Can 'Supernormals' Stave off Alzheimer's?

Older adults with excellent memories have more efficient connections between specific areas of the brain—a finding that could hold promise for the prevention of dementia and cognitive decline, according to a School of Nursing study.

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, an assistant professor of nursing, is exploring what can be learned from such individuals.

In a study published in *Cortex*, 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, 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 connections among spatially separated structures of the brain—between the cingulate cortex and other regions. Functional connectivity is measured by observing which 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," says 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, 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. The findings indicate that the way the cingulate cortex functions in supernormals may represent exceptional neural reserve—the ability of the mind to resist damage. The neural reserve could protect supernormals against the effects of amyloid plaques and allow their memories to be maintained, researchers say.

—Jessica O'Leary

Better Vision through Brain-Training Video Games

The peripheral vision of children with poor vision improved after only eight hours of training via kid-friendly action video games, according to a study by Rochester and Vanderbilt researchers. Most surprising to the scientists was the range of visual gains the children made, and that the gains were quickly acquired and stable when the children were tested a year later.

Duje Tadin, an associate professor of brain and cognitive sciences, helped design the games used in the study, which was supported by the National Eye Institute and published in *Scientific Reports*. "Children who have profound visual deficits often expend a disproportionate amount of effort trying to see straight ahead," he says. "So we devised a kid-friendly game that compels players to pay attention to the entire visual field."

A total of 24 youths from Tennessee and Oklahoma schools for the blind participated in the study. After eight hours of training, the children made improvements in a range of visual tasks. The researchers say the students were able to better perceive moving objects in the far periphery and were much faster at visual searches, such as finding a stapler on a messy desk.

"We were surprised by the range of improvements, and we were even more surprised when we tested a few of the students a year later and found that the gains they made were stable," says Jeffrey Nyquist, the study's lead author who has since founded a company called NeuroTrainer. "Within just a few hours of training, they were able to expand their usable visual field and visual search ability."

—Monique Patenaude

ADOBE STOCK

Antisense Compounds Offer New Weapon Against Influenza

Challenging a long-held convention, University researchers have shown they can inhibit the influenza A virus by targeting its genomic RNA with "antisense" compounds.

The findings, highlighted on the cover of *Nucleic Acid Therapeutics*, may offer scientists a new way to attack an increasingly drug-resistant pathogen that causes an estimated 250,000 to 500,000 deaths a year.

The collaboration, involving the labs of Douglas Turner, a professor of chemistry; Luis Martinez-Sobrido, an associate professor of microbiology and immunology; and two researchers in Poland, reported that "antisense" compounds targeting one of the virus's eight genomic RNA segments caused a 5- to 25-fold reduction of influenza A virus in cell cultures.

"Antisense" compounds are synthesized with nucleotides, the building blocks of nucleic acid. When the compounds—called antisense oligonucleotides—bind to the targeted genomic RNA, they block its ability to replicate.

"That's a big difference," Martinez-Sobrido says. "When mice are infected with 10,000 viruses, they all die. However, with 25 times less virus, all animals can survive infection and they don't even develop symptoms."

The most effective of the antisense compounds ranged from 11 to 15 nucleotides long, and were not toxic to host cells. To date, influenza viruses have shown a remarkable ability to mutate and become resistant to current antiviral drugs.

—Bob Marcotte

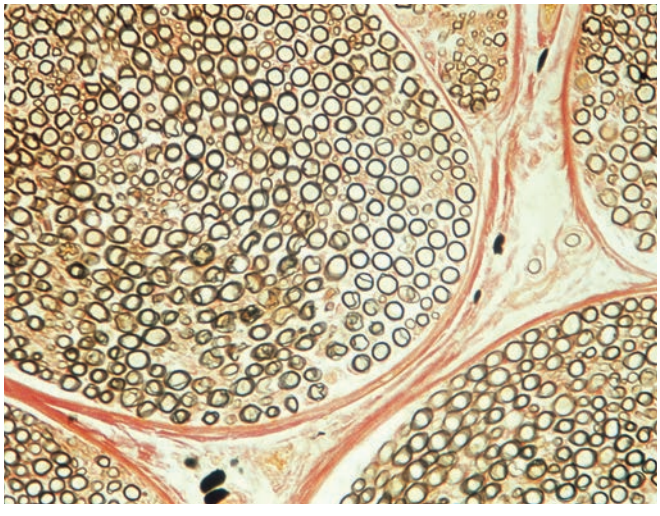
Repurposed Drug May Offer Treatment for Nerve Damage

Medical Center researchers may have identified a new means of enhancing the body's ability to repair its own cells. They hope the finding will lead to better diagnosis and treatment of traumatic nerve injuries, like those sustained in car accidents, sports injuries, or combat. The team showed that a drug previously approved for other purposes can "wake up" damaged peripheral nerves and speed repair and functional recovery after injury.

The study, which appeared in *EMBO Molecular Medicine*, demonstrates for the first time that 4-aminopyridine (4AP), a drug currently used to treat patients with the chronic nerve disease multiple sclerosis has the unexpected property of promoting recovery from acute nerve damage. The study is the first demonstration of the drug's benefit in treating acute nerve injury and the first time those benefits have been shown to persist after treatment was stopped.

Study authors John Elfar, associate professor of orthopaedics, and Mark Noble, the Martha M. Freeman, M.D., Professor in Biomedical Genetics, and their team, found that daily treatment with 4AP promotes repair of myelin, the insulating material that normally surrounds nerve fibers, in mice. The findings advance an area of research that has been stagnant for nearly 30 years and may address unmet needs of traumatically injured patients in the future.

—Susanne Pallo



NERVE CENTER: A Medical Center study indicates that a drug currently used to treat patients with multiple sclerosis may help repair damage to peripheral nerves. (Above, a transverse section of a human nerve.)

BIOPHOTO ASSOCIATES/SCIENCE SOURCE

Study Refutes Theory about Autism Brain Response

A Medical Center study is challenging the hypothesis that nerve cells in the brains of people with autism spectrum disorders do not reliably and consistently respond to external stimuli.

"Our findings show there is no measurable variation in how individuals with autism respond to repeated visual and tactile stimuli," says John Foxe, the Kilian J. and Caroline F. Schmitt Professor in Neuroscience, the chair of the Department of Neuroscience, and the senior author of the study.

Published in the journal *Cerebral Cortex*, the study involved 20 individuals diagnosed with autism and 20 individuals who served as healthy controls. The electrical activity in the participants' brains was recorded as they were exposed to repeated visual stimuli. No matter how the researchers measured the variability of the responses, brain responses in people with autism were as stable as those of the controls. To make sure that the finding didn't apply only to the visual system, the team also evaluated tactile inputs—repeated touches to the wrists of participants—and, once again, measures of brainwave responses provided no evidence of increased variability in the individuals with autism.

The work examined an understanding of how the brain responds to stimuli known as the neuronal unreliability theory, which has gained traction in recent years in the wake of a study published in 2012. The theory is based on the assumption that the brain's response to repetitive stimuli should be steady and consistent. According to the theory, the brain's response is not constant in people with autism and, consequently, alters their perception of the physical environment and impairs cognitive and social development.

That theory did not ring true with Foxe and his colleagues, based on their decades of studying the brain activity of children with autism spectrum disorders. Furthermore, the original studies that formed the basis for the hypothesis involved functional MRI experiments, work that measures changes in the blood oxygen levels in the brain. While fluctuations in blood flow are important indicators of brain activity, the measures do not precisely correlate to the more rapid electrical activity that occurs in the brain when nerve cells are stimulated.

The authors contend that while the new study essentially demonstrates negative findings, it represents an important contribution in the field of autism, in which much of the understanding of the disease is—to the frustration of patients, families, researchers, and caregivers alike—sometimes long on theory and conjecture but short on solid scientific research.

—Mark Michaud