Cognitive "fog" of normal aging linked to brain system disruption

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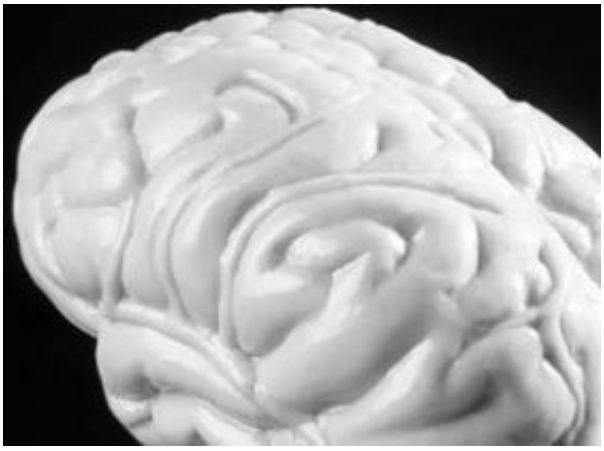

Researchers concentrated on large-scale connections between frontal and posterior brain regions that are associated with high-level cognitive functions such as learning and remembering.

Comparisons of the brains of young and old people have revealed that normal aging may cause cognitive decline due to deterioration of the connections among large-scale brain systems, including a decrease in the integrity of the brain's "white matter," the tissue containing nerve cells that carry information, according to a new study co-authored by several researchers from Washington University in St. Louis.

The study, which finds that the disruption occurs even in the absence of pathology associated with Alzheimer's disease (AD), is published by Cell Press in the Dec. 6, 2007, issue of the journal *Neuron*.

WUSTL co-authors include Denise Head, Ph.D., assistant professor of psychology and of African and African American Studies in Arts & Sciences and research assistant professor of radiology in the School of Medicine; Abraham Z. Snyder, Ph.D., M.D., research scientist with the Mallinckrodt Institute of Radiology and research associate professor of radiology in the School of Medicine; and Marcus E. Raichle, M.D., professor of neurology, of radiology and of anatomy and neurobiology in the School of Medicine.

Researchers assessed brain function in a sample of adults ranging in age from 18 to 93 and comprising 38 young adults and 55 older adults. They did so using functional magnetic resonance imaging (fMRI), which uses harmless radio waves and magnetic fields to measure blood flow in brain regions, which in turn reflects activity.

To assess the integrity of functional connections between brain areas, the researchers used fMRI to measure spontaneous low-frequency fluctuations known to reflect the activity of such connections. The researchers concentrated on large-scale connections between frontal and posterior brain regions that are associated with high-level cognitive functions such as learning and remembering.

Researchers reported a "dramatic reduction" in functional connections when they compared the younger and older groups.

The team also used an MRI technique called "diffusion tensor imaging" to measure the integrity of white matter in the brains of the subjects. This technique reveals details of the structure of brain tissue. Their analysis revealed that the reduced functional connection they detected in brain areas of the older subjects was correlated with decreased white matter integrity.

When the researchers tested the subjects' cognitive function, they found

that "Those individuals exhibiting the lowest functional correlation also exhibited the poorest cognitive test scores."

The researchers concluded that "our observations suggest that within the context of globally intact brain systems, subtle changes accumulate over time in advanced aging that disrupt the coordination of large-scale brain systems."

They also said that, although AD is known to produce similar deterioration due to pathological deposits of amyloid protein, "Our present results, in particular the analysis of individuals without amyloid deposition, show that normal aging is associated with a form of system disruption that is distinct from that associated with AD."

The research team also included investigators from the Howard Hughes Medical Institute, Harvard University, University of Michigan and Massachusetts General Hospital.

Source: Washington University in St. Louis