How to Keep Your Aging Brain Fit: Aerobics

Forget Crossword Puzzles -- Study Says 3 Hours of Exercise a Week Can Bolster Memory, Intellect

By SHARON BEGLEY
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The key to keeping intellectually sharp as we age may not be mental gymnastics, as commonly recommended, but real gymnastics.

According to a new study, the brain's long, slow decline may not be inevitable. For the first time, scientists have found something that not only halts the brain shrinkage that starts in a person's 40s, especially in regions responsible for memory and higher cognition, but actually reverses it: aerobic exercise. As little as three hours a week of brisk walking -- no Stairmaster required -- apparently increases blood flow to the brain and triggers biochemical changes that increase production of new brain neurons.

As brains age, normal wear and tear starting in middle age causes them to process information more slowly, which means it takes longer to make judgments and grasp complex information. Older brains also take longer to switch from one task to another and are less adept at "multitasking" (such as driving while simultaneously tuning the radio and checking the tailgater).

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The search for ways to slow down mental decline and detrimental brain changes that come with age has taken an unexpected turn lately. Popular wisdom, as well as some scientists, had long held that the way to stay mentally sharp was to do mental gymnastics. Crossword puzzles, reading, taking up a musical instrument and generally challenging the mind were supposed to stave off the mental ravages of old age.

That has been hard to prove. But support for the brain benefits of physical exercise has become stronger. A number of earlier studies showed that elderly people who take up aerobic exercise show improved cognitive function after a few months, says Arthur Kramer of the University of Illinois, Urbana: Their working memory is better, they are nimbler at switching between mental tasks, and they can screen out distractions better than people who did not get exercise training.

Now he and colleagues have discovered what may be the basis for these improvements. As little as three hours a week of aerobic exercise increased the brain's volume of gray matter (actual neurons) and white matter (connections between neurons), they report in the November issue of the Journal of Gerontology: Medical Sciences. "After only three months," says Prof. Kramer, "the people who exercised had the brain volumes of people three years younger."

Until 1998, neuro-dogma held that old brains do not grow new neurons. A study on patients in Sweden overturned that assumption. But researchers did not know whether people could do anything to boost this "neurogenesis," or even whether doing so would have cognitive benefits. The Illinois study is therefore the first to discover that older brains can indeed rev up their production of new neurons (no one has studied whether younger brains can), and it is apparently enough to make a real-world difference. Studies in both people and animals have linked increases in brain volume (which occur with some drugs) to improvements in thinking, remembering, cognitive flexibility (thinking outside the box) and perseveration (not getting stuck on one thought).

"This is a great emerging story," says Fred Gage of the Salk Institute, La Jolla, Calif., who was not involved in the Urbana study but led the 1998 discovery of human neurogenesis. "You can do something to influence your mental fate as you get older."

The Urbana scientists had 59 adults, age 60 to 79, get aerobics training, non-aerobic stretching-and-toning training, or nothing. The first two groups exercised for one hour three times a week, walking around a gym at a little more than three miles an hour. The researchers used MRI (magnetic resonance imaging) before

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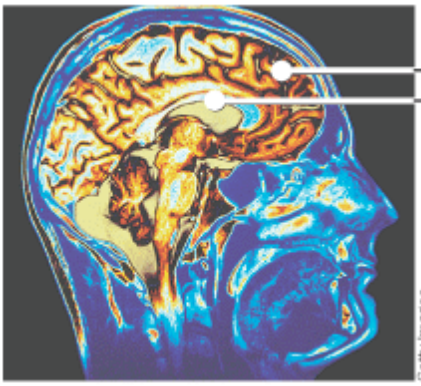
and after the program to measure the volunteers' brains.

Neither the stretchers-and-toners nor the couch potatoes showed any brain changes. But "the aerobic group showed a substantial increase in brain volume," says Dr. Kramer.

Gray matter increased most in the frontal lobes, the seat of high-order thinking such as attention and memory. White matter increased most in the corpus callosum. This is the bundle of neurons that connects the right brain and the left, and whose deterioration with age is thought to be responsible for slower thinking. With better connections, the hemisphere that is carrying out some task can send signals to the other side to pipe down, making for better cognitive efficiency.



"This is the first time anyone has shown that exercise increases brain volume in the elderly," says Dr. Kramer. "It suggests that aerobic exercise can stave off neural decline, and even roll back some normal age-related deterioration of brain structure."

Because the volunteers were all healthy, the study does not address whether exercise might slow down, let alone reverse, age-related brain diseases such as Alzheimer's. And because the scientists did not put their volunteers through a tougher regimen, they cannot say whether more strenuous exercise would boost neurogenesis even further, or whether the benefits top out at some point.

Although the study included relatively few people, scientists not involved in it say it fits with a growing body of evidence about the aging brain. "Different people from different labs are finding the same thing: evidence of an increase in cognitive capacity with exercise," says Salk's Prof. Gage.

Animal studies confirm the connection between moving your body and pumping up your brain. When lab mice get a lot of exercise, such as in a running wheel, the connections among neurons grow longer and more numerous. And in a harbinger of the Urbana results, says Prof. Gage, neurogenesis occurs in the bewhiskered runners' brains. "Even in mice who don't start exercising until they're elderly, exercise doesn't merely prevent decline in neurogenesis, but reverses it," he says. "There is activation of neural stem cells, which suggests that these cells are always there but become dormant with age." Exercise wakes them up, and they start giving birth to neurons that improve the mice's thinking and memory.

How might exercise work this magic? Studies in lab animals show that exercise raises blood levels of a molecule called IGF-1 (for insulin-like growth factor). Normally, IGF-1 does not cross the blood-brain barrier, explains Prof. Gage, but "with exercise it does." IGF-1 increases blood flow, which is good for brain neurons. Even more important, it induces neural stem cells to morph into actual neurons and other functional brain cells. The hippocampus, a structure that is crucial to forming new memories, is especially amenable to the benefits of IGF-1.

With more gray matter and white matter, "the brain is more interconnected, more plastic and

more adaptive to change," Prof. Kramer says.

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