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"I can give these kids a task to do in my lab, and I know they won't quit and that they will go all the way to try to execute that task." --Kit Parker

Making a Scientific Impact

Susan Gaidos
United States
29 August 2008

After 12 months on patrol in Iraq for the U.S. Marines, Sgt. Josue "Josh" Goss returned home in June to pursue another mission: graduate studies in biophysics. Although the transition to civilian life can sometimes be "brutal," the Harvard University lab where Goss

works operates with a familiar sense of camaraderie and urgency. His e-mails, for example, are peppered with military verbiage and frequent requests for "sitreps," or situation reports.

Most of these abbreviated commands come from Kevin "Kit" Parker, an associate professor of biomedical engineering and a veteran himself, who served 10 months on patrol in Afghanistan for the U.S. Army. In addition to Goss, the Parker lab has two other veteran students, undergraduates Josue Guerra and Jorge Pozo. Together, the former soldiers are pursuing studies on traumatic brain injury (TBI) caused by improvised explosive devices (IEDs).

Although their experience in a battlefield environment provides a common motivating factor for their studies, the students say it has, more significantly, helped prepare them for their scientific careers. "To be successful in the military, you've got to be a dynamic problem-solver. And that fits perfectly in line with research," Goss says. "Learning how to solve problems on the fly is the key to being effective in the laboratory."

GIVING BACK

Parker entered the Army through ROTC in 1992 while a graduate student at Vanderbilt University in Nashville, Tennessee, from which he received a master's degree in mechanical engineering and a doctorate in biological and applied physics. He joined the Army because things were going well for him and, he says, he "felt an obligation to give back in some way." After receiving his doctorate in 1998, he worked as a research fellow in pathology at Harvard Medical School in Boston. His expertise in engineering and biology caught the attention of the dean of Harvard's Division of Engineering and Applied Sciences. In 2002, he joined the department as assistant professor. A few months later, his U.S. Army Reserve unit was called into service, and Parker put his lab on hold.

During his 10-month rotation in Afghanistan, he was a captain with the 82nd Airborne Division,

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responsible for a five-man team that patrolled the mountains between Afghanistan and Pakistan. After returning home from active duty in 2003, he returned to the task of setting up his laboratory.

Parker's research interest was in the mechanical forces within the heart, but when he returned from Afghanistan he looked around in the lab to see what he could do to address some of the problems that come with combat casualty care. His group turned its attention to tissue engineering for a while. When the Defense Advanced Research Projects Agency asked him to take a look at traumatic brain injury, he surveyed the literature and found a "hole." The group is now pursuing studies that couple the mechanical forces of a blast, or pressure wave, to the activation of chemical-signaling pathways in neural cells.

"Traumatic brain injury is the signature injury of these wars. You can't have been downrange and not been exposed to IED," he says. "I thought my group had some tools and core competency that could impact this deficit in the field."

RISKY BUT EFFECTIVE ON-THE-JOB TRAINING

As veterans of the wars in Iraq and Afghanistan return to civilian life, a significant number of them are entering college programs, including graduate programs in science and related technical fields.

Parker says students who have been through the military often gain confidence and analytical skills that a typical student might not have. "I wish that I had gotten that basic training before I went to college," he says.

Students who have been in the service often enter Parker's lab with a sense of determination and will that others have not yet acquired, Parker says. "In the military, you're taught not to quit under any circumstances, no matter how bad it gets. I can give these kids a task to do in my lab, and I know they won't quit and that they will go all the way to try to execute that task.

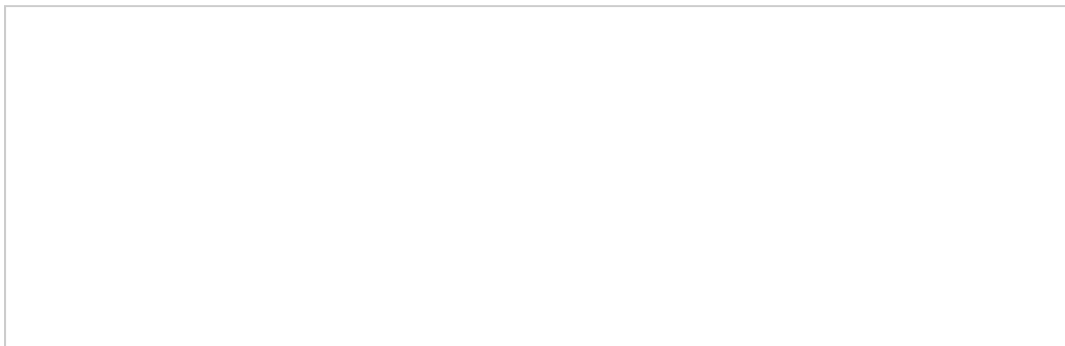
"That really means a lot when you are trying to push the envelope in terms of the science," he adds. "There are lots of things that can prevent you from doing things in science, and will is one of them."

Another is death or serious injury, also consequences of the wars in Iraq and Afghanistan. According to Pentagon tallies, more than 4700 U.S. soldiers have died in those two conflicts and about 33,000 have been wounded. That total fails to account for [at least 20,000 brain injuries](#), according to an analysis published late last year by *USA Today*. An estimated one in five Iraq and Afghanistan vets suffer symptoms of post-traumatic stress disorder or major depression, according to [a RAND Corp. analysis](#).

Goss and Guerra say that they were fortunate to serve deployments that were "less kinetic" than those served by many others. Although they dealt with the realities of IEDs during their missions, both escaped injury.

Pozo, a biology major at Northeastern University in Boston, wasn't quite as lucky. He was injured during his service, and those injuries were aggravated in a motorcycle accident soon after he joined the Parker lab early this summer. He is expected to make a full recovery, however, and plans to rejoin the group this fall, working as an undergraduate assistant through a co-op program.

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A new mission. Kit Parker (back) supervises students Josh Goss (middle) and Josh Guerra (front) in the lab.

Parker's group includes a dozen researchers. But for the veterans in the group, TBI research is "personal," Parker says. Although he always has students and graduates knocking on his door seeking a position in his lab, Parker says his veteran students came to him through serendipity and informal introductions. "I don't know if I would say I looked for them; I just didn't look away."

In 2004, Parker met Goss while giving a talk at Harding University in Searcy, Arkansas. Then an undergraduate enrolled in premed studies, Goss had returned recently from a tour of duty in Iraq. His biology professor introduced the two veterans. "We talked for a while, and I wished him luck," Parker said. "But I couldn't get that kid out of my head."

FINDING WORK-AROUNDS

When he was growing up in Little Rock, Arkansas, Goss says, it was "always a given" that he would one day be a scientist. "I just didn't know exactly what type. In the South, if you like science, you're pretty much destined for medical school, so that's the direction in which I was moving."

His college plans were put on hold in 2003 when the U.S. launched the invasion of Iraq. Goss completed a 6-month tour at the beginning of the war as part of a Marine reserve unit out of Little Rock, then returned to his studies at Harding.

One day, while running errands in his pickup truck, he received a call from Parker, who had just established an undergraduate research program in his lab through the U.S. National Science Foundation's Research Experiences for Undergraduates program. He asked Goss if he would like to come work in his lab over the summer. "I wasn't sure he would remember who I was," Parker says.

Goss remembered: "How can you forget this guy? He's 6'5" tall and has a big, booming voice." In June 2005, Goss went to Cambridge. "I found that I'm really creative and like to solve problems, and that suits me in research," he says. "I got a chance to really blossom here." That summer, he found a way to build engineered neural networks using brain cells collected from rodents. When he returned the following summer, he was assigned a team of his own to manage.

"Because of his leadership skills, I knew he was off and running," Parker says. "One of the things you learn on the battlefield is that the way to win is to find a way to make things work. We call it a work-around. I think especially in a battlefield like we're on today, the people that make it work are the ones

that find work-arounds, because often there is no dictated solution."

This year, after Goss returned from his second tour of duty in Iraq, Parker offered him a full-time position in his laboratory as "lab boss." Goss will oversee the day-to-day operations in the lab while pursuing his own research and working on a master's degree.

ON-THE-JOB TRAINING

Guerra, who, like Goss, goes by "Josh," was a high school senior in Miami, Florida, when the Iraq war kicked off. He had already been accepted at Harvard through an early action program that gave him an option to enter studies that fall or to wait a year.

"I had always planned to join the military, so my options at that point were to go straight to college and defer my service or join right after high school and go to college a little later. I went with the latter choice and joined the Army Reserves," he says.

After completing basic training, Guerra went to Advanced Individual Training to prepare him to assist in reconstruction projects. He served 11 months in Afghanistan, completing his military mission in March 2006 and entering Harvard the following fall.

Guerra says the experience provided some essential "on-the-job" training and put him on his current path of scientific inquiry. Before entering the military, "I leaned heavily toward poli sci and international relations," he says; after, he decided to pursue science instead. He's now working toward a double major in physics and chemistry.

"I'm not sure quite what my thought process was," Guerra says, "but one of the reasons I joined the military was because I wanted to make an impact. I guess along those lines of reasoning, I felt I could make more of an impact in science."

Parker asked Guerra to join his team, and this past summer Guerra worked to simulate the traumatic injuries caused by IEDs. "We reviewed his data in early August, and it is stunning," Parker says.

Goss and Guerra say that their shared experiences on the battlefield are always in the background but that the fast pace of the research environment leaves little time to "have a beer and talk about our war stories," as Guerra puts it. "But I can tell when I see how Kit treats me and what he expects of me, it's very different from what he would expect from another undergraduate."

Parker acknowledges this differential treatment, noting that it's due in part to the sense of responsibility that comes with serving in the military. "In the military, you're always trained to cover each other," Parker says. "There's a baseline level of trust that exists that in other circumstances would have to be earned over time."

Susan Gaidos is a freelance writer based near Portland, Maine.

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Middle: Eliza Grinnell/HSEAS

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