Must. Work. Harder. There's a term for people who don't seem to age: *superagers*. Coined by neurologist Marsel Mesulam, the term refers to people over 65 whose memory and attention are on par with healthy young adults. A team at Massachusetts General Hospital has been studying superagers to understand how they got that way. Using MRI scans, scientists identified a set of brain regions that differed between normally-aging adults and a group of 17 superagers. They found that the superagers' brains had much thicker *midcingulate cortex* and anterior *insula*, both areas traditionally associated with emotional regulation. The thicker those regions were, the better the subjects performed on tests of memory and attention. The big question is how does one become a superager in the first place? The answer is music to our ears here at Curious World Headquarters: work hard learning new things. Dr. Lisa Barrett, the lead researcher, believes that performing difficult—and temporarily uncomfortable—tasks is the secret. Powering through those bad feelings of being fatigued, stymied and frustrated is what keeps those superager brain regions thick and healthy. Barrett says that most of us tend to avoid unpleasant situations as we get older, and "consistently sidestep the discomfort of mental effort or physical exertion. All brain tissue gets thinner from disuse. If you don't use it, you lose it." That means brain deterioration as we get older isn't the result of aging, but the result of not using our brain properly as we age. Yikes. I'm definitely doing my CQ Workouts this week!

Daily Curio

An amusing daily fact from Justin Kitch, Curious CEO.

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Wanna be a superager?

‘Superaging’: How Some 80-Year-Olds’ Memories Are as Sharp as 20-Year-Olds’

It’s as inevitable as grey hair and wrinkles—when we get old, our memories decline, even if Alzheimer’s or dementia doesn’t accelerate that process. But there are a select few whose memories seem to remain as hale as those decades younger. Scientists call them superagers. And now, there is some clarity as to how these superagers hold on to their robust memory.

In superagers, the brain networks used for memory, learning, and resilience are nearly untouched by age. While other areas of their brains atrophied, the memory networks of superagers aged 60 to 80 were as healthy as those of the average 18-to-32-year-old’s brain, researchers at Massachusetts General Hospital reported recently in the Journal of Neuroscience. “We were surprised by that,” said Alex Touroutoglou, a researcher in neurology at Massachusetts General Hospital and a co-author of the study.

older-person_1024x576

In superagers, the brain networks used for memory, learning, and resilience are nearly untouched by age.

While some earlier evidence of "superaging" had been found in the brains of patients older than 80, the new results show how the trait can appear in brains up to two decades younger.

By watching how superagers avoid some of the consequences of normal aging, the researchers hope to understand and alleviate both the slow decline of healthy aging and the diseases that accelerate it.

To measure brain health, Touroutoglou and her collaborators examined the cortex, the layer on the surface of our brains rich in grey matter. Only a few millimeters thick, the cortex coats the brain's distinctive folds and is involved in many of the advanced thought patterns that are hallmarks of our humanity—like language, memory, and consciousness. But as we age, that cortex grows thinner, reducing the brain's cognitive resources. By measuring the thickness of this cortex, then, scientists can see how much aging has degraded that part of the brain.

When the team looked at the cortex of superagers, they found that in many areas, it had thinned out as expected. But in areas used to recall memories and to make new ones, it remained about as thick as those in the 18-to-32-year-old brains.

The researchers also found thick, healthy cortex in regions where it would bolster what Touroutoglou called "tenacity and the will to persevere in the face of challenges." If this correlation is replicated in other studies, it could mean that the memory networks alone aren't responsible for superaging. One interpretation is that elderly people who stay engaged with work, life, and family end up keeping these memory networks active, keeping them healthy later on.

The study reinforces similar results previously seen in the brains of superagers older than 80, said Emily Rogalski, a research associate professor of cognitive neurology at Northwestern University's School of Medicine who also studies the brains of superagers. She said she hoped more research on superaging could give a more optimistic view of aging: "There's a need for looking at more than what's going wrong with the brain."

Joseph Adreano, a psychiatry researcher at MGH and co-author on the study, said the next step is to understand how superager brains stay healthy. Even when brains age normally, without any visible sign of disease, they accumulate molecules called amyloids—the suspected culprits behind Alzheimer's and some dementias. Adreano is studying superagers to see if their brains contain fewer of these molecules, especially in the areas that have remained unusually healthy. "There's a possibility that these superaging people might be more resilient to disease," he said.

Despite their hopes to better understand Alzheimer's and dementia, the team is unsure how quickly, if at all, superaging research will help treat or prevent those diseases. The study used only healthy volunteers, so more research comparing the brains of superagers to those of diseased patients is needed to make progress on those diseases.

"We are at the very early stages, but it's exciting," Touroutoglou said.

The Changing Brain in Healthy Aging

In the past several decades, investigators have learned much about what happens in the brain when people have a neurodegenerative disease such as Parkinson's disease, AD, or other dementias. Their findings also have revealed much about what happens during healthy aging. Researchers are investigating a number of changes related to healthy aging in hopes of learning more about this process so they can fill gaps in our knowledge about the early stages of AD.

As a person gets older, changes occur in all parts of the body, including the brain:

- Certain parts of the brain shrink, especially the prefrontal cortex (an area at the front of the frontal lobe) and the hippocampus. Both areas are important to learning, memory, planning, and other complex mental activities.
- Changes in neurons and neurotransmitters affect communication between neurons. In certain brain regions, communication between neurons can be reduced because white matter (myelin-covered axons) is degraded or lost.
- Changes in the brain's blood vessels occur. Blood flow can be reduced because arteries narrow and less growth of new capillaries occurs.
- In some people, structures called plaques and tangles develop outside of and inside neurons, respectively, although in much smaller amounts than in AD (see "The Hallmarks of AD" for more information on plaques and tangles).
- Damage by **free radicals** increases (free radicals are a kind of molecule that reacts easily with other molecules; see "The Aging Process" for more on these molecules).
- Inflammation increases (inflammation is the complex process that occurs when the body responds to an injury, disease, or abnormal situation).

What effects does aging have on mental function in healthy older people? Some people may notice a modest decline in their ability to learn new things and retrieve information, such as remembering names. They may perform worse on complex tasks of attention, learning, and memory than would a younger person. However, if given enough time to perform the task, the scores of healthy people in their 70s and 80s are often similar to those of young adults. In fact, as they age, adults often improve in other cognitive areas, such as vocabulary and other forms of verbal knowledge.

It also appears that additional brain regions can be activated in older adults during cognitive tasks, such as taking a memory test. Researchers do not fully understand why this happens, but one idea is that the brain engages mechanisms to compensate for difficulties that certain regions may be having. For example, the brain may recruit alternate brain networks in order to perform a task. These findings have led many scientists to believe that major declines in mental abilities are not inevitable as people age. Growing evidence of the adaptive (what scientists call "plastic") capabilities of the older brain provide hope that people may be able to do things to sustain good brain function as they age. A variety of interacting factors, such as lifestyle, overall health, environment, and genetics also may play a role.

Another question that scientists are asking is why some people remain cognitively healthy as they get older while others develop cognitive impairment or dementia. The concept of "cognitive reserve" may provide some insights. Cognitive reserve refers to the brain's ability to operate effectively even when some function is disrupted. It also refers to the amount of damage that the brain can sustain before changes in cognition are evident. People vary in the cognitive reserve they have, and this variability may be because of differences in genetics, education, occupation, lifestyle, leisure activities, or other life experiences. These factors could provide a certain amount of tolerance and ability to adapt to change and damage that occurs during aging. At some point, depending on a person's cognitive reserve and unique mix of genetics, environment, and life experiences, the balance may tip in favor of a disease process that will ultimately lead to dementia. For another person, with a different reserve and a different mix of genetics, environment, and life experiences, the balance may result in no apparent decline in cognitive function with age.

Scientists are increasingly interested in the influence of all these factors on brain health, and studies are revealing some clues about actions people can take that may help preserve healthy brain aging. Fortunately, these actions also benefit a person's overall health. They include:

- Controlling risk factors for chronic disease, such as heart disease and diabetes (for example, keeping blood cholesterol and blood pressure at healthy levels and maintaining a healthy weight)
- Enjoying regular exercise and physical activity
- Eating a healthy diet that includes plenty of vegetables and fruits
- Engaging in intellectually stimulating activities and maintaining close social ties with family, friends, and community

"Vascular Disease" and "Lifestyle Factors" provide more information about these issues and how they may influence the risk of developing AD.

ACTIVE Study May Provide Clues to Help Older Adults Stay Mentally Sharp

The phrase "use it or lose it" may make you think of your muscles, but scientists who study brain health in older people have found that it may apply to cognitive skills as well. In 2006, scientists funded by NIA and the National Institute of Nursing Research completed a study of cognitive training in older adults. This study, the Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) study, was the first randomized controlled trial to demonstrate long-lasting, positive effects of brief cognitive training in older adults.

The ACTIVE study included 2,802 healthy adults age 65 and older who were living independently. Participants were randomly assigned to four groups. Three groups took part in up to 10 computer-based training sessions that targeted a specific cognitive ability—memory, reasoning, and speed of processing (in other words, how fast participants could respond to prompts on a computer screen). The fourth group (the control group) received no cognitive training. Sixty percent of those who completed the initial training also took part in 75-minute "booster" sessions 11 months later. These sessions were designed to maintain improvements gained from the initial training.

The investigators tested the participants at the beginning of the study, after the initial training and booster sessions, and once a year for 5 more years. They found that the improvements from the training roughly counteracted the degree of decline in cognitive performance that would be expected over a 7- to 14-year period among older people without dementia:

- Immediately after the initial training, 87 percent of the processing-speed group, 74 percent of the reasoning group, and 26 percent of the memory group showed improvement in the skills taught.
- After 5 years, people in each group performed better on tests in their respective areas of training than did people in the control group. The reasoning and processing-speed groups who received booster training had the greatest benefit.

The researchers also looked at the training's effects on participants' everyday lives. After 5 years, all three groups who received training reported less difficulty than the control group in tasks such as preparing meals, managing money, and doing housework. However, these results were statistically significant for only the group that had the reasoning training.

As they get older, many people worry about their mental skills getting "rusty." The ACTIVE study offers hope that cognitive training may be useful because it showed that relatively brief and targeted cognitive exercises can produce lasting improvements in the skills taught. Next steps for researchers are to determine ways to generalize the training benefits beyond the specific skills taught in ACTIVE and to find out whether cognitive training programs could prevent, delay, or diminish the effects of AD.