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How Exercise Makes Your Brain Grow

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By Dr. Mercola

Can exercise help boost your cognitive faculties? Researchers increasingly say the answer is a resounding yes. Recent research reveals that exercise promotes a process now known as *neurogenesis*, i.e. your brain's ability to adapt and grow new brain cells, regardless of your age.

As reported by *Forbes Magazine*:¹

"Not only has research discovered that we can foster new brain cell growth through exercise, but it may eventually be possible to 'bottle' that benefit in prescription medication.

The hippocampus, a brain area closely linked to learning and memory, is especially receptive to new neuron growth in response to endurance exercise. Exactly how and why this happens wasn't well understood until recently.

Research has discovered that exercise stimulates the production of a protein called FNDC5... Over time, FNDC5 stimulates the production of another protein in the brain called Brain Derived Neurotrophic Factor (BDNF), which in turn stimulates the growth of new nerves and synapses... and also preserves the survival of existing brain cells."

In essence, physical activity produces biochemical changes that strengthen and renew not only your body but also your brain—particularly areas associated with memory and learning.

Researchers Aim to Bottle Exercise Benefits...

Researchers at Harvard Medical School now believe they may be able to recreate the [benefits of exercise](#) by putting this protein, FNDC5, into a pill. Bruce Spiegelman, PhD, told *Forbes*:

"What is exciting is that a natural substance can be given in the bloodstream that can mimic some of the effects of endurance exercise on the brain."

They believe such a drug might be useful for those experiencing cognitive decline, including those with early-stage Alzheimer's and Parkinson's disease. So far, the hypothesis has only been tested on animals however.

In a recent study published in the journal *Cell*,² the researchers successfully increased BDNF in the brains of mice by piggybacking FNDC5 molecules on a virus. According to the authors:

"Perhaps the most exciting result overall is that peripheral delivery of FNDC5 with adenoviral vectors (i.e. a virus) is sufficient to induce central expression of BDNF and other genes with potential neuroprotective functions or those involved in learning and memory."

Personally, I don't believe you can fool your body in the long term. It's important to realize that while a pill may be able to mimic a specific biological effect that exercise produces, such as increasing production of a specific protein or chemical, it will never provide you with ALL the health effects exercise provides, which go far beyond any one specific effect.

Exercise has *countless* effects on your body -- not only on your muscle fibers and brain, but also on your immune system, your ability to fight [cancer](#) and much more. To "mimic" all of these benefits, you would literally need handfuls of different pills -- and even then they could never reproduce the *synergistic* benefits that exercise has on your body and mind.

For example, besides boosting memory and learning, regular exercise is also one of the "secret weapons" to overcoming [depression](#). It does this quite effectively by normalizing insulin resistance and boosting natural "feel good" hormones and neurotransmitters associated with mood control in your brain.

Earlier this summer, Princeton University researchers reported³ that physical exercise also helps you combat anxiety by making your brain more resilient during times of stress.

You Cannot Fool Your Body in the Long Run

While actual physical activity can offer you dozens of health benefits, a pill might only be able to recreate one at a time. Besides losing out on the synergistic benefits, taking a pill versus engaging in physical activity will also cost you financially and physically, as there might be unforeseen adverse side effects of the drug to contend with.

Story at-a-glance

- Recent research reveals that exercise promotes a process known as neurogenesis, i.e. your brain's ability to adapt and grow new brain cells, regardless of your age
- During exercise, nerve cells release proteins that stimulate the production of brain-derived neurotrophic factor or BDNF, which in turn helps preserve existing brain cells and stimulates the growth of new neurons
- There's compelling evidence showing that exercise produces large cognitive gains and helps fight dementia
- BDNF is also expressed in your neuro-muscular system where it helps protect against age-related muscle atrophy. So BDNF is actively involved in the preservation and rejuvenation of both your muscles and your brain
- Workouts using nothing but your own body weight are an efficient way to get fit. You can even fulfill the requirements for a high intensity exercise using nothing more than your own body weight, a chair, and a wall

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All in all, you're FAR better off just getting physically active. To get the most out of your workouts, I recommend a comprehensive program that includes [Peak Fitness high-intensity exercise](#), [strength training](#), stretching, and core work.

Non-exercise activity and movement is also critical for optimal health, as explained by [Dr. Joan Vernikos](#). Sitting for extended periods of time is actually an independent risk factor for poor health and premature death. Even if you exercise regularly and are fit, uninterrupted sitting for a great percentage of the time increases your risk of dying prematurely.

Simply standing up, a minimum of 30 times a day, is a powerful antidote to long periods of sitting and is, surprisingly enough, *more effective* than walking. The good news is that there are virtually unlimited opportunities for movement throughout the day, from doing housework or gardening, to cooking and even just standing up every 10 minutes.

Your Brain Health Is Directly Related to Exercise

That said, let's look at some of the beneficial effects exercise can have on your brain. According to John J. Ratey, a psychiatrist who wrote the book *Spark: The Revolutionary New Science of Exercise and the Brain*, there's overwhelming evidence that exercise produces large cognitive gains and helps fight dementia. Besides triggering the release of [BDNF](#), exercise also protects your brain by:

- Increasing production of nerve-protecting compounds
- Improving and increasing blood flow to your brain
- Improving development and survival of neurons
- Altering the way damaging proteins reside inside your brain, which appears to slow the development of [Alzheimer's disease](#). In animal studies, significantly fewer damaging plaques and fewer bits of beta-amyloid peptides, associated with Alzheimer's, were found in mice that exercised

Ideally, you'd want to make exercise a regular part of your life from as early on as possible. But it's never too late to start. Even seniors who take up a fitness regimen can improve their cognitive function.

For example, a team at the University of Edinburgh followed more than 600 people, starting at age 70, who kept detailed logs of their daily physical, mental and social habits. Three years later, their brains were imaged for age-related changes, such as brain shrinkage and damage to the white matter, which is considered the "wiring" of your brain's communication system. Not surprisingly, seniors who engaged in the most physical exercise showed the least amount of brain shrinkage.⁴

Similarly, Kirk Erickson, PhD of the University of Pittsburgh, found that adults aged 60 to 80 walking moderately (just 30 to 45 minutes, three days per week for one year) increased the volume of their [hippocampus](#) by two percent. The hippocampus is a region of your brain important for memory. Erickson told WebMD:⁵

"Generally in this age range, people are losing one to three percent per year of hippocampal volume. The changes in the size of the hippocampus were correlated with changes in the blood levels of the brain-derived neurotrophic factor (BDNF)."

Erickson also found higher fitness levels associated with a larger prefrontal cortex. He called exercise "one of the most promising nonpharmaceutical treatments to improve brain health." The most important message from studies like these is that mental decline is NOT inevitable! And exercise is as good for your brain as it is for the rest of your body.

Fasting Can Also Trigger Brain Rejuvenation

Growing evidence indicates that fasting and exercise trigger similar genes and growth factors that recycle and rejuvenate both your brain and muscle tissues. These growth factors include BDNF, as previously mentioned, as well as muscle regulatory factors, or MRFs. These growth factors signal brain stem cells and muscle satellite cells to convert into new neurons and new muscle cells respectively.

Interestingly enough, BDNF also expresses itself in the neuro-muscular system where it protects neuro-motors from degradation. (The neuromotor is the most critical element in your muscle. Without the neuromotor, your muscle is like an engine without ignition. Neuro-motor degradation is part of the process that explains age-related muscle atrophy.)

So BDNF is actively involved in both your muscles *and* your brain, and this cross-connection, if you will, appears to be a major part of the explanation for why a physical workout can have such a beneficial impact on your brain tissue. It, quite literally, helps prevent, and even reverse, brain decay as much as it prevents and reverses age-related muscle decay.

This also helps explain why *exercise while fasting* can help keep your brain, neuro-motors, and muscle fibers biologically young. For more information on how to incorporate [intermittent fasting](#) into your exercise routine for maximum benefits, please see this [previous article](#). *Sugar* suppresses BDNF, which also helps explain why a low-sugar diet in combination with regular exercise is so effective for protecting memory and staving off depression.

Almost Anyone Can Improve Their Fitness Without Joining a Gym

In related fitness news, forgoing expensive exercise equipment and focusing on pushing, pulling and lifting your own body weight is becoming a popular alternative that is suitable for most people, regardless of age or fitness level. According to Bret Contreras,⁶ author of *Bodyweight Strength Training Anatomy*:

"If more people knew you could get a good physique using your body as a bar bell, they could take matters into their own hands. Find things in the environment: a table to get underneath, hold on to the sides of and then pull the body upward; a rafter for a pull-up. To work your glutes (buttocks muscles), all you need is a couch. It doesn't have to be intimidating. You could do a 20-minute workout three times a week and have an incredible physique, so long as you push hard and keep challenging yourself."

Adaptability is a major benefit of [body weight exercises](#): It's adjustable to almost anyone, from the least fit to the professional athlete. Just learn the basics and try different approaches until you find what works best for you. In the video below, Jill Rodriguez, one of the personal trainers at Mercola.com, demonstrates some basic body weight exercises, and how to add levels of difficulty as you go along.

You can do these exercises just about anywhere... at home, outdoors, or in a gym. You can even fulfill the requirements for a *high intensity* exercise using nothing more than your own body weight, a chair, and a wall! This program is described in my previous article, "[The Scientific 7-Minute Workout](#)." As the title implies, this science-backed routine only requires a seven minute investment, as the program calls for as little as 10- to 15-seconds of rest between each 30-second exercise, which should be performed in rapid succession.

Need a Portable Fitness Routine? There's an App for That...

In today's world, you have plenty of technological allies in fitness. With prices ranging from free to \$3.99, a previous article brings you information about six [bodyweight apps](#) for your iPad or phone. One helps you work out your own customized workout for your skill and fitness level. Another can keep you body challenged. Other non-bodyweight training apps help you track your progress in jogging or running, keep track of your workouts, or calculate heart rate with a range of tools to keep you on track. These apps let you bring your own personal trainer along on every workout, no matter where you are.

For Total Body-Mind Health, Adopt a Well-Rounded Fitness Program

Ideally, you'll want to strive for a varied and well-rounded fitness program that incorporates a wide variety of exercises. As a general rule, as soon as an exercise becomes easy to complete, you need to increase the intensity and/or try another exercise to keep challenging your body.

Additionally, as I mentioned earlier, more recent research has really turned the spotlight on the importance of *non-exercise* movement. Truly, the key to health is to remain as active as you can, all day long, but that doesn't mean you train like an athlete for hours a day. It simply means, whenever you have a chance to move and stretch your body in the course of going about your day—*do it!*

And the more frequently, the better. Everything from standing up, to reaching for an item on a tall shelf, to weeding in your garden and walking from one room to another, and even doing dishes count. In short, it's *physical movement*, period, that promotes health benefits by the interaction your body gets with gravity. To learn more about this important aspect of health, please see this previous [article](#). That said, I recommend incorporating the following types of exercise into your program:

1. **Interval (Anaerobic) Training:** This is when you alternate short bursts of high-intensity exercise with gentle recovery periods.
2. **Strength Training:** Rounding out your exercise program with a 1-set strength training routine will ensure that you're really optimizing the possible health benefits of a regular exercise program. You can also "up" the intensity by slowing it down. For more information about using [super slow weight training](#) as a form of high intensity interval exercise, please see my interview with Dr. [Doug McGuff](#).
3. **Stand Up Every 10 Minutes.** This is not intuitively obvious but emerging evidence clearly shows that even highly fit people who exceed the expert exercise recommendations are headed for premature death if they sit for long periods of time. My interview with NASA scientist [Dr. Joan Vernikos](#) goes into great detail why this is so, and what you can do about it. Personally, I usually set my timer for 10 minutes while sitting, and then stand up and do one legged [squats](#), jump squats or lunges when the timer goes off. The key is that you need to be moving all day long, even in non-exercise activities.
4. **Core Exercises:** Your body has 29 core muscles located mostly in your back, abdomen and pelvis. This group of muscles provides the foundation for movement throughout your entire body, and strengthening them can help protect and support your back, make your spine and body less prone to injury and help you gain greater balance and stability.

[Foundation Training](#), created by Dr. Eric Goodman, is an integral first step of a larger program he calls "Modern Moveology," which consists of a catalog of exercises. Postural exercises such as those taught in Foundation Training are critical not just for properly supporting your frame during daily activities, they also retrain your body so you can safely perform high-intensity exercises without risking injury.

Exercise programs like Pilates and yoga are also great for strengthening your core muscles, as are specific exercises you can learn from a personal trainer.

5. **Stretching:** My favorite type of stretching is active isolated stretches developed by Aaron Mattes. With Active Isolated Stretching, you hold each stretch for only two seconds, which works with your body's natural physiological makeup to improve circulation and increase the elasticity of muscle joints. This technique also allows your body to repair itself and prepare for daily activity. You can also use devices like the [Power Plate](#) to help you stretch.

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