Muscle memory means myelin memory

"First we make our habits, and then our habits make us."
— John Dryden, born 1631

John T. Unger

Outdoors

COURTESY PHOTO

On a recent ski outing in Big Horn Gulch, Julie Singer, Maggie McCabe, Steve Boyle, and Lisa Hickman each raise a ski tip in a salute to the great outdoors. This seemingly simple maneuver actually engages complicated nervous-system controls.

Drop the tailgate of a pick-up truck, and climb up onto it. Then jump off.

How do your legs know just how much shock to absorb in preventing you from collapsing on landing? The answer lies in a combination of your use of visual depth perception, input from the position sensors within your joints, and your previous experience with similar jumps during your past years.

In common terms, the latter of these three elements is often referred to as muscle memory. This phrase is used to represent the habits of movement that, with repeated use, become nearly natural. They can occur almost as reflexive behaviors, without need for purposeful forethought.

When an icy patch is encountered by a trained and practiced backcountry skier on climbing skins, a muscle memory accommodation is instantly put into use by the muscles of the legs, arms, and trunk.

While the core muscles unconsciously contract to form a stable center, other events occur simultaneously. The arms and hands bear more weight on the ski poles to add some forward motion, while the knees bend more to position the feet directly under the person's center of gravity and make the most of the marginal traction under the skins.

Just like when a downhill cyclist automatically releases the brake the instant the rear wheel begins to skid on a descent, what once were learned conscious muscle activities have become instantaneous responses after thousands of repetitions. But is it accurate to call it muscle memory?

Practice makes permanent

Everyone who has learned to drive a car, hit a ball, or play the fretboard on a stringed instrument has developed some of these muscle-memory skills.

However, muscle cannot move, especially in sequences of coordinated patterns, without the commands of the nerves. Nerves are surrounded by a layer of specialized cells called myelin, which helps in sending accurate messages from the brain to the targeted muscles. For these reasons, it may be more accurate to think of these automatic coordinated movements as "myelin memory" instead of "muscle memory."

From ski instructors to coaches to music teachers, the phrase "practice makes perfect" is often rejected in favor of "practice makes permanent." Usually this statement is followed by specifying that "only perfect practice makes perfect."

Not only do such accurately performed repetitions lead to permanent motion memory, but in some movement behaviors it can lead to physical changes in the brain structure itself. These can be seen in studies using magnetic resonance imaging (MRI), as published in neurology journals in recent years.

These layers of muscle patterns performed unconsciously can free up the athlete or outdoors enthusiast to enjoy the company of their peers and the scenery, or to add subtle stylistic flourishes and deft elements of artistry to the performance of their particular sport.

Many studies are being done to uncover these neurological mechanisms for learning physical techniques in sports or the arts.

It has been shown that it is less effective to try learning multiple maneuvers all at one time, as the coordinating center of the brain (the cerebellum) can be more successful if fewer maneuvers are introduced together. Six hours later, though, the previous skills can be maintained cleanly if newer movement skills are introduced at or after that time.

How is it that a senior citizen who has not been on a bicycle in many decades can regain that complicated set of muscle skills in a minute or two once he or she is again on a bike? This is the permanent nature of skills that have been ingrained by daily repetition, even if those many repetitions had ended 30 years previously.

After several seasons of regular exposure, a trail runner heading up a steep and rocky mining road develops the skill of foot placement between unstable places, using mainly peripheral vision. This opens up the opportunity for being aware of weather changes, route finding, and the pleasures of quiet, self-propelled travel.

Similarly, higher speed activities such as downhill skiing are extremely dependent on muscle memory reactions, permitting more purposeful split-second decisions regarding the when and how of executing a course in the most satisfying way.

The next time you hear the phrase "muscle memory," silently substitute the word "myelin." Whichever way you choose to think of it, give a moment's gratitude for the magic of the nervous system that gives us such amazing ways to experience the outdoors.

John T. Unger is a Diplomate of the American Chiropractic Board of Sports Physicians, with more than 25 years of practice in Montrose. Whether using muscle or myelin, it's all good. Ideas for future columns are welcomed at

How to offset the agony of your feet

Feet are very quick to let you know that they are cold and don't like it. Considering that they are at the very end of our circulatory system, they may need some special attention to stay warm during your activities outdoors.

Mark Rackay

Tips from the Posse

As we have discussed before, if your core begins to chill, the blood from your extremities will be where you will begin to feel it first, and feet are definitely at the end of the extremities. Let's assume that from past columns that you now have your core well insulated and toasty warm but your feet are cold.

It is probably a good idea to decide what type of activity you are going to be partaking in outside as you consider footwear.

Sitting for long periods of time, such as when ice fishing or riding a snowmobile, would require a boot with very heavy insulation.

One type is called a Pac Boot. These have an insole or sock that is very heavy and can usually be removed. These also have very thick soles with extra insulation on the bottom to help keep cold out.

The problem with these is when you have to walk. They are so clumsy and heavy that you may think you have cinder blocks on your feet. They will also cause your feet to sweat when you do much activity with them on. Sweaty feet translate to cold feet.

If activity is going to be involved, such as hiking or hunting, the more traditional lace-up boots would probably be better suited. These should be laced up rather snugly for support while walking but loosened when you sit or stop so that the circulation can move better through your feet.

Boots are available with varying amounts of insulation from 200 grams up to 2,000. This alone does not necessarily mean warmth. Waterproof is an absolute must and once again, Gore-Tex is your friend. If you choose regular leather boots a good coating of a waterproofing agent is a must. Once boots become wet, they can freeze and take your toes down with them.

Wear socks made of wool or a wool blend. Avoid cotton, as it holds moisture and will make your feet cold. Avoid the temptation to wear multiple pairs of socks. A sock liner of a moisture wicking material with a heavy wool sock over it is just the ticket.

Save that second pair of socks to put in your pack to change into if your feet get wet from sweat or water/snow that snuck in through that big hole in the top. I once stepped through the ice on a creek and got a boot full. That extra pair really saved the day.

If you are going to be walking in snow, a pair of snow gaiters really helps. These gaiters will cover your laces and up the calf of your leg. This helps keep your pants dry and will help keep your calf warm. It also helps keep your laces from becoming a frozen mess that can only be untied with a pocketknife.

COURTESY/MARK RACKAY

Pac-type boots on the left for extreme conditions and more traditional insulated hiking boots for more strenuous activity and less-extreme conditions. Boot warmers are indispensable to keeping your feet comfortable in the outdoors.

If your feet begin feeling numb, do not hesitate to remove your boots and rub your feet with your hands. Your toes turning numb is the first warning sign for frostbite, so don't ignore the signal. You can also build a fire and warm them. Take that opportunity to make sure that those socks are dry before putting your boots back on.

There are feet warmers available. The air activated packets of these can be placed in your boots and provide some heat for several hours. These are especially useful if your activity level is going to be low.

There are also several electric models out there that work well if you don't mind the extra weight. Be careful in relying on any foot warmers. Murphy's Law will usually shine in here, and the batteries run out, leaving you with cold feet, so be certain that you have a back-up plan.

One last thing I recently began using is the electric boot-dryer. If you are going out for multiple days there is just not enough time for the boots to dry out. Starting a day with wet boots is a bad idea. It can only get worse from there.

These dryers will warm up and dry out a pair of boots in just a few hours. I use them even during the summer months while the rains are falling but that is another story.

Keep those feet warm and dry and until next time, see you on the trail.

Mark Rackay is a freelance writer who serves as a director for the Montrose County Sheriff's Posse. For information about the posse, call 252-4033 (leave a message) or email info@mcspi.org.