PHYS ED

How Walking Can Build Up the Brain

Older men and women who walked for six months showed improvements in white matter and memory, while those who danced or did stretching exercises did not.

James Stukenberg for The New York Times

By Gretchen Reynolds

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Exercise can freshen and renovate the white matter in our brains, potentially improving our ability to think and remember as we age, according to a new study of walking, dancing and brain health. It shows that white matter, which connects and supports the cells in our brains, remodels itself when people become more physically active. In those who remain sedentary, on the other hand, white matter tends to fray and shrink.

The findings underscore the dynamism of our brains and how they constantly transform themselves — for better and worse — in response to how we live and move.

The idea that adult brains can be malleable is a fairly recent finding, in scientific terms. Until the late 1990s, most researchers believed human brains were physically fixed and inflexible after early childhood. We were born, it was thought, with most of the brain cells we would ever have and could not make more. In this scenario, the structure and function of our brains would only decline with age.

But science advanced, thankfully, and revised that gloomy forecast. Complex studies using specialized dyes to identify newborn cells indicated that some parts of our brains create neurons deep into adulthood, a process known as neurogenesis. Follow-up studies then established that exercise amplifies neurogenesis. When rodents run, for example, they pump out three or four times as many new brain cells as inactive animals, while in people, beginning a program of regular exercise leads to greater brain volume. In essence, this research shows, our brains retain lifelong plasticity, changing as we do, including in response to how we exercise.

These past studies of brain plasticity generally focused on gray matter, though, which contains the celebrated little gray cells, or neurons, that permit and create thoughts and memories. Less research has looked at white matter, the brain's wiring. Made up mostly of fat-wrapped nerve fibers known as axons, white matter connects neurons and is essential for brain health. But it can be fragile, thinning and developing small lesions as we age, dilapidations that can be precursors of cognitive decline. Worryingly, it also has been considered relatively static, with little plasticity, or ability to adapt much as our lives change.

But Agnieszka Burzynska, a professor of neuroscience and human development at Colorado State University in Fort Collins, suspected that science was underestimating white matter. "It's been like the ugly, neglected stepsister" of gray matter, she says, ignored and misjudged. She considered it likely that white matter possessed as much plasticity as its gray counterpart and could refashion itself, especially if people began to move.

So, for the new study, which was published online in June in NeuroImage, she and her graduate student Andrea Mendez Colmenares and other colleagues set out to make over people's white matter. They began by gathering almost 250 older men and women who were sedentary but otherwise healthy. At the lab, they tested these volunteers' current aerobic fitness and cognitive skills and also measured the health and function of their white matter, using a sophisticated form of M.R.I. brain scan.

Then they divided the volunteers into groups, one of which began a supervised program of stretching and balance training three times a week, to serve as an active control. Another started walking together three times a week, briskly, for about 40 minutes. And the final group took up dancing, meeting three times a week to learn and practice line dances and group choreography. All of the groups trained for six months, then returned to the lab to repeat the tests from the study's start.

And, for many, their bodies and brains had changed, the scientists found. The walkers and dancers were aerobically fitter, as expected. Even more important, their white matter seemed renewed. In the new scans, the nerve fibers in certain portions of their brains looked larger, and any tissue lesions had shrunk. These desirable alterations were most prevalent among the walkers, who also performed better on memory tests now. The dancers, in general, did not.

Meanwhile, the members of the control group, who had not exercised aerobically, showed declining white matter health after the six months, with greater thinning and tattering of their axons and falling cognitive scores.

For the exercisers, these findings "are very promising," Dr. Burzynska says. They tell us that white matter remains plastic and active, whatever our age, and a few brisk walks a week might be enough, she says, to burnish the tissue and slow or stave off memory decline.

Of course, the brain changes were subtle and somewhat inconsistent. Dr. Burzynska and her colleagues had expected, for instance, that dancing would produce greater white matter and cognitive improvements than walking, she says, since dancing entails more learning and practice. But walking was more potent, suggesting that aerobic exercise, by itself, matters most for white matter health. "The dancers spent some of their time each session watching the instructors and not moving much," Dr. Burzynska says. "That probably affected their results."

The study participants also were past 60, inactive and worked out for only six months. It remains unclear whether the brains of younger, fitter people would likewise benefit or if longer-term aerobic exercise might prompt larger improvements in memory and thinking. But, for now, Dr. Burzynska says, the results offer "a strong case for getting up and moving" for the sake of our white matter.