

BRAINS AND BRAWN

It has long been a cliché that muscle bulk doesn't equate to intelligence. In fact, most of the science to date about activity and brain health has focused on the role of endurance exercise in improving our brain functioning. Aerobic exercise causes a steep spike in blood movement to the brain, an action that some researchers have speculated might be necessary for the creation of new brain cells, or neurogenesis. Running and other forms of aerobic exercise have been shown, in mice and men, to lead to neurogenesis in those portions of the brain associated with memory and thinking, providing another compelling reason to get out at lunchtime and run.

Since weight training doesn't cause the same spike, few researchers have thought that it would have a similar effect. But recent studies intimate otherwise. Several studies involve animals. It's not easy, of course, to induce a mouse or a lab rat to lift weights, so the experimenters have to develop clever approximations of resistance training to see what impact adding muscle and strength has on an animal's brain. In a study presented at the annual meeting of the Society for Neuroscience in November, [researchers from Brazil](#) secured weights to the tails of a group of rats and had them climb a ladder five sessions a week. Other rats on the same schedule ran on a treadmill, and a third group just sat around. After eight weeks, the running rats had much higher levels of brain-derived neurotrophic factor (B.D.N.F.), a growth factor that is thought to help spark neurogenesis, than the sedentary rats. So did the rats with weights tied to their tails. The weight-bearing rats, like the runners, did well on tests of rodent learning and memory, like rapidly negotiating a water maze. Both endurance and weight training seemed to make the

rats smarter.

In somewhat similar fashion, [researchers from Japan](#) recently found that loading the running wheels of animals improved their brain functioning. A loaded running wheel is not strictly analogous to weight lifting; it's more similar in human terms to a stationary bicycle with the resistance dialed high — in this case, quite high, as the resistance equaled 30 percent of the rats' body weights in the last week of the monthlong study. By then, the rats on the loaded wheels could run barely half as far as a separate group of rats on unloaded wheels, but the rats on the loaded wheels had packed on muscle mass, unlike the other rats. The animals that were assigned to the loaded wheels showed significantly increased levels of gene activity and B.D.N.F. levels within their brains. The higher the workload the animals managed to complete, the greater the genetic activity within their brains.

This “study demonstrates for the first time that voluntary wheel running with a load increases a muscular adaptation and enhances gene expression” in the rat brain, said Min-Chul Lee, a researcher at the University of Tsukuba in Japan and lead author of the study, which was also presented at the annual meeting of the Society for Neuroscience. Even more striking, he added, his findings indicate that “this kind of exercise may have the identical or even more useful effects than endurance training (e.g., treadmill exercise) on the rat brain.”

Whether the same mechanisms occur in humans who undertake resistance training of one kind or another is not yet fully clear, but “the data look promising,” said Teresa Liu-Ambrose, a principal investigator at the Brain Research Center at the University of British

Columbia. In results from her lab, older women who lifted weights performed significantly better on various tests of cognitive functioning than women who completed toning classes. Ms. Liu-Ambrose has also done brain scans of people who lifted weights to determine whether neurogenesis is occurring in their brains, and the results, still unpublished, are encouraging, she said.

Just how resistance training initiates changes in cognition remains somewhat mysterious. Ms. Liu-Ambrose said that “we now know that resistance training has significant benefits on cardiovascular health” and reduces “cardiovascular risk factors,” which otherwise would raise “one’s risk of cognitive impairment.” She speculates that resistance training, by strengthening the heart, improves blood flow to the brain generally, which is associated with better cognitive function. Perhaps almost as important, she added, resistance training at first requires an upsurge in brain usage. You have to think about “proper form and learning the technique,” she said, “while there generally is less learning involved in aerobic training,” like running.

The brain benefits from being used, so that, in a neat circle, resistance training may both demand and create additional brain circuitry.

Imagine what someone like Einstein might have accomplished if he had occasionally gone to the gym