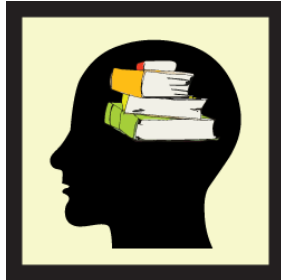


# Insights from Spark by John Ratey MD

***“Right now the front of your brain is firing signals about what you’re reading, and how much of it you soak up has a lot to do with whether there is a proper balance of neurochemicals and growth factors to bind neurons together. Exercise has a documented, dramatic effect on these essential ingredients.” - John Ratey MD***

## Exercise accelerates learning



When you exercise, your body naturally releases a protein called ‘brain-derived neurotrophic factor (BDNF)’ into the bloodstream and up to the brain. In the 1990s, scientists discovered BDNF rapidly accelerates brain cell growth and increases the ability to learn.

***“Researchers found that if they sprinkled BDNF onto neurons in a petri dish, the cells automatically sprouted new branches, producing the same structural growth required for learning—and causing me to think of BDNF as Miracle-Gro for the brain... BDNF gathers in reserve pools near the synapses and is unleashed when we get our blood pumping.” - John Ratey MD***

***“Exercise sparks the master molecule of the learning process” - John Ratey MD***

## Exercise enhances creativity



During exercise, the hippocampus brain region receives a large amount of BDNF growth factor. The hippocampus acts like a cartographer for the brain - linking new information to existing memories.

***“A memory, scientists believe, is a collection of information fragments dispersed throughout the brain. The hippocampus serves as a way station, receiving the fragments from the cortex, and then bundling them together and sending them back up as a map of a unique new pattern of connections.” - John Ratey MD***

Exercise sparks growth in the hippocampus, helping you create new connections between existing ideas and allowing you to come up with novel solutions to complex problems.

***“If you have an important afternoon brainstorming session scheduled, going for a short, intense run during lunchtime is a smart idea.” - John Ratey MD***

## What’s the most ‘productive’ way to exercise?

Largest cognitive benefits in the least amount time, done sustainably

### Type:

The most effective form of exercise for increasing mental performance is aerobic exercise (also known as cardio). Aerobic exercise includes any activity that pushes your heart and lungs for a sustained period. Examples include running, biking, and swimming. Although weight training is essential for physical health, it won’t provide the cognitive benefits aerobic exercise does.

### Timing:

Schedule your aerobic exercise before learning a difficult subject, tackling a complex project, or conducting a brainstorming.

### Duration:

Exercise for 20-30 minutes with at sustained heart rate of 60-70% of your maximum heart rate ( $\text{max heart rate} = 208 - (0.7) \times \text{current age}$ ). If you exceed 70% of your maximum heart rate, you’ll start burning reserve fuel (glycogen) and releasing large amounts of lactic acid, which breaks down muscle. The more time you spend above 70% of your maximum heart rate, the more recovery time you’ll need between exercises, and the less often you’ll reap the cognitive benefits of exercise. If you don’t have a heart rate monitor, don’t worry. Iowa State University kinesiologist Panteleimon Ekkekakis has found moving at a pace which feels “somewhat hard” is a good indication you are exercising near 70% of your maximum heart rate.

You experience the largest mental gains when you combine aerobic exercise with an activity that requires advanced motor skills:

***“Choose a sport that simultaneously taxes the cardiovascular system and the brain—tennis is a good example—or do a ten-minute aerobic warm-up before something nonaerobic and skill-based, such as rock climbing or balance drills. While aerobic exercise elevates neurotransmitters, creates new blood vessels that pipe in growth factors, and spawns new cells, complex activities put all that material to use by strengthening and expanding networks. The more complex the movements, the more complex the synaptic connections.” - John Ratey MD***

***“In order for man to succeed in life, God provided him with two means, education and physical activity. Not separately, one for the soul and the other for the body, but for the two together. With these two means, man can attain perfection.” - Plato***