insight into decision-making by studying rats' performance of the "rat cognitive effort task" in which rats learn to earn sugary pellet treats by poking their nose into one of five response holes when a light inside one of the holes is illuminated. Before each test, the rats can choose to press one of two levers, one lever leading to an "easy" test, where the light is on for 1 second, with a reward of one pellet, and the second lever leading to a more attentionally demanding task, where the light is on for only 0.2 seconds, but results in a reward of two pellets. Researchers have found that some rats preferentially choose the easy test ("slackers"), while others prefer the more challenging test ("workers"), and that this choice is not correlated with the rat's ability or efficiency at completing the task.

Through selective inactivation, the team has shown that many brain regions are involved in evaluating the required effort, and that different mechanisms are involved in accomplishing the task. Their experiments have also showed that there is not a simple decision-making center in the brain, but rather that signals through many brain regions and systems, which integrate information to measure information about risk, reward and effort required, resulting in the making of a decision.

"Our research shows that decision-making relies on brain regions involved in emotional responses (the basolateral amygdala) and translating those emotions into actions (striatal and dopamine systems) but also regions of frontal cortex (the anterior cingulate and medial prefrontal cortices) which are involved in detecting causal relationships between events, and evaluating outcomes." says Catharine Winstanley.

Many psychiatric disorders are associated with defects in decision making, such as bipolar mania, psychopathy, drug and gambling

addiction, and suicidal ideation. Understanding the mechanisms underlying the decision-making process could therefore lead to the identification of new targets of intervention in these disorders.

In healthy humans, the ability to choose an option that may be more difficult but may lead to a higher reward in the long run can have important consequence for individuals in terms of personal and economic success.

"The degree to which we are willing to select options that require more cognitive effort but which have the potential to lead to greater rewards has far-reaching consequences for our economic and personal success. The availability of a large range of behavioral tests in animals can help decipher the key players in the brain, in terms of brain regions and chemical signals, that are involved in making these decisions. Understanding how the brain makes decisions is one of the most fundamental questions in neuroscience today." says Catharine Winstanley.

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