

New insights into the dynamics of the brain's cortex

Using mathematics and a computer model of brain activity, Roberto Fernández Galán, Ph.D., an assistant professor of neurosciences at Case Western Reserve University School of Medicine, has shown a direct link between activity in the cortex and the microscopic structure of this neuronal network. The findings are published in *PLoS ONE* on May 14.

Building on the existing body of research, Galán's work indicates that the spontaneous activity of small neuronal networks in the cortex consists of highly structured patterns rather than random "noise," shedding light on previous speculations. Galán proved that these structured patterns are inextricably shaped by the network connectivity. "The activity patterns can be used to inform researchers about the anatomy of the underlying neuronal network," Galán explains.

"Reciprocally, the connections in the network determine the patterns of spontaneous neuronal activity and their complexity."

"The calculations and the computer model showed that these structured patterns can function as an 'alphabet' of the neural code, since the network activity consists of combinations of these patterns, similarly to a printed text that consists of combinations of letters," Galán added. "These findings are useful in determining how much information a neuronal network in the brain can process."

Galán's research represents an important step forward in the systems level of neuroscience, which studies how neurons behave when connected together to form networks. This information may ultimately be used to study how the brain processes and stores sensory information and why alterations of the connections between neurons lead to pathologies such as epilepsy.

"Roberto Fernández Galán has made an outstanding addition to the Case Western Reserve University School of Medicine," said Dean Pamela B. Davis, M.D., Ph.D. "We are excited about the impact of this paper in the field of neurosciences and are looking forward to his continued contributions to the top-tier research conducted by our faculty."

Citation: Galán RF (2008) On How Network Architecture Determines the Dominant Patterns of Spontaneous Neural Activity. *PLoS ONE* 3(5): e2148. doi:10.1371/journal.pone.0002148

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