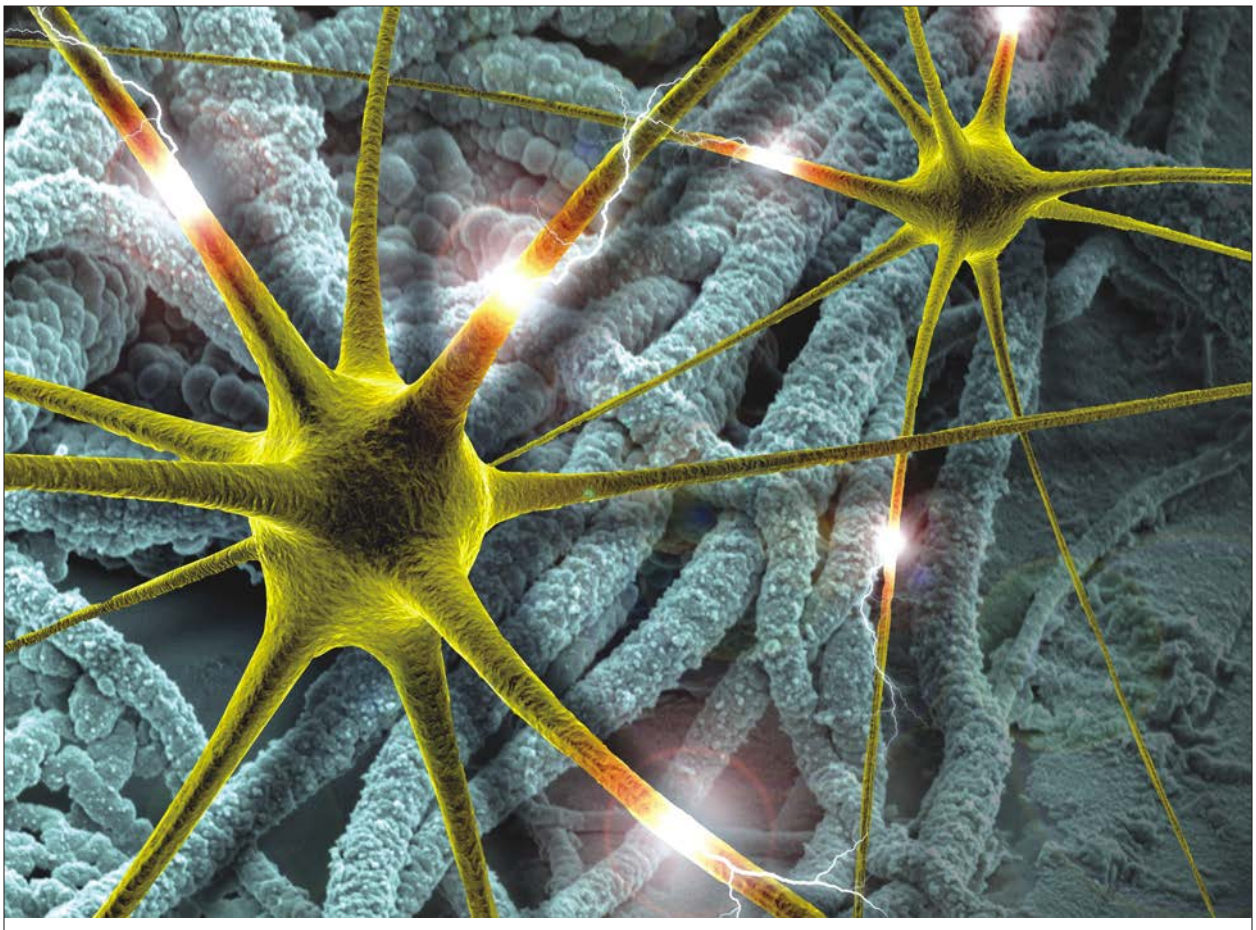

Current Research in **Neuroscience**

ISSN 1996-3408

Academic
Journals Inc.

www.academicjournals.com

Human Working Memory Is Based on Dynamic Interaction Networks in the Brain

A research project of the Neuroscience Center of the University of Helsinki sheds light on the neuronal mechanisms sustaining memory traces of visual stimuli in the human brain. The results show that the maintenance of working memory is associated with synchronisation of neurons, which facilitates communication between different parts of the brain. On the basis of interaction between the brain areas, it was even possible to predict the subject's individual working memory capacity.

The results were published last week in the online version of the journal PNAS.

The working memory of an average person can sustain only three of four objects at a time. The brain areas maintaining the working memory are known well, but there is little information about how these areas interact. The research group led by Satu and Matias Palva imaged the brain activity of subjects performing working memory tasks by using magneto- and electroencephalography (MEG and EEG). In addition to this, they developed a new method for using MEG and EEG data to identify networks of fast neuronal interactions, i.e., synchrony, between different areas of the cerebral cortex. With this novel approach, it was possible to reveal functional networks formed by brain areas at the accuracy of milliseconds.

Maintaining of a memory trace synchronised different brain areas

In their study, the researchers mapped almost four billion different neuronal interactions. They were especially interested in rhythmic interactions between different parts of the brain. While sustaining the working memory of visual stimuli, the rhythmic activity of the subject's different brain areas were transiently synchronised. The results reveal that the synchronisation of neuronal activity in different brain areas had a connection both to the maintenance and to the contents of working memory.

The study also revealed several specialized function-specific networks and interactions between them. The network comprising different areas of the brain's frontal and parietal lobes played a central role. These areas are responsible for the coordination of attention and action. The networks in the occipital lobe, on the other hand, handle and maintain the sensory information about the visual stimuli.

Working memory and attention are the cornerstones of our cognition and consciousness -- knowledge about their underlying neuronal mechanisms can be applied, for example, when developing therapeutic and diagnostic methods for Alzheimer's disease, dementia, schizophrenia, perception and learning disorders, autism and other brain diseases.

Source: Proceedings of the National Academy of Sciences, 2010; DOI: 10.1073/pnas.0913113107