

Epilepsy marked by neural 'hub' network

March 25 2008

An increased number of neuron “hubs” in the epileptic brain may be the root cause for the seizures that characterize the disorder, according to a UC Irvine study.

Researchers Robert Morgan and Ivan Soltesz with the Department of Anatomy and Neurobiology identified that these hubs – a small number of highly connected neurons – are formed in the hippocampus during the transition from a healthy brain to an epileptic one. The increased number of connections among these hubs, they found, circulate and amplify signals to such a degree that they overwhelm brain networks, leading to epileptic seizures.

The study appears this week in the online early edition of the *Proceedings of the National Academy of Sciences*.

“The structure of the epileptic brain differs substantially from that of a healthy one, and our discovery of this hub network offers insight into how epilepsy may develop,” Morgan said. “By establishing therapeutic measures that can selectively target these hub cells, we may be able to create a treatment for epilepsy.”

The researchers used a computer model of a moderately injured hippocampus – the brain region involved in many forms of epilepsy – to create the signaling networks that mimic an epileptic brain, and they found that one featuring a greater number of neuronal hubs promoted the onset of seizure.

By comparing this model with previous animal model studies of epilepsy, they identified these hubs as the network conduits for seizures. Soltesz said that previous studies revealed the existence of these hubs but did not define their role.

“This study is a great example of integrating data from biomedical informatics with basic and clinical research to advance the effort to understand and potentially treat disease and disorders like epilepsy,” added Soltesz, who is chair of the anatomy and neurobiology department and a member of UC Irvine’s Epilepsy Research Center.

Epilepsy affects more than 2 million individuals of all ages in the U.S. alone and at least 50 million worldwide. It is characterized by the occurrence of spontaneous, unpredictable seizures, which can interfere with daily life, be dangerous, and lead to death of some brain cells. While much information is available about the abnormal communication of neuronal networks in epilepsy, the basic mechanisms, involving both genetic and acquired elements, are not fully understood.

Source: University of California - Irvine

Citation: Epilepsy marked by neural 'hub' network (2008, March 25) retrieved 17 July 2023 from <https://medicalxpress.com/news/2008-03-epilepsy-neural-hub-network.html>

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