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Human Connectome Project releases major data set on brain connectivity

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The Human Connectome Project, a five-year endeavor to link brain connectivity to human behavior, has released a set of high-quality imaging and behavioral data to the scientific community. The project has two major goals: to collect vast amounts of data using advanced brain imaging methods on a large population of healthy adults, and to make the data freely available so that scientists worldwide can make further discoveries about brain circuitry.

The initial data release includes brain imaging scans plus behavioral information—individual differences in personality, cognitive capabilities , emotional characteristics and perceptual function—obtained from 68 healthy adult volunteers. Over the next several years, the number of subjects studied will increase steadily to a final target of 1,200. The initial release is an important milestone because the new data have much higher resolution in space and time than data obtained by conventional brain scans.

The Human Connectome Project (HCP) consortium is led by David C. Van Essen, PhD, Alumni Endowed Professor at Washington University School of Medicine in St. Louis, and Kamil Ugurbil, PhD, Director of the Center for Magnetic Resonance Research and the McKnight Presidential Endowed Chair Professor at the University of Minnesota.

"By making this unique data set available now, and continuing with regular data releases every quarter, the Human Connectome Project is enabling the scientific community to immediately begin exploring

relationships between brain circuits and individual behavior," says Van Essen. "The HCP will have a major impact on our understanding of the healthy adult human brain, and it will set the stage for future projects that examine changes in brain circuits underlying the wide variety of brain disorders afflicting humankind."

The consortium includes more than 100 investigators and technical staff at 10 institutions in the United States and Europe. It is funded by 16 components of the National Institutes of Health via the Blueprint for Neuroscience Research.

"The high quality of the data being made available in this release reflects an intensive, multiyear effort to improve the data acquisition and analysis methods by this dedicated international team of investigators," says Ugurbil.

The data set includes information about brain connectivity in each individual, using two distinct magnetic resonance imaging (MRI) approaches. One, called resting-state functional connectivity, is based on spontaneous fluctuations in functional MRI signals that occur in a complex pattern in space and time throughout the gray matter of the brain. Another, called diffusion imaging, provides information about the long-distance "wiring" – the anatomical pathways traversing the brain's white matter. Each method has its own limitations, and analyses of both functional connectivity and structural connectivity in each subject should allow deeper insight than by either method alone.

Each subject is also scanned while performing a variety of tasks within the scanner, thereby providing extensive information about "Task-fMRI" brain activation patterns. Behavioral data using a variety of tests performed outside the scanner are being released along with the scan data for each subject. The subjects are drawn from families that include siblings, some of whom are twins. This will enable studies of the

heritability of brain circuits.

The imaging data set released by the HCP takes up about two terabytes (2 trillion bytes) of computer memory—the equivalent of more than 400 DVDs—and is stored in a customized database called "ConnectomeDB."

"ConnectomeDB is the next-generation neuroinformatics software for data sharing and data mining. It's a convenient and user-friendly way for scientists to explore the available HCP data and to download data of interest for their research," says Daniel S. Marcus, PhD, assistant professor of radiology and director of the Neuroinformatics Research Group at Washington University School of Medicine. "The Human Connectome Project represents a major advance in sharing brain imaging data in ways that will accelerate the pace of discovery about the human brain in health and disease."

Provided by Washington University School of Medicine