# Reading the Mind and Jogging the Brain

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A fondness for reading, if properly directed, can be an education in itself. In 2012, neurobiologists at Stanford Univ. asked subjects to read passages from a novel while inside MRI machines, and examined the blood flow in their brains. The findings showed that any sort of reading, even if it is just fiction or leisure reading, is good for the brain, it increases blood flow to the brain. When the subjects were asked to read the book critically (like one would do for an exam.), the blood flow increased beyond executive function regions (the parts of the brain responsible for problem solving).

Reading, as it turns out, is like a workout for the brain. The brain is like a muscle; the less it is used, the more it atrophies. If we reduce reading, the connectivity in our network of neurons in the brain (neuron is the smallest thinking unit in the brain) reduces. Keeping the brain active, helps in growth of new brain cells, irrespective of age. A study, published in the year 2014 in the journal Neurology, suggests that people who read, write, and engage in mentally stimulating activities preserve memories at a rate at least 32% higher than those who do not-and more importantly, are more likely to avoid dementia. In science-speak, exercising the brain with mentally stimulating tasks helps build new neuronetic connections, which makes it harder for the plaques and tangles of Alzheimer's disease to take hold and cause memory loss.

If one is in an appreciating mode while reading, both hemispheres of the brain (one half attending to emotions and feelings and the other half attending to cold logic, number crunching and analytics) het involved in the learning process and thus learning happens with greater profundity as well as creativity and retention are improved. Diversifying one's perspectives too can help boost intelligence and creativity. On the other hand, a belief around fixed limits (for instance believing "I cannot top in the examination") or fixedness of views (except of course, 'values' which need to be relatively fixed in order to give sane axioms for societal & personal stability) stifles intelligence and creativity, while a belief, in continuous capacity to grow, stimulates creativity.

Scientists at the University of Liverpool monitored the brain activities of those put to read serious literature, both in their original, tough and challenging form as well as in their easier and modern translation. The results: the more challenging original books "set the brain into more electrical activity than the pedestrian versions". And more electrical activity means greater creation and retention.

In 2004, evolutionary biologists Daniel E. Lieberman of Harvard Univ. and Dennis M. Bramble of the University of Utah published a seminal article in the journal *Nature* titled "Endurance Running and the Evolution of Homo" in which they posited interesting findings and observations. The data about brain size and endurance capacity in mammals like dogs, guinea pigs, foxes, mice, wolves, rats, civet cats, antelopes, elands, mongoose and goats was compared with that for humans. A notable pattern was that species like dogs and rats that have a high innate endurance capacity also had larger brain volumes relative to their body size, while humans have a brain that is about three times larger, given our species' body size in comparison with that of other mammals.

Scientists have discovered that exercise builds a brain that resists physical shrinkage and enhances ***cognitive flexibility.*** The latest neuroscience suggests that exercise does more to bolster thinking than even thinking does.

Why would exercise build brainpower in ways that thinking might not? The brain, like all muscles and organs, is a tissue, and its function declines with underuse and age. Beginning in our late 20s, most of us will lose about 1% annually of the volume of the hippocampus, a key portion of the brain related to memory and certain types of learning.

Just how exercise remakes minds on a molecular level is not yet fully understood, but research suggests that exercise prompts increase in brain-derived neurotropic factor (BDNF), a substance that strengthens cells and axons, fortifies the connections among neurons and sparks neurogenesis. After workouts, most people display higher BDNF levels in their blood streams.

Whatever the activity, an emerging message from the recent science is that exercise need not be exhausting or strenuous to be effective for the brain. When a group of 120 older men and women were assigned to walking or stretching programmes for a major 2011 study, the walkers wound up with larger hippocampuses after a year. Meanwhile the stretchers lost volume to normal atrophy. The walkers also displayed higher levels of BDNF in their blood streams than the stretching group and performed better on cognitive tests.

The most concrete evidence comes from experiments on Lab animals by Rhodes at Beckman Institute for Advanced Science & Technology at The University of Illinois that put groups of mice into four distinct living arrangements.

One group lived in a world of sensual & gustatory plenty, dining on nuts, fruits, cheese, etc. Balls, plastic tunnels, nibble-able blocks, mirrors and seesaws filled other parts of the cage. Group-2 had access to all of these pleasures, plus they had small disc shaped running wheels in their cages. The third group's cages held no embellishments, and they received standard, dull kibble. And the fourth group's home contained the running wheels but no other toys or special treats.

All groups of mice completed a series of cognitive tests at the start of the study. Then they ran, played or, if their environment was un-enriched, lolled about in their cages for several months.

At the end of the study, Rhodes's research team found that the toys and tastes, no matter how stimulating, had not improved the animals' brains. Only one thing mattered and that's whether they had a running wheel. Animals that exercised, whether or not they had any other enrichments in their cages, had healthier brains & performed significantly better on cognitive tests than the other mice. Animals that didn't run, no matter how enriched their world was otherwise, did not become more intelligent.

Although scientists thought until recently that humans were born with a certain number of brain cells and would never generate more, yet they now know better. In the 1990's, using a sophisticated technique that marks newborn cells (the subjects were injected with a substance that marks newborn cells in the brain, thus the workings of individual neurons and the make-up of brain matter itself can be examined), researchers determined during autopsies that adult human brains contained quite a few 'new' neurons. Fresh cells were especially prevalent in the hippocampus, indicating that neurogenesis-or the creation of new cells-was primarily occurring there.

Even more heartening, scientists found that exercise jump starts neurogenesis. It was found that mice and rats that ran for a few weeks generally had about twice as many ‘new’ neurons in their hippocampi as had the sedentary animals. Their brains, like other muscles, were bulking up.

However, it was the ineffable effect that exercise had on the functioning of the’newly formed’ neurons that was most startling. Brain cells can improve intellect only if they join the existing neural network, and many do not, instead rattle aimlessly around in the brain for a while before dying.

One way to pull neurons into the network, however, is to learn something. In a 2007 study, new brain cells in mice became looped into the animals’ neural networks if the mice learned to navigate a water maze, a task that is cognitively but not physically taxing. However, these brain cells were very limited in what they could do. When the researchers studies brain activity afterwards, they found that the newly wired cells fired only when the animals navigated the maze again, not when they practiced other cognitive tasks. The learning encoded in those cells thus did not transfer to other types of rodent thinking.

Exercise, on the other hand, seems to make neurons nimble. When researchers in a separate study had mice run, the animals’ brain readily wired many new neurons into the neural network. However, very significantly, those neurons didn’t fire later only during running, they also lighted up when the animals practiced cognitive skills, like exploring unfamiliar environments. Thus, in the mice, running, unlike learning, had created brain cells but also found that it shuts them down when they shouldn’t be in action. For quite some time, scientists studying exercise were puzzled by physical activity’s two seemingly incompatible effects on the brain. On the one hand, exercise is known to prompt the creation of new and very excitable brain cells. At the same time, exercise also induces an overall pattern of calm in certain parts of the brain.

Most of us probably do not realize that neurons are born with certain predispositions. Some, often the younger ones, are by nature easily excited. They fire with almost any provocation, which is laudable (and desirable) if one wishes to speed one’s thinking and memory formation. However, this feature is less desirable during times of everyday stress. If a stressor doesn’t involve a life-or-death decision, however it requires considered action, then having lots of excitable neurons firing all at once can be counterproductive, inducing anxiety.

Studies in animals had shown that physical exercise creates excitable neurons in abundance, especially in the hippocampus, a portion of the brain involved in thinking and emotional responses. However, exercise has also been found to reduce anxiety in humans and animals. Exercise has long been thought to be an effective cure for anxiety and depression, however, the brain mechanism behind the phenomenon had remained a mystery. The Princeton University researchers wondered how physical activity can simultaneously create ideal neurological conditions for anxiety and nimbleness as well as leave the practitioners (of physical activity) with a deep-rooted calm.

To address this issue with finality, they gathered adult mice, injected them with a substance that marks newborn cells in the brain, and for six weeks, allowed half of them to run at will on little wheels, while the others sat quietly in their cages. Later, the researchers determined each group’s baseline nervousness. If access was allowed to cages with open well-lighted areas, the running mice were more willing (although cautiously) to explore and spend time in open areas-an indication of their more confidence and less anxiety-than the sedentary animals. The researchers also checked the brains of some of the runners and the sedentary mice to figure out how many and what varieties of new neurons they contained. The startling revelation was that the runners had in their brains not only greater number of nimble neurons (responsible for speedier thinking) but also nanny neurons designed to shush and quiet activity in the brain.