Even in healthy elderly, brain systems become less coordinated

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Some brain systems become less coordinated with age even in the absence of Alzheimer's disease, according to a new study from Harvard University. The results help to explain why advanced age is often accompanied by a loss of mental agility, even in an otherwise healthy individual.

The study, published in the Dec. 6 issue of *Neuron*, was led by Jessica Andrews-Hanna, a doctoral candidate in the Department of Psychology in the Faculty of Arts and Sciences at Harvard, with Justin Vincent, a graduate student in the Department of Psychology, and Randy Buckner, Harvard professor of psychology and an investigator with the Howard Hughes Medical Institute.

"This research helps us to understand how and why our minds change as

we get older, and why some individuals remain sharp into their 90s, while others' mental abilities decline as they age," says Andrews-Hanna. "One of the reasons for loss of mental ability may be that these systems in the brain are no longer in sync with one another."

Previous studies have focused on the specific structures and functions within the brain, and how their deterioration might lead to decreased cognitive abilities. However, this study examined the way that large-scale brain systems that support higher-level cognition correlate and communicate across the brain, and found that in older adults these systems are not in sync. In particular, widely separated systems from the front to the back of the brain were less correlated.

The researchers studied 55 older adults, approximately age 60 and over, and 38 younger adults, approximately age 35 and younger. They used a neuroimaging technique called fMRI to obtain a picture of activity in the brain. The results showed that among the younger people, brain systems were largely in sync with one another, while this was not the case with the older individuals.

Among the older individuals, those who performed better on psychometric tests were more likely to have brain systems that were in sync. These psychometric tests, administered in addition to the fMRI scanning, measured memory ability, processing speed, and executive function.

Among older individuals whose brain systems did not correlate, not all of the systems were affected in the same way. Different systems process different kinds of information, such as the attention system, used to pay attention, and the default system, used when the mind is wandering. The default system was most severely disrupted with age. Some systems do remain intact; for example, the visual system was very well preserved. The study also showed that the white matter of the brain, which connects

the different regions of the brain, begins to lose integrity with age.

One of the challenges to studying the aging brain is that the early signs of Alzheimer's disease are very subtle, and it is difficult to distinguish between the early stages of Alzheimer's disease and normal aging. In order to ensure that the researchers were only looking at healthy aging brains, the researchers used a PET scanning process to identify the presence of amyloid, a chemical present in individuals with Alzheimer's. When the presence of this chemical was detected, individuals were not included in the study. In this way, the researchers ensured that they were looking at a healthy aging brain.

"Understanding why we lose cognitive function as we age may help us to prolong our mental abilities later in life," says Buckner. "The results of this study help us to understand how the aging brain differs from the brain of a younger individual."

Source: Harvard University