Learning to Learn

The Neuroscience of Affective Learning

Written by Emma Barnard
Illustrated by Sam Kennedy

Understanding the neural basis of how we learn can have great academic benefits. You may have tried different methods like old-school flashcards, study groups, or even the fancier Feynman method. All of our brains learn and process differently; however, there are general neuroscientific and psychological guidelines that can help take our study skills to the next level. To study most effectively, it is important to have a baseline understanding of how learning and memory work from a neuroscientific perspective.

Our brains are made up of billions of cells called neurons. Seeing, smelling, and reacting to outside stimuli — even our thoughts can be boiled down to these microscopic cells making up our brain. Neurons communicate with each other by sending chemical and electrical signals. These chemical messengers, neurotransmitters, are the most important messengers for learning and memory.

The process of learning has to do with "changes in the strength and number of connections between existing neurons," a phenomenon that is referred to as synaptic plasticity. As you gain experiences, your brain rewires itself to accommodate them. Memories are connections between neurons in the brain, and neural or synaptic connections are the messages sent between neurons. A common neuroscientific saying, "Neurons that fire together wire together," means that multiple neural connections can create a synaptic network made up of messages sent between individual neurons. Memories that are similar in content will be wired closer together in the brain. Think of it as a mind map — topics that have closer associations will have closer neural connections and consequently be encoded closer in neural networks. More neurons firing together creates stronger memories. Just like working out a muscle, these synaptic connections need to be strengthened and multiplied over time

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Now that you have a basic understanding of how the brain learns, you can harness this knowledge to improve your studying skills, your exam scores, and your grade point average (GPA).
Some important aspects of studying and acquiring information are motivation and reinforcement. Dopamine, a neurotransmitter associated with the feeling of pleasure, becomes important, as it is a fundamental aspect of our reward system. Think of scrolling through TikTok and getting a burst of dopamine each time you see a new video. We can try to simulate these dopamine hits while doing something a little bit more productive, like homework or studying. One way of doing this is utilizing Pavlovian conditioning; in other words, training yourself. For example, while doing a reading, eat a piece of chocolate or take ten minutes to exercise after you finish a chapter. Platforms like Duolingo and Quizlet already do this by sending "Good Job" messages or bursts of confetti for correct answers and study streaks. By taking that break, eating that chocolate, or getting that confetti, you are experiencing something positive that causes dopamine to release o in your brain, making you feel good. This process teaches your brain to associate studying with positive feelings. The more you do it, the more you will be motivated to pick up a book to read and get that reward. Once the brain's association of studying and reward is strong enough, the reward of chocolate or a break is no longer needed; studying alone will stimulate dopamine release. If academic validation is not enough, try some hits of dopamine.
Once you have the motivation to study, you will want to make sure that you are using your time well. No one wants to waste time studying if the information will not stick. When you are studying, you will want to make connections to other topics you are learning and already know, adding to and strengthening those synaptic networks. That way, if you are lost during an exam and struggling to recall information, you can think of something similar, going from there to remember the answer. Some common techniques using this idea of creating associations are mnemonics, concept maps, and actively connecting material to past concepts. These patterns of letters and prompts are very helpful in facilitating connections and strengthening synaptic networks. Similarly, chewing certain gums, wearing a specific perfume, or even playing with the same fidget toy while both studying and taking an exam will also add to the synaptic network and help prompt recall.

Strengthening recall and synaptic networks takes time. It is an academic right of passage to cram information at one point in your collegiate career; however, it is impossible to commit information to long-term memory doing that. You cannot create strong neural connections overnight. Just like you would practice your tennis serve over and over, you need to practice your recall. Your brain has remarkable plasticity, so you need to consistently go over concepts to create synaptic networks. If you only have one night, try some of these techniques to make the most of the time.
While we all have brains, we all create unique connections and networks. A technique that works for a friend might not work for you, so the best advice is to experiment. Try different techniques and use the basic neuroscientific concepts outlined to create your study plan. The neuroscientific process of learning is the same for everyone, so it is a matter of figuring out how to best stimulate this process for yourself. • • •