Network 'hubs' in the brain attract information, much like airport system

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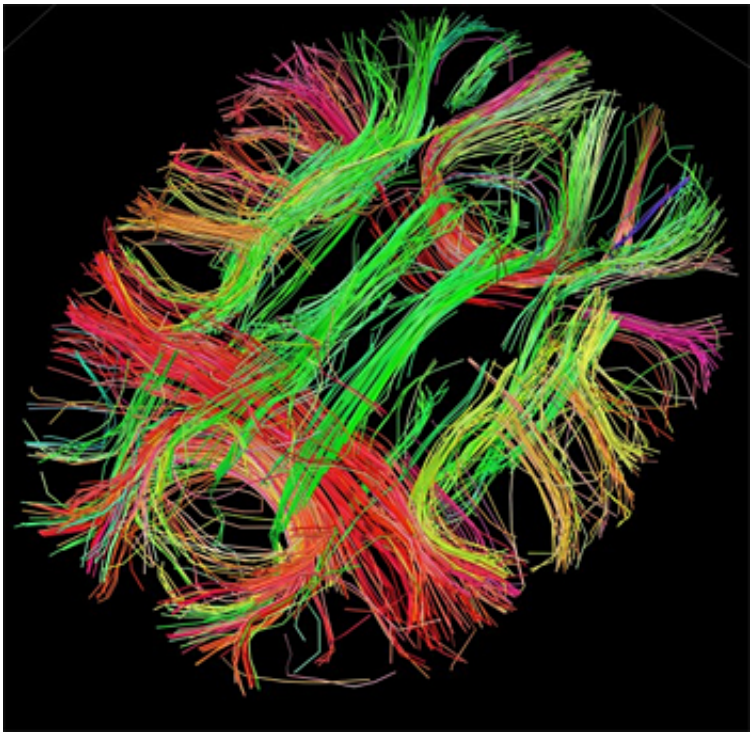

White matter fiber architecture of the brain. Credit: Human Connectome Project.

One of the brain's main jobs is information processing - what is critical, however, is that information in the brain gets transferred to the right places at the right times.

Research on large-scale brain networks by the University of Michigan

Medical School reveals that "hubs" in the brain - highly connected regions that like hubs of the airport system - tend to consistently attract information flow.

"Understanding how information transfer occurs in the brain is critical, especially if network hubs are taken off line by anesthesia, tumor or stroke," says senior study author George A. Mashour, M.D., Ph.D., Bert N. LaDu Professor of Anesthesiology and Director of the Center for Consciousness Science at the University of Michigan.

Mashour and study corresponding author UnCheol Lee, Ph.D., lead the UM's Center for Consciousness Science, one of the few centers in the world that examines the mechanisms and measurement of consciousness.

Their study findings, published in today's *PLOS Computational Biology*, may provide a more straightforward approach to understanding how the overall architecture of the brain shapes information transfer in complex networks.

"It could help us better understand principles of information processing in the brain as the field maps out the structural and functional connections of different brain regions," says Lee, associate director of the Center for Consciousness Science.

The nation is in the early stages of an ambitious project called the BRAIN Initiative to map the structural and functional network of the healthy brain.

Scientists are expected to explore exactly how the brain enables the human body to record, process, utilize, store and retrieve vast quantities of information, all at the speed of thought.

"What is unique about this study," says lead author and physicist Joon-

Young Moon, "is that we found a consistent relationship of hubs and information flow in many types of networks, including empirical brain networks reconstructed from human electroencephalogram.

"Hubs may not, as we commonly think, be control centers that send out information, but rather a critical destination where information is received and integrated."

The University of Michigan demonstrated the general relationship of hub status and information inflow using mathematical analysis, simulation studies in computational brain network models and brain electrical activity data collected from the EEGs of humans in the conscious and unconscious state.

More information: "General relationship of global topology local dynamics, and directionality in large scale brain networks," *PLOS Computational Biology*, April 13, 2015. DOI: 10.1371/journal.pcbi.1004225

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