Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Beginning in infancy, exercise helps the brain as much as the body**

By Chicago Tribune, adapted by Newsela staff

Published: 09/30/2015

Exercising can allow people to lose weight, become stronger and live longer. Surprisingly, though, the greatest benefits may be to the brain.

Physical fitness directly affects our minds and plays a key role in the way the brain develops and functions. Moreover, exercise is linked to brain changes throughout all stages of life, beginning in infancy and lasting through old age.

**The Earlier Exercise Begins, The Better**

Babies, for example, need regular exercise to form connections in the brain, and in children, research suggests that exercise improves attention, focus and academic performance. In the elderly, exercise has been shown to help slow memory loss.

Lise Eliot is a neuroscientist who writes about the benefits of movement on the brain in her book “Pink Brain, Blue Brain.” She points out that exercise affects body and brain alike. “The brain benefits as much as the heart and other muscles from physical activity,” she said.

“We’ve found exercise has broad benefits," said researcher Charles Hillman, a professor at the University of Illinois at Urbana-Champaign. These benefits include "improvements in attention, working memory and the ability to multitask.” Hillman also said that exercising during childhood may have protective effects on brain health across the life span.

**Fertilizer For The Brain**

How does exercise help the brain?

In the mid-1990s, Carl Cotman’s team at the University of California-Irvine first showed that exercise triggers the production of brain-derived neurotrophic factor, or BDNF. BDNF is a protein that helps support the growth of existing brain cells and the development of new ones.

As people get older, BDNF levels fall, and this decline is one reason brain function deteriorates in the elderly, according to Cotman. Certain types of exercise are thought to counteract these age-related drops in BDNF.

“In a sense, BDNF is like a brain fertilizer,” said Cotman, founding director of the Institute for Memory Impairments and Neurological Disorders (UCI Mind). “BDNF protects neurons from injury and facilitates learning.”

**Blood Flow And Brain Function**

Over the last two decades, researchers have learned that exercise acts on multiple levels in the brain.

The brain is made up of cells called neurons, which are connected to each other by links called synapses. As we age, the synapses are lost or break down. Cotman’s work has shown that in older rodents, exercise increases the number of synapses and stimulates the brain to develop more neurons.

Exercise also increases the release of neurotransmitters, chemicals that relay signals between neurons, said Romain Meeusen, a researcher at the University of Brussels. “This could be one of the mechanisms of the anti-depressive effect of exercise,” he said. Exercise not only improves mental function, but also can improve mood.

Research also suggests that exercise improves blood flow to the brain. “The blood carries oxygen and feeds neural tissues, so you’re getting the benefits that come with that,” Hillman said. Increasing blood flow is one more way that exercise can improve brain function.

**Exercise In Life's Three Key Stages**

The positive effects of exercise on the brain can be seen during three key stages of life: infancy, pre-adolescence and adulthood.

**Infancy**

Exercise is healthy for the brain even at a very young age. Mobile children hit their cognitive milestones faster, said Eliot.

Infants are in near-constant motion, which is extremely important for development, she said. This movement “strengthens their muscles and hones their neural circuits for smooth, purposeful motor skills.”

The process continues throughout life but is most intense in infancy and toddlerhood, when children are mastering brand-new skills like sitting, standing, walking, running and jumping.

Eliot worries that babies in the United States are spending too much time strapped in devices. Because of how important exercise is to a young developing brain, it is urgent that infants be allowed to be physically active.

**Pre-adolescence**

Exercise is also healthy for pre-adolescent brains. In fact, some research suggests that regular exercise can improve academic performance. Hillman’s team found that children ages 7 through 9 who participated in a 60-minute after-school exercise program had better focus, processed information more quickly and performed better on cognitive tests than children who didn’t exercise. The more days the children attended the exercise program, the greater the changes in their brain function or cognition.

Finally, exercise improves brain function for adults. Sadly, the hippocampus, a key region of the brain, naturally shrinks in late adulthood. The hippocampus is involved in memory and learning, and as it shrinks, adults' memory becomes worse.

**Adulthood**

Research suggests exercise can increase the size of the hippocampus and increase levels of a protein that helps to grow new brain cells, potentially holding off changes in the brain and improving memory function.

Researchers from the University of Wisconsin School of Medicine and Public Health also found that people who said they exercised for 30 minutes five times a week in late-middle age did better on cognitive tests.

Additionally, adults who exercised showed less accumulation of the beta amyloid plaque. The beta amyloid plaque is a protein that builds up in the brains of people with Alzheimer’s disease. Alzheimer's is a disease that mostly affects older adults and is marked by the loss of memory and mental function.

At all ages, active people did better on immediate memory and visual spatial tests and had larger hippocampi compared with inactive people.

**Questions:**

* **Using evidence from the text, explain the benefits of exercise.**
* **Using evidence from the text, explain how exercise affects the brain.**
* **What is the benefit of increased blood flow to the brain?**
* **Using evidence from the text, explain how exercise affects the brain during infancy.**
* **Using evidence from the text, explain how exercise affects the brain during pre-adolescence.**
* **Using evidence from the text, explain how exercise affects the brain during adulthood.**