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Mathematical model describes the collaboration of individual neurons

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How do neurons in the brain communicate with each other? One common theory suggests that individual cells do not exchange signals among each other, but rather that exchange takes place between groups of cells. Researchers from Japan, the United States and Germany have now developed a mathematical model that can be used to test this assumption. Their results have been published in the current issue of the journal *PLoS Computational Biology*.

A neuron in the neocortex, the part of the brain that deals with higher brain functions, contacts thousands of other neurons and receives as many inputs from other neurons. Previously, it has been very difficult to use measured signals to interpret the way the cells work together. Scientists at the RIKEN Brain Science Institute (BSI) in Japan have now joined forces with researchers at the Forschungszentrum Jülich, Germany, and MIT in Boston, USA, to develop a mathematical model that can clarify the way neurons collaborate.

"From the many signals measured in parallel, the novel method filters the information on whether the neurons communicate individually or as a group", explains Dr. Hideaki Shimazaki from BSI. "Furthermore it takes into account that these groups of cells are not fixed but, instead, can organize themselves flexibly within milliseconds into groups of different composition, depending on the current requirements of the brain."

Prof. Sonja Grün from Forschungszentrum Jülich hopes that the method

can help researchers to prove the existence of dynamic cell assemblies and clearly assign their activities to certain behaviors. The scientists already demonstrated that neurons work together when an animal anticipates a signal, which may allow it to have a more rapid or more sensitive response.

In future, the scientists hope to learn how to use their methods on the signals recorded from hundreds of neurons simultaneously. This would raise the probability of observing cell assemblies involved in planning and controlling behavior.

Provided by RIKEN