

Selected Robust Findings from the (Neuro)Science of Learning

learning: a change in the neuron patterns of the brain; the creation of new neurological material and/or their connections

your brain needs the following to learn effectively:

1. hydration

- a. neurons store water in vacuoles
- b. the brain needs water to produce hormones and neurotransmitters
- c. water is necessary for nerve transmission (which uses 1/2 of all the brain's energy)
- d. dehydration can impair short-term memory function and the recall of long-term memory

2. diet/glucose

- a. diets high in saturated fat increase the risk of neurological dysfunction
- b. a high-fat, refined sugar diet reduces neuronal plasticity and brain-derived neurotrophic factor (BDNF)—which stimulates the growth of new nerve cells and synapses
- c. glucose enhances learning; since neurons cannot store glucose, they depend on the bloodstream for a constant supply
- d. good foods for glucose: grains, legumes, fruits, and vegetables

3. exercise

- a. our brains function optimally with regular physical activity
- b. exercise enhances your memory and ability to learn
 1. exercise stimulates the production of a protein called FNDC5
 2. FNDC5 stimulates the production of BDNF, which stimulates the growth of new nerve cells and synapses, improves overall brain health, and makes brain cells more resilient
- c. regular exercise reduces stress, which otherwise erodes neural connections

4. sleep

- a. cerebrospinal fluid flushes neurotoxins out of the brain through the spinal column
- b. electrical impulses shift memories from the hippocampus (which has limited storage space) to the prefrontal cortex, freeing up the hippocampus for new learning the next day
- c. cortical cells repeatedly fire, facilitating the formation of long-term memories
- d. getting less than 6 hours of sleep greatly reduces these processes
- e. sleeping immediately after learning something new is beneficial for your memory

5. oxygen

- a. your brain demands a largely disproportionate share of your body's total oxygen consumption
- b. oxygen delivery and blood flow to the brain is essential for learning
- c. physical activity increases blood flow (and oxygen) to the brain

Key References

- Brown, Peter C., Henry L. Roediger III, and Mark A. McDaniel. 2014. *Make It Stick: The Science of Successful Learning*. Cambridge, MA: Belknap Press.
- Doyle, Terry, and Todd Zakraisek. 2013. *The New Science of Learning: How to Learn in Harmony with Your Brain*. Sterling, VA: Stylus Press.