Engineering new solutions

A team at the Army Research Laboratory (ARL) led by Eric Wetzel, EG95, has developed a novel tether that attaches a football helmet to a player's chest to prevent his head from snapping back and slamming into the ground in a tackle.

The device capitalizes on the properties of shear thickening fluids, whose stiffness changes under stress. At low speeds, they're elastic and stretchable, but when hit with a violent force, they become rigid.

"The beauty of the tether is that it allows players to move their heads from side to side and up and down under normal playing conditions, but it tightens under impact, slowing the head down so that it hits the ground with less velocity," Wetzel says.

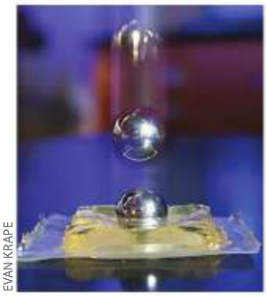
The device is aimed specifically at preventing the type of head injury that occurs with a backwards fall.

The project was one of seven selected to receive $500,000 from the 2015 Head Health Challenge, a collaboration among the NFL, Under Armour, GE and the National Institute of Standards and Technology.

"Partnering with the NFL enables us to complete the loop," says Wetzel. "We developed the technology here at ARL, we'll test it on football players, and then we'll bring the results back to the military."

Wetzel credits his collaboration with Norm Wagner, the Robert L. Pigford Chaired Professor of Chemical and Biomolecular Engineering at UD, for at least part of his success in developing the RAT (rate-actuated tether) strap.

"Norm is a world-renowned expert in shear thickening fluids," Wetzel says. "We are teaming with him [through STF Technologies, a spin-off company from his UD research] to make better materials for this application."



EVAN KRAPE

UD prof. Norm Wagner is an expert on shear-thickening fluids (pictured here), which harden upon impact.

Wagner has submitted a new proposal to Head Health Challenge to develop field-responsive nanocomposites in helmets.

"We've gotten good results in lab testing with these STF materials in terms of their capability to absorb energy," he says. "We know that helmets can't eliminate concussion, but we're hopeful that the risk can be dramatically reduced for not only football players but also first responders, members of the military and youth athletes. We can't solve all problems with our technology, but we can make people's lives safer."

"I think it's great that Prof. Kaminski and the University of Delaware are trying to learn more about concussions. It's a very dangerous injury and can really damage an athlete's future. The more trainers know about concussions, the better they can treat and take care of the athlete."

–NFL center Gino Gradkowski, AS11

What we don't know

UD's Kaminski says that we need the science to support decision making for athletes.

In 2011, he facilitated the passage of a concussion law that sets regulations for schools in the Delaware Interscholastic Athletic Association.

Concussion laws, which essentially promote a "when in doubt, sit it out" policy for interscholastic athletes, are now in effect in all 50 states and the District of Columbia. The first of these laws was passed in Washington in 2009 and named after Zachery Lystedt, a 13-year-old junior high football player who was left with permanent disabilities when he returned to play after a concussion and suffered a second injury in the same game.

Kaminski, who has been collecting data on ball heading in female soccer players for more than a decade, sees the laws as an essential first step in an ongoing process of education, training, data collection and policy-making to ensure that coaches, officials, players and parents work together to protect young athletes from the long-term effects of blows to the head.

But when it comes to making arbitrary decisions—for example, prohibiting heading in soccer players younger than 14—he's reluctant to get on board.

"Why 14? Why not 12?," he says. "Our goal is ultimately to have quantifiable data about outcomes, but it's just too early for that. We're really just starting to know what we don't know." ▮

—Diane Kukich, AS73, 84M