From Running to Groundbreaking Research

What if you could reap the benefits of exercise just by thinking about it? How much of an impact would that have on your life? Guang Yue, PhD, director of Human Performance and Engineering Research at Kessler Foundation, investigates how the brain controls movement.

His interest in movement began when he was a college athlete. “As a middle distance runner, I was always fascinated by our ability to move,” explained Dr. Yue. “This led to my interest in helping those who have lost the ability due to injury or disease.”

Kessler Foundation welcomed Dr. Yue in January 2012. With more than 18 years of experience, Dr. Yue studies the role of the central nervous system in movement and muscle function. He also examines the brain’s reaction to injury, disease, and medical treatment. His research promises to benefit people with multiple sclerosis, stroke, and injuries to the brain and spinal cord.

“A voluntary movement begins in the brain with the intention to move,” he explained. The intent passes through a series of pathways of neurons in the brain. Each muscle is directly controlled by a specific group of motor neurons in the spinal cord. The brain recruits the number of neurons needed to trigger the movement and determines the necessary level of quickness and intensity. “Once the movement occurs, information sensed by sensory organs such as the eye and receptors in the muscle, joint, and skin notifies the brain of the status of the ongoing movement. The brain compares this information with the intended movement in an effort to correct any errors. An injury or disease that affects any part of this chain will interfere with a person’s ability to move normally,” Dr. Yue noted.

To find solutions to movement abnormalities, Dr. Yue utilizes non-invasive electrophysiological and imaging techniques. His goals are to restore or improve motor function through targeted therapies or new technologies.

In a groundbreaking study, he discovered that people can gain strength through imagery training. When individuals lift weights, for example, they gain muscle strength. But if they just sit and think about lifting the weight—in an effort to activate those brain cells controlling strong muscle contractions—without letting the contraction occur, the muscles will also gain some strength. “Eventually, the trained brain can send a stronger signal through the motor neurons in the spinal cord to the muscle, recruiting more muscle fibers to participate in the contraction and activating them to higher intensity, leading to greater force,” stated Dr. Yue. This effect is somewhat similar to that used by athletes who picture themselves excelling in big games. They develop a game plan and mentally execute it. The power of visualization!
This type of research is especially relevant to people unable to participate in conventional strength building exercises. “They can use their minds to train the central motor system with no or low muscular activities to gain or maintain strength,” he said.

Dr. Yue is also exploring causes for muscle fatigue. When individuals feel fatigued and unable to use more strength, it may be that their brains are delivering poor signals to their muscles. It may be possible to develop treatments that improve mobility by restoring lost brain function.

Dr. Yue’s expertise is a key addition to Kessler Foundation’s research team. Vice President for Research, John DeLuca, PhD, said, “Dr. Yue bridges the gap between our physical and cognitive research. Our scientists understand the muscle’s role in movement. Tying in that expertise with how the brain rebuilds strength will accelerate our discoveries that improve quality of life for individuals with physical disabilities.”

Foundation researchers are studying the effects the LokomatPro V6 has on improving function in individuals with spinal cord injury and other neurological conditions. The Lokomat combines strength building with visualization by having robotic technology move a person’s legs over a treadmill in a repetitive walking motion while having an interactive screen for augmented feedback in front of the user. With the screen, participants are able to visualize how they’re walking in a virtual environment, which causes them to further their efforts. Dr. Yue will oversee this project as well as the resuming Ekso trials in 2012. He is also dedicated to quickly translating and disseminating research to inform the public of Kessler Foundation’s discoveries.

In his free time, Dr. Yue maintains his passion for utilizing strength and mobility. He enjoys hiking, jogging, and is a sports enthusiast. We are proud to welcome Dr. Yue to the Kessler Foundation family!

Support Dr. Yue’s research and help us write a new story.