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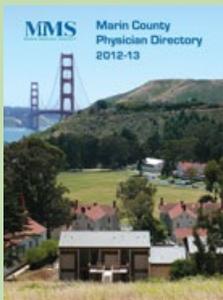
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### CURRENT BOOKS

## Exercise makes us smarter!

Peter Bretan Jr., MD



**Spark: The Revolutionary New Science of Exercise and the Brain**, by John Ratey, MD, with Eric Hagerman, 304 pages, Little, Brown, \$25.

I always knew that exercise made me feel better, but after reading *Spark* I can share with you scientific evidence that it also made me smarter. I always thought that it was just my morning jog that helped kick-start my days since my youth. I also believed that the discipline of exercise helped me train my brain to do what it did not naturally want to do, such as spending hours reading about subjects that really did not interest me. I did not expect that the biomechanics of movement, when repeated to the point of sustained physiologic discomfort, could actually stimulate neuronal development.

This last aspect of exercise is the premise of *Spark*, a book by Dr. John Ratey, an associate clinical professor of psychiatry at Harvard Medical School. He has written more than 60 journal papers on psychiatry and psychopharmacology, along with the bestselling 2001 book, *A User's Guide to the Brain*, which explains how neuroscience affects emotions, behavior and overall psychology.

Ratey opens *Spark* with a quote from Plato: "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." From there Ratey begins to lay out the strong scientific foundation for his thesis: that exercise has a profound impact on cognitive abilities and mental health. Citing Duke University's 2000 study that exercise is better than sertraline (Zoloft) in treating depression, Ratey feels that exercise is not just a simple therapeutic option, but one of the best treatments we have for most psychiatric problems.

Ratey cites many excellent references to support his theories. For example, a study published in the *Journal of Applied Physiology* in 2002 article examined our ancestral patterns of physical activity (termed "Paleolithic rhythms"), which were established as part of our genetic hardware more than two million years ago. The study showed that we expend 38% less energy per unit BMI compared to our Stone Age ancestors. Paleolithic man walked almost 10 miles a day just to eat.

Darwinian evolution dictates that stresses that don't kill you make you stronger. Ratey summarizes our biologic rhythm with: "Regular aerobic activity calms the body, so that it can handle more stress before the serious response involving heart rate and stress hormones kicks in. It raises the trigger point of the physical reaction. In the brain, the mild stress of exercise fortifies the infrastructure of our nerves cells by activating genes to produce certain proteins that protect the cells against damage and disease."

Ratey describes the lack of physical activity in our high schools, noting that the average American student spends 5.5 hours per day in front of a screen of some sort, such as a television, computer, or handheld device. He comments on the failings of our traditional gym classes to counteract this sedentary culture, observing that less than 3% of adults over the age of 24 stay in shape through playing team sports.

Ratey shows that exercise not only counteracts our cultural lack of adequate physical activity, but also makes the brain more efficient. The strongest support for Ratey's thesis comes from the California Dept. of Education, which has consistently shown that students

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with higher fitness scores also have higher test scores.

Physical-fitness programs such as swimming and square dancing also serve as a social lubricant, according to Ratey. If everyone feels self-conscious, then such programs offer a level playing field for all, and it becomes more palatable for students to take on an awkward but apparently beneficial activity. Corporations use this technique in bringing different personalities to work for the good of a team. Ratey makes the case for establishing exercise as a more integral part of all educational systems, or it is a lost opportunity for society in general, especially in the lower-income groups.

**Ratey** also reviews the molecular neurotransmitters of the brain: gamma-amino butyric acid (GABA), glutamate, serotonin, norepinephrine and dopamine. About 80% of the signaling in the brain is carried out by the balance of glutamate and GABA. Glutamate stimulates neuronal activity, while GABA inhibits it. Serotonin helps modify runaway brain activity that can lead to depression, anxiety and obsessive-compulsiveness. Norepinephrine often amplifies signals that influence attention, perception, motivation and arousal. Dopamine is the learning, reward, attention and movement neurotransmitter. Exercise, says Ratey, balances these neurotransmitters by increasing brain-derived neurotrophic factor (BDNF), which nourishes neurons like fertilizer. He reviews numerous clinical and animal studies that support the link between exercise, increased BDNF brain level, and increased learning capabilities.

According to Ratey, exercise works in everyday life to alleviate anxiety, both for the brain and body. It provides distraction, reduces muscle tension, builds brain resources, teaches a different outcome, reroutes neuronal circuits, improves resilience, and sets one free. At high intensity (75-90% of maximum heart rate), the body enters into anaerobic range. Here the pituitary gland releases human growth hormone (HGH). Ratey describes HGH as the "body's master craftsman." It helps burn belly fat by layering on muscle fibers, balances neurotransmitter levels, and boosts production of beneficial growth factors. Most important, HGH "pumps up brain volume," meaning that high-intensity exercise can reverse loss of brain volume that naturally occurs with aging, says Ratey. HGH normally stays in the bloodstream only a few minutes, but a session of sprinting can keep the levels elevated for up to four hours.

Finally, Ratey offers a prescription for how much exercise people need. There is no firm answer, but the general guideline is about 30 minutes of moderate aerobic activity per day or three hours per week.

I am a lifelong aficionado of exercise, and this book validates all the intuitive reasons I have had for my daily (almost religious) routine, which helps me prepare for the sedentary but stressful life of a surgeon. If you are in the mainstream of not-so-compulsive exercisers, this book will give you scientific and medical reasons to start living smarter, with less depression and anxiety ... a great investment for both your brain and your body, as well as for public health.

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