

How Does Exercise Affect the Brain?

Recent neuroscience reports have shed new light on this basic question, revealing some intriguing facts about how exercise affects the brain. "It's sort of surprising to think about," says Carl W. Cotman, PhD, neurobiologist at University of California-Irvine and a Dana Alliance member. "You're literally building the structure of the brain, just by moving your feet."

Regular exercise helps your brain by...

- *Improving concentration and attention:* Brain imaging studies show that highly-fit older adults have faster reaction times—an indication of better concentration—than their less-fit counterparts. They also are better able to focus on relevant information and ignore irrelevant cues, indicating better attention.
- *Reducing gray matter loss:* Highly fit people also show less of a decrease in gray matter in the cortex than is normally seen with aging, which may suggest a protective effect of exercise against nerve cell death. This effect is most pronounced in areas of the brain involved in executive cognition that typically decline most with aging.
- *Promoting neurogenesis:* Neurogenesis is the production of new nerve cells as a result of neuronal cell division. Laboratory animals that are allowed to voluntarily run on an exercise wheel show increases in the generation and survival of new neurons (brain cells) in the hippocampus (the area of the brain involved in short term memory). This increased neurogenesis is associated with improved learning.
- *Strengthening synapses:* In animals, running also increases the strength of synaptic connections. This occurs through the same molecular mechanism that is believed to underlie long-term memory formation.
- *Changing gene patterns:* Exercise induces changes in the expression patterns of a wide array of genes, with some becoming more active and some showing less activity. Many of the genes that become more active are known to play roles in the structure and adaptability of synapses, suggesting a direct role for exercise in synapse density.
- *Increasing growth factors:* Growth factors are molecules that promote the health of specific cells; they are produced by cells other than the ones they nourish. Nerve growth factors (neurotrophins) play vital roles in nourishing and supporting nerve cells. A growth factor called BDNF (for brain-derived neurotrophic factor) increases significantly in the brains of animals that run voluntarily. Separate studies show that when people with depression exercise in addition to taking antidepressants, their BDNF levels go up and their depression symptoms decrease.
- *Enhancing blood flow:* Exercise also increases the density and size of brain capillaries, which has the effect of increasing blood flow and oxygen to the brain. This may in turn help support the survival of new neurons and facilitate faster "firing" by neurons.

What can regular exercise do for you? It can...

- Increase self-esteem and self-confidence
- Reduce anxiety and stress
- Improve mood
- Improve sleep
- Increase energy
- Decrease the risk of heart disease and help prevent risk factors such as obesity and high blood pressure
- Reduce body fat by increasing the body's calorie burning efficiency
- Slow the rate of bone loss with age
- Enable the body to use insulin more efficiently
- Lower the risk of certain cancers, including cancers of the breast, uterus, and colon
- Improve cardiovascular health
- Help control weight and prevent obesity