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Saving Pvt. Ryan ... From Pain

By Noah Shachtman Noah Shachtman Also by this reporter

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It's a scene that's been repeated thousands of times on hundreds of battlefields -- a soldier is hit by gunfire or shrapnel. He calls out for a medic, who tries to stabilize him on the spot and arranges for the injured warrior to be taken to a field hospital. And then, the soldier is gone -- maybe for the rest of the conflict.

But with the pace of American military missions getting faster and faster, losing GIs to injuries becomes an increasingly ugly option: Units that stay together fight better, military analysts say. And with soldiers operating in smaller groups -- think of the Special Forces combing the mountains of Afghanistan -- there often isn't a medic around to provide aid.

So Pentagon-funded scientists and doctors are working on a suite of technologies and treatments to let soldiers heal themselves, just about instantly. Acute pain and blood loss will be controlled in five minutes or less, if the program is successful. And an injured GI, assuming the wounds are not too severe, can stay alive and fighting on the battlefield for up to 96 hours -- without the help of a medic, without being evacuated.

"It sounds coldhearted, but a wounded soldier can be more disruptive than a dead one. At minimum, you need a couple of guys to carry him out. And once he's out, it hurts unit cohesion," said Jim Lewis, with the Center for Strategic & International Studies. "So the more you can do upfront to stabilize someone -- and the more that person can do for themselves -- the better."

The technologies, developed under a broad Defense Advanced

Research Projects Agency effort called Persistence in Combat (PDF), all sound pretty far-fetched: a painkiller soldiers could take - before they get hurt; a sensor that scans the eye for internal trauma; a bandage that stimulates skin repair with electrical impulses. But several of these projects are surprisingly close to reality, with human trials either underway or about to begin.

Next summer, researchers from Rinat Neuroscience in Palo Alto, California, will begin human testing on what they call RI624 -- and what Darpa calls a "pain vaccine." The drug uses an antibody to keep in check a neuropeptide that helps transmit pain sensations from the tissues to the nerves.

It's a radically different approach from the morphine and morphine-like drugs soldiers and civilian patients get today. Morphine kills the perception of pain by limiting sensory input to the brain. But it doesn't exactly do wonders for math or motor skills.

"We're working on something that takes away pain without interfering with cognitive faculties," said Franz Hefti, an executive at Rinat, a spinoff of biotech giant Genentech.

If successful, RI624 won't completely cut out the need for traditional painkillers, noted Dr. Donald Stanski, a Stanford University professor of anesthesia and clinical pharmacology who's consulting with Rinat. But RI624 -- administered by injection -- could reduce the amount of morphine and other orally ingested analgesics the wounded need to take. And that would be the first major upgrade in battlefield pain management in more than a century, according to Hefti.

"Soldiers in Iraq are getting the same stuff that they got in the Civil War," he said.

Antibodies, like the one on which RI624 relies, have lengthy half-lives -- in rodent tests, about a week. So soldiers could take RI624 days before combat, and feel less pain if they get hit in action.

Rinat has received about \$700,000 from Darpa for the effort --

compared with \$55 million in private funds. So it's no surprise that Hefti doesn't see the military as RI624's primary market. Instead, he believes, the drug will be used mostly for postoperative pain and chronic pain caused by conditions like arthritis.

Other projects funded by Persistence in Combat should have civilian applications as well. Medical College of Wisconsin neurology professor Dr. Harry Whelan has used Darpa money to develop light-emitting diodes that reverse damage done to the eyes by lasers. But he's also using the therapy to treat a few of the harsher side effects of chemotherapy.

Scientists at MD Biotech in Morgantown, West Virginia, are working on optical scanning instrumentation, or OSI, that can tell whether someone has inhaled nerve gas or botulinum toxin -- threats a soldier might face on the battlefield. But the handheld OSI can also spot evidence of cyanide or carbon monoxide inhalation -- which regularly affect firefighters, too.

By looking at the blood vessels in the eye, the device can see what's going on deeper in the body, said Dr. Lance Molnar, the company's director of life science. The color of the eye's vasculature indicates how much oxygen is in the blood; the lighter the color, the less oxygen there is. So the presence of carbon monoxide, which keeps the blood from accepting oxygen, is easy to detect.

Darpa has been at the center of controversy and funding battles of late. Much of its Information Awareness Office -- responsible for the Terrorism Information Awareness data-mining scheme and the online gutted by congressional overseers.

But Persistence in Combat seems less likely to raise hackles because of its clear-cut benefits to soldiers and civilians.

The effort does keep with one long-standing Darpa tradition, however: science that's so bleeding-edge it can border on the wacky. How else would you describe a battery-powered bandage that speeds skin repair with electrical impulses? Or a nanotechnological magnetic tourniquet?

"It's not clear to me whether this is driven by the gee-whiz toy story -- people coming in with all these weird projects -- or by a structured understanding of why people end up dead in combat," said John Pike, director of GlobalSecurity.org. The nano-tourniquet seems particularly suspect.

When it first began, Persistence in Combat was also going to examine alternative healing approaches, "such as acupuncture, acupressure employing stimulation to release pain-relieving biomolecules, biofeedback, training and meditation. East Asian techniques for combat medicine and pathways/mediators of pain meridian points (were also) of particular interest," according to the program's website.

But such plans have since been dropped as the effort comes closer to reality. Persistence in Combat is without a program manager at the moment, but research is continuing. And Darpa plans to have the project ready to be integrated into the next generation of soldier battle suits in 2008.

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