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Signal analysis techniques used to map normal neural activity

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(Medical Xpress)—Looking at a tangled mass of network cables plugged into a crowded router doesn't yield much insight into the network traffic that runs through the hardware.

Similarly, Lynn H. Matthias Professor of Electrical and Computer Engineering Barry Van Veen says that looking at the three pounds of interwoven neurons that make up the hardware of the human brain doesn't give the complete picture of the brain activity that supports human cognition and consciousness.

Working with multiple collaborators, Van Veen has applied signal analysis techniques to the electric or magnetic fields measured noninvasively at the scalp through electroencephalography (EEG) or magnetoencephalography (MEG) to develop methods for identifying network models of brain function—essentially, traffic patterns of neural activity present in the human brain.

"It's analogous to coming up with a new microscope," says Van Veen.

Having a reliable traffic map of normal brain function provides a baseline for comparison for understanding how different disorders, substances and devices affect the brain. "Now that we've got the tool ready, the opportunities to try it out on scientifically interesting questions are really blossoming," says Van Veen.

For instance, network models may provide a better blueprint for how medical devices can interface with the brain. Van Veen recently began working with biomedical engineering Associate Professor Justin Williams to apply his work toward making better brain-machine interfaces.

But the implications of network models go beyond engineering questions. The effect of alcohol on the brain just begs for network analysis, according to Van Veen. The network model could allow researchers to see precisely which parts of the brain are altered by alcohol consumption. It could provide insight into how short-term memory works, help explain the effects of schizophrenia and monitor treatment, help measure the depth and effectiveness of different types of anesthesia, and even help give insight into the brain activity that precedes—or prevents—a miraculous recovery from a coma.

"We're developing this tool as a significant improvement over what people have had access to before," says Van Veen. "The possibilities for using it to study different aspects of brain function are nearly unlimited."

Provided by University of Wisconsin-Madison