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RESEARCH NEWS

JUNE 10, 2004

Alzheimer's May Leave Some Forms of Memory Intact

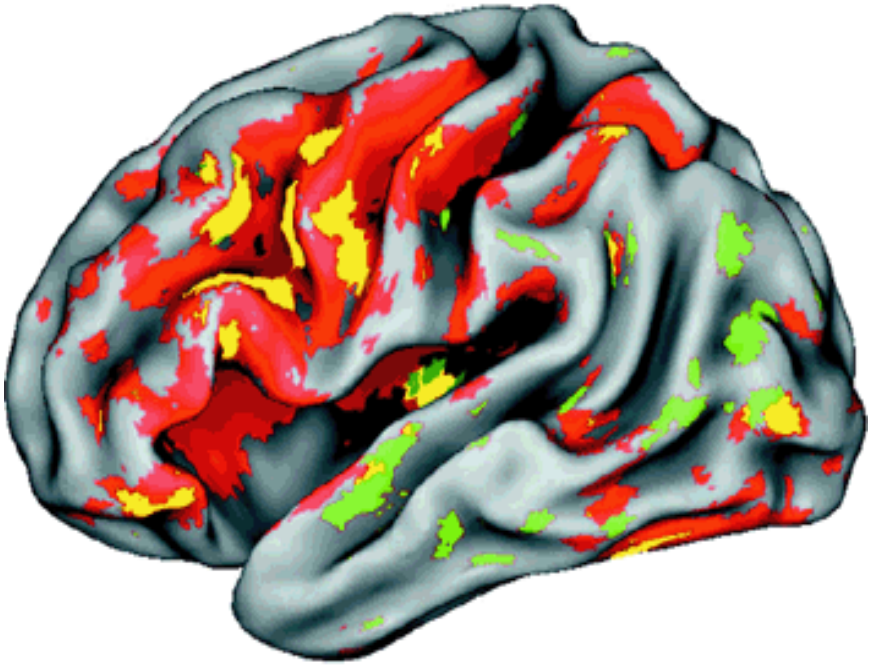

Image Title: Frontal brain regions used during the word classification task, shown in red, reduced their activity with practice, as shown in yellow. Frontal regions of the brain are involved in high level cognition and planning. The finding that those regions change activity with learning suggests certain memory functions affecting complex cognitive abilities are preserved in Alzheimer's disease. - Randy L. Buckner, HHMI at Washington University in St. Louis

Howard Hughes Medical Institute (HHMI) researchers have made the surprising discovery that people with Alzheimer's disease retain the capability for a specific form of memory used for rote learning of skills, even as their memories of people and events are extinguished.

The scientists' discovery suggests new strategies to improve training and rehabilitative programs that may bolster the retained cognitive function of

those with Alzheimer's disease as well as healthy older people.

“From this and other studies we have done, it appears that a number of brain systems are more intact in Alzheimer's than we had anticipated,” said Howard Hughes Medical Institute researcher Randy L. Buckner at Washington University in St. Louis. “The findings suggest that if we can help people use these brain systems optimally by providing the right kinds of cues or task instructions, we may be able to improve their function.”

In an article published in the June 10, 2004, issue of the journal *Neuron*, Buckner and Cindy Lustig, also at Washington University, compared implicit memory capabilities in young adults, healthy older adults and those in the early stages of Alzheimer's disease.

Implicit memory is called upon when trying to recall procedures like tying a shoe. Explicit memory is used remember past associations and events. Buckner said that although researchers have used behavioral studies to distinguish implicit memory from explicit memory, the neurobiology underpinning implicit memory remains a mystery.

In anatomical terms, the kind of explicit memory that is severely impaired in Alzheimer's disease depends on the condition of the medial temporal lobe, including the hippocampus, said Buckner. “The form of memory that enables us to learn a cognitive skill is less well understood, although it is thought to depend on areas of the cerebral cortex,” said Buckner.

For their study, Lustig and Buckner recruited 34 young adults, 33 healthy older adults, and 24 older adults in the early stages of Alzheimer's disease. They designed their study to compare the implicit memory capabilities of younger and older people both with and without Alzheimer's symptoms. Lustig and Buckner presented the subjects with a series of words and asked them to decide whether the words represented living or non-living objects. They also hoped that their studies would provide a clearer picture of the regions of the brain that are employed in such tasks.

“For this task, we found that all three groups showed a significant reduction with practice in the time required to decide on a word, which is the hallmark of implicit learning,” said Buckner. While the younger adults were faster in performing the tasks, all three groups showed a robust reduction in time with practice, he said.

The researchers next asked the subjects to repeat the classification task as their brains were scanned using functional magnetic resonance imaging. “What was surprising and novel in this study is that the brain region with the greatest activity during the task was the high-level region of the frontal cortex,” said Buckner. “We didn't expect this because high-level cognition is affected in Alzheimer's disease. These results suggest that despite the damage to these areas in Alzheimer's, certain memory processes that seem to depend

on them remain fundamentally intact."

The researchers found that the reduction in time required to perform the classification task correlated with a reduction in activity in frontal cortex. This reduction is a characteristic property of a brain region that is adjusting its activity to function more efficiently as it becomes accustomed to a particular task. "This finding suggests there is a link—although it doesn't prove it—between activity reductions in frontal cortex and this type of learning," said Buckner.

Although the findings are preliminary, Buckner believes the studies point to a promising approach for training and rehabilitation. "Our hope is that by demonstrating the availability of these systems, this knowledge will be translated to cognitive training programs for the healthy elderly and those with forms of dementia, which we just had not anticipated when we began this work," Buckner said.

At this point it appears that structured training programs might be the most effective approach. "Our earlier work had shown that if you leave older adults to form their own approach to a task spontaneously, that's perhaps the least helpful situation," he said. "Whereas, if you constrain the task and give very directed goals, it helps older adults recruit those remaining neural areas. In this study, we've shown that it is possible to tap into high-level cognitive areas that show preserved memory function."

Further research, said Buckner, will include studies to understand the neural mechanisms underlying implicit memory, to pinpoint how they are compromised in both the healthy elderly and those with Alzheimer's disease.