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Researchers identify brain region as possible target for dementia prevention

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A University of Rochester study has found that older adults with excellent memories have more efficient connections between specific areas of the brain—findings that could hold promise for the prevention

of dementia and cognitive decline.

Although researchers have historically viewed memory deterioration as an inevitable part of the aging process, a small group of older adults —called "supernormals"—are able to maintain their memory capacities much better than their peers. Feng (Vankee) Lin, PhD, an assistant professor in the University of Rochester School of Nursing, is spearheading a new approach to the study of Alzheimer's disease by exploring what can be learned from these individuals.

In a study on the topic published in *Cortex*, an international journal devoted to the study of cognition and the relationship between the nervous system and mental processes, Lin and her team explored differences in brain function among three groups of older adults: supernormals, who were defined as having higher than average memory scores for their age, older adults diagnosed with amnestic mild cognitive impairment who are at high risk for developing Alzheimer's disease, and a healthy control group. The study is the first to compare the brain function of supernormals to those who are at risk for developing Alzheimer's.

Specifically, Lin and her colleagues measured the functional connectivity—the connection among spatially separated structures of the brain—between the cingulate cortex and other regions. Functional connectivity is measured by observing what parts of the brain are activated at the same time or in rapid succession in response to a stimulus.

"The cingulate cortex acts as a 'hub' and receives input from many areas in the brain. Its functioning often deteriorates early in the aging process and in the development of Alzheimer's disease, so it could play a key role in memory decline," said Lin. "It's a vulnerable area that hasn't been explored in this way before."

As part of the study, the team analyzed a national data set from the Alzheimer's Disease Neuroimaging Initiative, which collects brain imaging scans and provides them to researchers across the country. The participants also underwent memory, executive function, language, and other tests to assess their cognitive abilities.

Lin found that individuals who had stronger or more efficient functional connectivity between the cingulate cortex and certain regions of the brain had better memories compared to those who had weaker or less efficient relationships between the same areas. Supernormals also had lower levels of amyloids, groups of proteins that are associated with Alzheimer's disease.

But even when amyloids were present, the relationship between better functional connectivity and better memory still remained. These findings indicate that the way the cingulate cortex functions in supernormals may represent exceptional neural reserve—the ability of the mind to resist damage. This neural reserve could protect supernormals against the effects of amyloid plaques and allow their memories to be maintained. "Our results show that the cingulate cortex could be a viable target for interventions aimed at preventing memory decline or enhancing memory capacity," said Lin. "In the future, we may be able to modify the function of this region in individuals who are at risk for developing Alzheimer's to slow down cognitive decline."

Lin hopes to study this topic further with a larger sample size and connect her findings to other studies on the relationship between lipids in the blood and the development of Alzheimer's disease.

Ping Ren, a post-doctoral fellow at the UR School of Nursing; Mark Mapstone, PhD, professor of neurology at the University of California-Irvine; Steven P. Meyers, MD, PhD, professor of imaging sciences, neurosurgery, and otolaryngology at the UR School of Medicine and

Dentistry; Anton Porsteinsson, MD, professor of psychiatry at the UR School of Medicine and Dentistry and the director of the University of Rochester Alzheimer's Disease Care, Research, and Education Program; and Timothy M. Baran, PhD, a research assistant professor in the Department of Imaging Sciences at the University of Rochester, also contributed to this study.

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