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Mnemonic Mechanisms for Making Memories

Thayne L. Sweeten
Utah State University Brigham City

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By Thayne Sweeten, Ph.D.
Utah State University

Abstract

In many classes, students are faced with the daunting task of remembering a lot of terms or structures in a relatively short period of time. Though there is much to memorize, students may not be aware of the many mnemonic mechanisms that can help them make quick and lasting memories. This article describes three such mechanisms: word associations, visual images, and stories. Examples of how these mechanisms can be applied, either individually or in combination, are provided in the context of teaching human anatomy. Whether used by teachers or students, these mechanisms can be incorporated into a class, providing fun and effective ways to both teach and learn.

Introduction

Taking a university course on human anatomy can be like drinking from a fire hydrant. In a few short months, students are expected to regurgitate the names of almost every bone in the body, along with the names of the bumps, cracks, and holes found in these bones. Next, they are expected to learn the names of muscles, along with their various origins, insertions, and actions. They also must remember the names of important nerves and their innervations, along with major blood vessels of the body, including the organs that each vessel serves. The lists of structures and parts to memorize goes on and on, filling nearly 200 pages of lecture notes! For many of us that struggle with memory, drinking from this hydrant is a daunting undertaking, threatening drowning in an overwhelming flow of information.

Many subjects and courses are rich in terms or structures that students must memorize. Although students are given long lists of material to memorize, provided

tools or mechanisms to help remember these new materials are often lacking. The pedagogical approach often consists of the teacher introducing material and expecting the students to take it home to study, presumably to cement into their minds with repetition. Multiple exposures to material is an effective way to learn, but it is not very efficient in memory-laden classes, especially to busy students with multiple demands on their time. Such an approach may soon become tedious, leading to exhaustion and poor academic performance.

Alternative methods are available to assist with memorization. Books have been written on the subject, drawing on an abundance of scientific literature (Klemm, 2012). Many of these mechanisms are based on the concept of linking something that one already knows to new information that one is trying to learn, analogous to using a bridge that has already been built to cross a river instead of making a new one. These techniques incorporate imagination, visualization, and creativity, which in turn, can make learning enjoyable. Do they work? An extensive history of research supports their effectiveness in a wide variety of individuals and conditions (Lewinsohn et al., 1977; Hill et al., 1991; Susana, 2017). My anecdotal experience, along with feedback from many students, is consistent with this research. In fact, these types of mnemonic techniques work so well that they are the primary mechanism used by memory champions at international memory competitions (Zogaj, 2012). The purpose of this article is to increase awareness of these concepts and to provide original examples of some of these techniques for use in instruction.

There are many "memory mechanisms" that have been described (Rupp, 1998; Vaughn, 2007). For the purpose of this paper, I will describe three techniques that can be used individually or in combination: word associations, visual images, and stories. These can serve as teaching and learning tools, not only in an anatomy class, but also in any class that requires some memorization, or even in daily living.

Word Associations

Anatomists have developed technical terms for parts and regions of the body. In the case of the armpit, it is formally known as the axilla and is part of the axillary region, the area of the upper chest surrounding the armpit. How can we use what we already know to memorize the new term "axillary region"? Many students have heard of or even used Axe deodorant, so we can build on this and other knowledge about the

armpit, by saying we use axe deodorant in the ill-smelling hairy armpit. Students know about Axe deodorant, they know that the armpit can smell ill, and they know that it is hairy. When we put the underlined terms together we get axillary. This may seem a little complicated at first, but it can be a very fun and effective way to learn.

Another, perhaps simpler, example involves the anatomy of a neuron. A neuron has a single extension that leaves the cell body to send electrical signals to other cells. This structure is called an axon. Bundles of axons make up nerves. Looking at the word axon, what can we take, which we already know from that word, to help us remember its name? How about we use *axe* again and say that if we put an axe on the axon we could keep a neuron from sending a signal. As a point of emphasis, and to improve retention, we would show a picture of a neuron with its axon and then use an animation of an axe coming down on the axon to cut it (Figure 1).

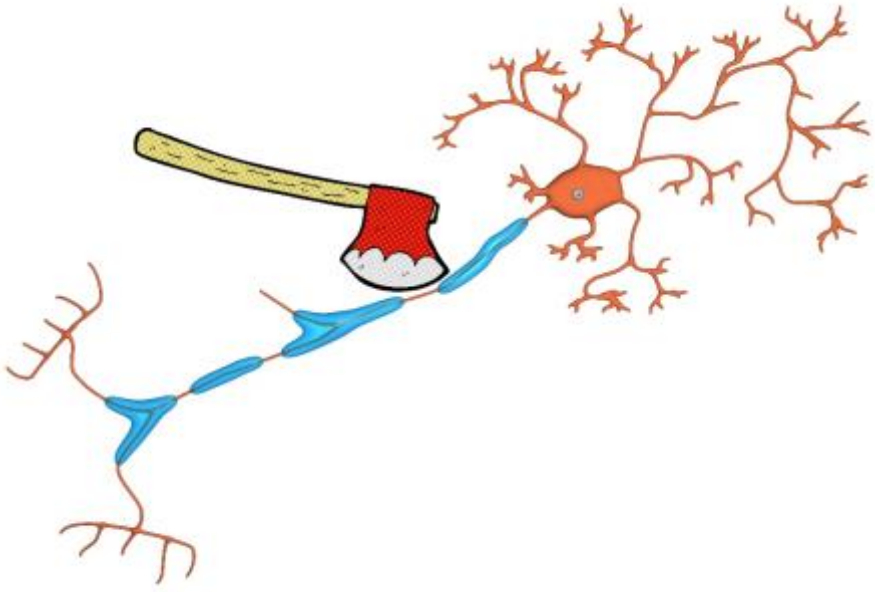

Figure 1: A picture of an axe on a neuron can help students remember the term axon.

Visual Images

Visual images connected to word associations can be a powerful way to reinforce memories. This may be due to the fact that visual memories have been shown to be superior to auditory memories (Rigney & Lutz, 1976; Brady et al., 2008). Perhaps this

is intuitive for those of us who remember peoples' faces much easier that their names. Therefore, an image of an axe chopping an axon, or a stick of Axe deodorant in someone's ill-smelling armpit, can be used to reinforce word associations or auditory cues. However, not all visual images have the same memory impact. For example, while at an amusement park recently, I saw a young couple walk by with large, purple, spiked Mohawk hairdos. Unlike the other people at the park, these individuals have readily stayed in my memory. Why? Because they were atypical, so they stood out. Images that remain in our minds the best are those that stick out as unique, different, or unusual (McDaniel, 1986). Unique visual images can be useful tools to help remember anatomy. For instance, one part of the body that anatomy students must memorize is the popliteal fossa: the shallow indentation found on the backside of the knee. Using our word association technique, we can dissect popliteal into two words: "pop" and "little," as *little* sounds much like "liteal," the last part of popliteal. Now we have two familiar words that can be linked to the new word. To bring this all together in an image, we can show a picture of a person in a difficult yoga pose balancing a *pop* that is *little* in the back of her knee (Figure 2).

Figure 2: A picture of a person in a difficult yoga pose balancing a "pop" that is "little" in the back of her knee to remember *popliteal fossa*.

Not all words or terms lend themselves well to word associations, and it is best not to "reach" too far in making associations or they can become confusing. However, if even 10% to 20% of terms in a class lend themselves to simple word associations, this can be a useful and enjoyable way to reduce memory burden.

Incorporation of Story

Stories, along with either real or imagined visual images, can also be effective tools to help with making memories, especially if there is sequential information to retain. In anatomy classes around the world, one sequence of structures that students cannot avoid learning is the twelve cranial nerves and their functions. Learning these nerves can be a challenging task, but the task is eased with stories. For instance, one of the first things that I do when teaching the cranial nerves is show the students a cartoon. The cartoon is a Looney Tunes clip of Wile E. Coyote and the Road Runner that I remember from Saturday morning cartoons of my youth, and conveniently, it is now available on the internet. In the clip, Wile E. paints a road leading to a painting of a fake tunnel on a rock wall with the hopes of luring the Road Runner to run into the wall. The Road Runner falls for the bait and takes off full speed down the road toward the "tunnel." Miraculously, when he reaches the painted tunnel, he runs right through it. Wile E. is dismayed and attempts to also give the tunnel a try. He steps back to get a good run at it, his nose out front, and approaches the tunnel with legs spinning. He is not so fortunate. He hits the cliff head-on and falls backward. The Road Runner then dashes back through the tunnel, running over Wile E. and leaving him flat on his back in a daze. The clip ends. At this point, I ask the students what part of Wile E. hit the cliff first. "His nose," they reply. "What hit next?" I ask. They respond, "His eyes." I then explain that the last thing that happened to Wile E. was that he was left lying on his back with his eyes spinning in circles. By remembering this clip, students can more easily recall the first three cranial nerves. The first cranial nerve corresponds to the structure that hit first, his nose. It is associated with smell and is called the "olfactory" nerve, enabling us to smell things like an old factory. Second, Wile E.'s eyes hit the wall. The second cranial nerve is the optic nerve, used for sight. The third cranial nerve is the oculomotor nerve, which innervates many of the muscles of the eye, "motoring" the oculi to spin in circles and focus near-and-far, just like Wile E.'s eyes did after his unfortunate event.

Additional stories can be useful in helping students remember cranial nerve IV and subsequent nerves. Cranial nerve IV is called the trochlear nerve. This nerve helps with moving the eye down and to the side. The story that helps me remember the fourth cranial nerve is the tale of the Three Billy Goats Gruff. In this story, three Billy goats want to cross a bridge spanning a deep gorge, but they are stopped by a troll guarding the bridge. The smallest goat attempts to cross first. After being stopped by the hungry troll, the little goat convinces the troll to spare him and eat his bigger brother who is soon to cross. The troll, who appreciates the concept of super-sizing a meal, agrees with this plan of sibling betrayal and waits for the "Big Mac." Of course, the same scenario plays out with the Second Billy goat. Eventually, the super hungry troll waits for the approach of the third and largest Billy goat, only to be disappointed by the fact that the oldest goat also has an extra-large set of horns that sends the poor troll falling to his demise. Students have likely heard this classic tale, but they are unaware that there was a fourth Billy Goat. The Fourth Billy Goat appears at the end of the story following the fall of the troll. While crossing the bridge, he looks to the side and down and exclaims, "The troll is clear." Of course, the *fourth* goat was using his *fourth* cranial nerve, the trochlear nerve, to look *sideways* and *down* at the fallen troll. We have now learned the name, number, and function of the fourth cranial nerve, all while listening to a fairy tale.

I like to continue this story by asking, "Why did the goats want to get to the other side of the bridge?" Because they wanted to try the gem-like grass. The fifth cranial nerve is called the trigeminal nerve, and it innervates the muscle used for chewing things like grass. Imagine these goats chewing/trying this gem-like grass in a peaceful green field on the other side of the bridge. As they chew the tall grass, it rubs against and tickles their faces. Cranial nerve V also enables sensation of stimuli on the face, allowing one to feel the temperature and touch of cool grass, etc., on the face, like what is happening to these goats as they chew.

The adventures can continue for our goats and for us as we utilize word associations, visual images, and stories to help remember the lists of life. What will happen next is only limited by our imaginations. Perhaps our feeding goats will use their abducens nerves to move their eyes laterally just in time to see the six hungry pirates who want to abduct them. My experience, consistent with Brahler & Walker's (2008), has shown that these are fun and effective techniques to enhance memory and aid student success, especially in memory-intensive courses where content flows quickly.

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