Medical Xpress

Classifying neural circuit dysfunctions using neuroeconomics

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The traditional approach to psychiatric diagnosis is based on grouping patients on the basis of symptom clusters. This approach to diagnosis has a number of problems, as symptoms are not necessarily specific to a single diagnosis. Symptoms may vary among patients with a particular diagnosis, and there are no clear diagnostic biomarkers or tests for psychiatry as there are for other areas of medicine.

With this in mind, Steve Chang, along with colleagues from Duke University, introduces a new classification scheme for psychiatric symptoms based on the state of a dysfunctional neural circuit. This is a thought-provoking proposal altering the way science thinks about psychiatric disorders, all of which have been found to have some form of neural circuit dysfunction.

The authors focus on two kinds of functional deficits. Variance-shifted functionality is a condition by which a damaged circuit continues to function, but not at its optimal capacity. State-shifted functionality, on the other hand, is when the function of the circuit is either completely absent or altered in such a way that its output is functionally different.

They discuss these deficits from the perspective of neuroeconomics, an interdisciplinary field that studies the process of decision-making, and related investigations in animals.

"This paper suggests a future in which a cluster of important symptoms for some psychopathology is isolated, classified according to the

information-based scheme outlined by Chang et al. and then used to guide the production of a model organism exhibiting deficits in a contributing neural system," commented neuroeconomics expert P. Read Montague at Virginia Tech. "These possibilities are quite exciting not only because of the possible insights into basic mechanisms, but also because of the potentially fruitful interplay with clinical applications."

"Every day, millions of people struggle with mental illness. While great progress has been made in our understanding of mental illnesses, we lack an adequate framework for connecting mental illness with the underlying problems in the brain," saidstudy's first author Steve Chang, postdoctoral fellow at Duke University and member of the Duke Institute for Brain Sciences. "Our understanding of electrical circuits and recent animal studies in the field of neuroeconomics provides novel insights into the ways neural circuits might fail, resulting in specific symptoms. Our hope is that these insights spur new research and ideas in the treatment of mental disorders."

"In an era where psychiatry hopes to draw tighter links between brain biology and diagnosis, it is important to find ways to begin the discussion about how this might be accomplished," commented Dr. John Krystal, Editor of *Biological Psychiatry*. This study is a step in that direction.

More information: The article is "Mechanistic Classification of Neural Circuit Dysfunctions: Insights from Neuroeconomics Research in Animals" by Steve W.C. Chang, David L. Barack, and Michael L. Platt (doi: 10.1016/j.biopsych.2012.02.017). The article appears in *Biological Psychiatry*, Volume 72, Issue 2 (July 15, 2012)

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