The Brain's Role in Optimal Performance

Optimizing performance. For decades (and perhaps longer), the notion of getting better at anything requiring physical skill – running, jumping, weight-lifting, you name it – was largely based on the concept that one needed to focus on enhancing strength and flexibility through training the musculoskeletal system. The feeling was and the science showed that the muscles required for the execution of the skill in question had to be trained and strengthened consistently and diligently. Furthermore, bones, ligaments and tendons were obviously important structural contributors to stability. Efforts were focused on training and protecting these structures from injury, or rehabilitating injured structures to maximize function. In short, the paradigm for optimizing athletic performance was biomechanical in nature. And muscle strength as well as dynamic flexibility training were recognized as *the* keys to success.

But a new neurologically focused paradigm in optimal performance is emerging. Armed with today's knowledge of how the brain works and its significant contributions to performance, both on and off the playing field, elite athletes as well as their coaches and advisers understand that tireless strength and flexibility training alone isn't even close to solving the optimal performance equation. The neurologic paradigm in sports performance is now recognized and highly valued. You also have to train the nervous system.

[See: The Best Olympic Sport for Your Body Type.]

Sports medicine – the medical field that deals with physical fitness as well as preventing and treating injuries related to sports and exercise – has made dramatic progress over just a few decades, largely based on applying lessons learned through research from a biomechanical approach to performance. The goals of enhancing performance and improving recovery from injury by studying joint function, muscle strength, causes of mechanical and/or material failure and related issues have paid great dividends for athletes and for the generally maturing and/or elderly populations.

Sports neurology is an emerging sub-specialty in both neurology and sports medicine - a love child, if you will. This field promotes an alternative to the biomechanical paradigm trailblazed by sports medicine. In sports neurology, both central and peripheral neurologic function, including the brain/spinal cord and the neuromuscular system, have emerged as critically important components of sports and other cognitive performance. Exercise and physical conditioning have long been known to have a positive effect on brain and overall neurologic function. Our field's effectiveness in communicating these benefits to the world is gaining ground. But now, we're increasingly understanding the relationship in reverse. Training the brain can have a significant positive effect on the physical aspects of performance.

As a result of recent educational efforts, medical concern and media reporting, most people connect or frame the brain within the larger topic of sport in the context of concussion. As sports neurologists, our aim is to buck that trend. We also want to educate the public on different aspects of the brain and nervous system, focusing on their contribution to sports performance. Neurological function should be considered, discussed and studied as critical aspects of athleticism, not limited to the negative and stigmatized topics of brain injury and concussion. We

want to expose people to the concept of "training the brain." We aim to use the social capital of sports to introduce concepts related to neurologic function critical to not only athletic, but also academic and professional performance.

We believe that insight and understanding of the benefits of early and continuous brain assessment and training contributes to optimization of overall neurologic health across the lifespan. A healthier and better performing adolescent and young adult brain will result in better function and improved quality of life as a senior citizen. Beyond the performance aspect of brain training, there are also benefits in prevention as well as treatment of chronic neurologic and degenerative diseases, including Alzheimer's and other dementia-related conditions, mood disorders, Parkinson's disease and more.

Rapidly evolving and increasing volume of research on the topic has demonstrated that neurological functions are critical contributors to optimal performance in sport and in the game of life. These neurological functions can be assessed and trained. We used to think of the nervous system as static wires connecting one area to another. Back then, the thought was that these connections either worked, or not – with little ability to improve or recover after injury. We now know differently because of something called neuroplasticity. Neuroplasticity involves the brain's ability to adapt and change with its environment or as a result of training. This simplified explanation doesn't nearly do this incredible phenomenon justice, however. When someone suffers a brain injury, for example, it's through the process of neuroplasticity that rehabilitation can occur by training a non-damaged area of the brain to "take over" a function previously controlled by a part of the brain that has become damaged. The injured brain can change, evolve, adapt and improve.

Armed with the knowledge that neuroplasticity can help rehabilitate someone after neurologic injury has occurred, sports neurology has concerned itself with developing ways to harness the brain's amazing ability to change, evolve and improve so as to both prevent injury and enhance performance. Here are a few examples found to be useful for assessing, training and monitoring brain performance while also helping prevent injury:

Cognitive and mindfulness training: The ability to maintain focus and concentration can be measured, practiced and improved. Training the brain is relative to vigilance, and the ability to predict rather than react can be measured, practiced and improved. The most elite and awarded athletes do these things well. Some by way of natural abilities, and others through dedicated, purposeful training of these neurological skills. Furthermore, the ability to be and stay in the moment and pursue "flow state" as well as quiet the autonomic system to optimize performance under stress can be shaped and conditioned through mindfulness training. Hitting a free-throw or sinking a putt under pressure, nailing the game-winning field goal and other sports achievements don't happen automatically for most people. Those who can maintain a calm, relaxed focus or remain in flow state are most successful. These represent neurological skills that can be trained.

[See: 6 Ways to Train Your Brain for Healthy Eating.]

Vision training: Some of the most commonly assessed aspects of Sports Vision are trainable and include:

- **Hand-eye coordination:** The ability to move the body in conjunction with what the eyes are seeing.
- **Dynamic visual acuity:** The ability to keep objects clear in the line of sight even when they're moving and/or when the athlete is moving.
- **Tracking ability:** The ability to maintain clear focus on an object or multiple objects moving in space.
- **Visual reaction time:** How quickly an individual is able to accurately react to something that he or she sees.
- **Depth perception:** Understanding where everything on the field or the court (for example) is taking place in relation to other objects. Without proper depth perception, we could never be able to hit or field a ball, throw to someone else or judge the distance to a goal or hoop.
- **Peripheral awareness:** The ability to see "out of the corner of your eye." Athletes who have great peripheral awareness tend to be very good at their sport because they can get a jump on some of the action.
- **Contrast sensitivity:** This refers to the ability to distinguish between objects of varying color and intensity. Seeing and tracking a white ball on the green grass may be much easier than seeing and tracking a white ball in the air against a cloudy gray sky in an individual with poor contrast sensitivity.

Balance, vestibular and proprioception training: All athletes are aware of the importance of good balance. But most are unaware of how it can be improved through knowledge of center of gravity, as well as an understanding of how visual, vestibular and proprioceptive functions work together to achieve balance. The vestibular organs (located within the ear) work intimately with the visual system to help with sensing movement and acceleration, particularly while maintaining focus on an object (such as another player or a ball, which might also be moving). The proprioceptive system refers to nerves that send signals from muscles and joints to provide information to the brain on where the extremities are positioned in space. Yes, this unsung hero of the senses refers to being able to sense the orientation of our own limbs. Without it, we would be unable to walk unless we watched our limbs. Fortunately, it's possible to train the body to become better at recognizing where the limbs are in space and how to move efficiently to achieve the desired effect. Professional athletes, for example, are often masters at this.

[See: 9 Foods That Can Keep Your Brain Sharp.]

When it comes to training for peak performance, biomechanics are critical. And so are the brain and nervous system. And when it comes to training the brain, whether the "performance" is on a court or field, in a classroom or in a boardroom, the benefits can make all the difference.