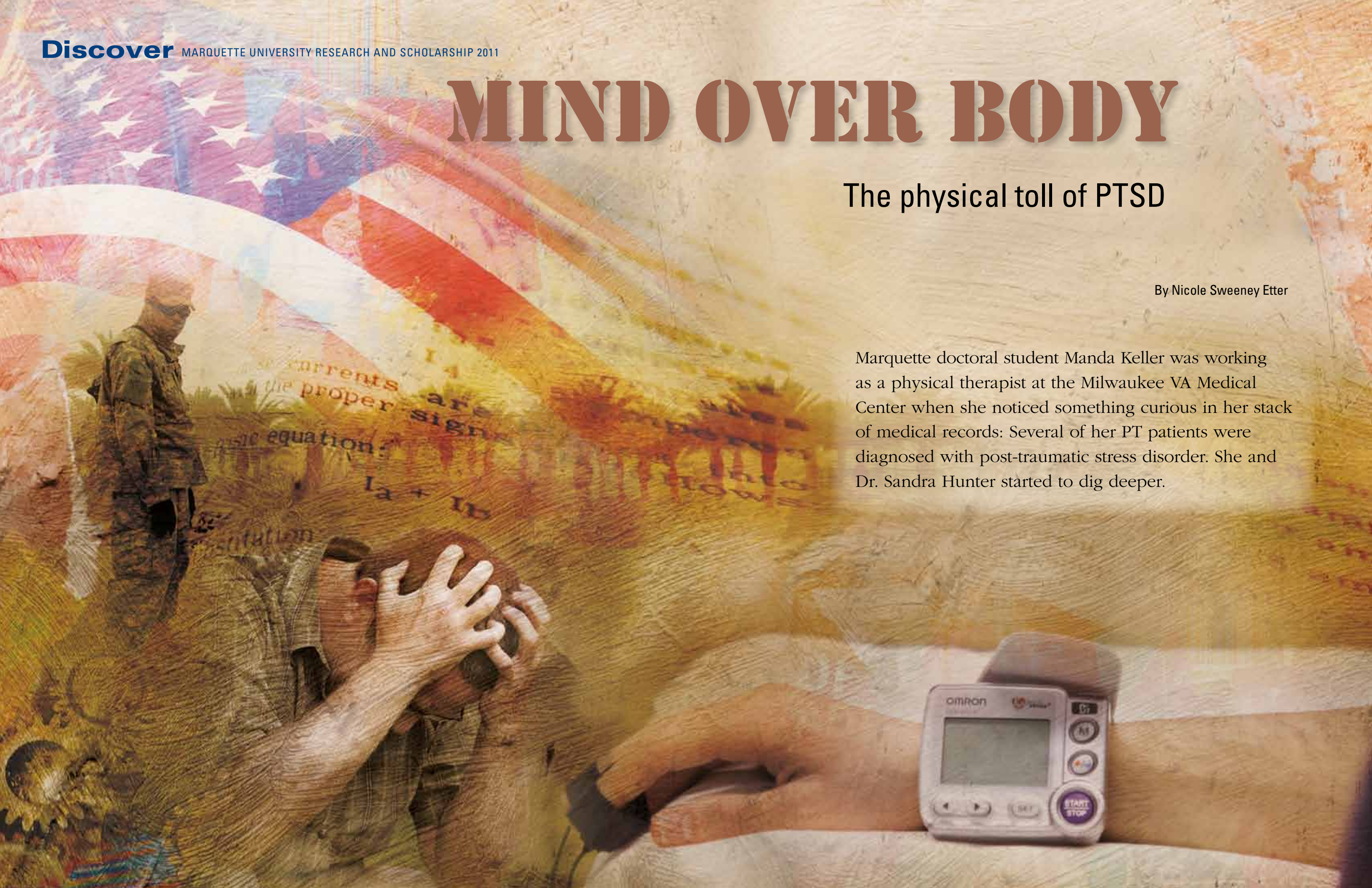


# MIND OVER BODY

The physical toll of PTSD

By Nicole Sweeney Etter

Marquette doctoral student Manda Keller was working as a physical therapist at the Milwaukee VA Medical Center when she noticed something curious in her stack of medical records: Several of her PT patients were diagnosed with post-traumatic stress disorder. She and Dr. Sandra Hunter started to dig deeper.



“We don’t know if or how PTSD affects the motor system or motor performance,” Keller says. Her earlier research with Hunter, associate professor of exercise science in Marquette’s College of Health Sciences, had already shown the detrimental effects of acute stress on motor performance. Now they hope to better understand the effects of chronic stress by studying motor performance in combat veterans during fatiguing



contractions of the hand muscles. The project is funded by the Clinical and Translational Science Institute of Southeast Wisconsin.

“This is novel work,” says Hunter, who is the principal investigator and Keller’s doctoral adviser. “Nobody has ever studied this before. Previous research has focused on the psychological aspects of PTSD.”

PTSD symptoms can include hyperarousal, flashbacks, nightmares and numbness. Veterans with the debilitating condition also have lower rates of employment, and the researchers wonder if physical impairment is a factor. “Does PTSD have a motor involvement or is it

primarily psychological, or both?” Hunter asks. “PTSD has the potential to really upset their physical performance. And then if we add a cognitive stress on top, even a simple motor task, is that going to affect veterans with PTSD even more?”

Hunter’s and Keller’s previous study, which was published in the *Journal of Applied Physiology* in 2010, studied the impact of acute stress on motor performance and muscle fatigue in healthy young men and women. “We know about fight or flight, but, really, how does activation of the fight or flight system affect the underlying motor control of daily activities, especially during fatiguing tasks?” Hunter asks. Potentially a lot, it turns out. Researchers stressed participants by giving a timed, difficult mental math test — asking them to count backward by large numbers — while performing a fatiguing arm exercise. To account for distraction, participants were also given a very simple mental task.

The study showed for the first time “that a difficult mental math test really affects your ability to hold steady muscle contractions and how quickly you fatigue, particularly at low forces,” Hunter says. “Women actually have the greatest decrement in motor performance when exposed to a stressor, though we’re not sure whether that’s a sex difference or a strength difference.”

Keller, who has a pre-doctoral rehabilitation research fellowship at the VA Medical Center, then repeated the same tests with 20 veterans ages 26-52, most of whom served in the recent Iraq and Afghanistan wars. The study is ongoing, but early results reveal that even without any mental tasks, veterans with PTSD are less steady and

fatigue more quickly than control subjects. It’s still unknown if simultaneously performing the mental tasks will further impair the veterans’ motor performance.

“So now that we know that they fatigue more quickly and to a greater magnitude during low-force tasks that are applicable to tasks performed during daily activities, the next step is to figure out where the fatigue is occurring within the neuromusculoskeletal system,” Keller explains.

To do that, researchers will use techniques such as electrical stimulation and transcranial magnetic stimulation to determine if fatigue is originating in the central nervous system or in the muscle. “If we know the site of fatigue, then we can provide targeted strategies to counteract such problems,” Hunter says. If fatigue occurs in the central nervous system, then strength training may be helpful. Fatiguing contractions are the basis of all strength-training programs, and initial increases in strength occur first within

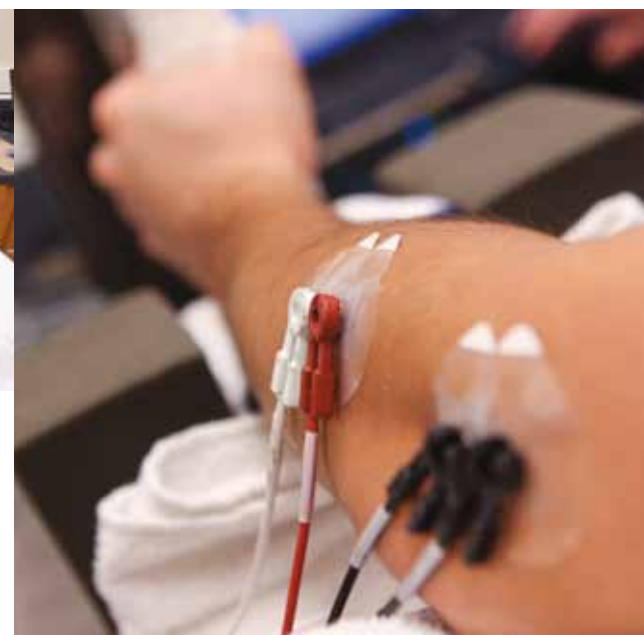


To better understand the effects of chronic stress, Marquette researchers test motor performance in combat veterans during fatiguing contractions of the hand muscles.

the nervous system, which adapts by working more efficiently. Hunter’s previous research had shown that older women increased their strength by 43 percent in 12 weeks of training — even though their muscles grew in size by only 10 percent.

Veterans’ physical impairments could impede their rehabilitation, which often relies on improving strength by performing fatiguing contractions. By better understanding the root of veterans’ motor problems, researchers could design better rehab treatments, Hunter says.

The researchers are even more excited about the next phase: Collaborating with Marquette colleague Dr. Paul Gasser to explore the genetic predisposition of PTSD and motor performance. In particular, they’d like to know if veterans who have the genes associated with PTSD are also the ones who have decrements in motor performance. ■



## Other PTSD research at Marquette

**Dr. Paul Gasser**, an assistant professor of biomedical sciences, studies the effects of stress on the brain and has focused on PTSD for the past five years. He is trying to understand the stress hormones that influence the consolidation and persistence of emotional memories, as well as the risk factors that predispose one to PTSD. “PTSD intrigues me because it’s a disorder in which the normal process of adaptation to and recovery from stress is disrupted,” he says. “If we can understand how and why that happens, we may be able to develop strategies to decrease the incidence of PTSD and improve the effectiveness of treatments.”



**Dr. Ed de St. Aubin**, an associate professor of psychology, studies survivors of life-threatening, potentially traumatizing events, including people with PTSD. He thinks the condition can reveal important findings about everything from resilience to identity/existentialism to coping mechanisms. “We are particularly interested in how such an event impacts the life story one tells oneself and others in order to provide meaning and purpose to one’s existence,” de St. Aubin explains. “We are now moving toward examining the various biopsychosocial trajectories that follow a traumatic injury by longitudinally tracking changes in one’s self-narrative, as well as biomarkers of post-trauma health.” For the upcoming project, he is collaborating with **Dr. April Harkins**, assistant professor of clinical laboratory science. “We are hoping to bring to light some biomarkers in the blood that may be predictive of developing PTSD,” Harkins explains.



**Dr. John D. Zemler**, a visiting assistant professor of theology and life member of the Disabled American Veterans, is a former U.S. Army captain who specializes in treating PTSD as a “soul wound.” His research focuses on the spiritual dimensions of PTSD and how to heal souls wounded by trauma. He manages the website [ptsdspirituality.com](http://ptsdspirituality.com). “The site is mostly visited by family and friends who are concerned about someone with PTSD,” he says. “Through it and by other means, I help folks understand they don’t have to kill themselves and the situation is not absolutely hopeless.”