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# Drug Delivery Particles Mimic White Blood Cells

ARLINGTON, Va., Dec. 19, 2003 -- Researchers have taken cues from the way white blood cells heal injury and fight disease to produce a highly targeted system that might someday be used for drug delivery.

Whitaker investigator Douglas Goetz, Ph.D., associate professor of chemical engineering at Ohio University, led a group that engineered biodegradable particles that mimic the action of white blood cells (leukocytes).

In the case of a bacterial infection or traumatic injury, leukocytes attach themselves to the blood vessel wall at the site to help fight infection or heal the wound. But in inflammatory diseases, such as atherosclerosis and arthritis, leukocytes tend to gather at the wrong place, aggravating the situation or causing new problems.

Goetz and his team took cues from leukocyte activity to engineer small particles that would be as selective and aggressive in seeking out their targets, and yet would home in on sites of inflammation.

The group attached targeting molecules to polymers of polylactic acid and polyethylene glycol, which are commonly used in medical applications and can be used as biodegradable capsules to carry therapeutic drugs. The targeting molecules seek out markers on the surface of inflamed cells that line the inner walls of blood vessels. Then they grab hold.

"Our biodegradable particles were 100 times more effective at sticking to the blood vessel wall than other materials tested in previous studies," Goetz said. The tests were successful both in laboratory preparations and in mice.

Because they attached to the inner walls of blood vessels, the engineered particles are pushed by the force of blood flowing through the vessels. The particles could be designed to either firmly adhere to the vessel wall or stay loosely attached and roll slowly in the direction of the current.

"It demonstrates how well we can control these particles, not only with selective delivery, but also the type of relationship they have with the vessel wall," Goetz said. At this point, it is unclear what effect the adhesive relationship might have on drug delivery.

Because the particles are so selective and aggressive in their binding,

they may prove to be efficient vehicles for delivering targeted medicines for diseases ranging from cardiovascular illness to arthritis to cancer. But the researchers will have to optimize drug and particle uptake rates and address other issues before clinical testing could begin.

Goetz's work, published in the Dec. 23 issue of the *Proceedings of the National Academy of Sciences*, is supported by a Whitaker Foundation Biomedical Engineering Research Grant. Collaborators include Justin Hanes and Jie Fu of The Johns Hopkins University; Kevin Shakesheff and Aliasger Salem of the University of Nottingham in England; Mohammad Kiani and Ramin Ansari of the University of Tennessee Health Science Center; and David Kurjiaka, Harshad Sakhalkar and Milind Dalal of Ohio University.

**Contact:**
Douglas Goetz, Ohio University
Frank Blanchard, The Whitaker Foundation