# White Blood Cell Uses DNA 'Catapult' to Fight Infection

August 13 2008

(PhysOrg.com) -- U.S. and Swiss scientists have made a breakthrough in understanding how a type of white blood cell called the eosinophil may help the body to fight bacterial infections in the digestive tract, according to research published online this week in *Nature Medicine.*

Hans-Uwe Simon, from the University of Bern, Switzerland, Gerald J.Gleich, M.D., from the University of Utah School of Medicine, and their colleagues discovered that bacteria can activate eosinophils to release mitochondrial DNA in a catapult-like fashion to create a net that captures and kills bacteria.

"This is a fascinating finding," says Gleich, professor of dermatology and internal medicine at the University of Utah and a co-author of the study. "The DNA is released out of the cell in less than a second."

Eosiniphils, which comprise only 1 to 3 percent of human white blood cells, are known to be useful in the body's defense mechanisms against parasites. But their exact role in the immune system is not clear. Unlike other white blood cells, which are distributed throughout the body, eosinophils are found only in selected areas, including the digestive tract. Mitochondria – often referred to as the power plants of the cell – are components within cells that are thought to descend from ancient bacteria. Although most cellular DNA is contained in the nucleus, mitochondria have their own DNA.

Previous research has shown that eosinophils secrete toxic granule

proteins during parasite infections and that these granule proteins kill bacteria. Simon, Gleich, and their colleagues found that when eosinophils are stimulated by infection, such as E. coli, they rapidly secrete mitochondrial DNA. This DNA binds to the granule proteins and forms a net that is able to trap and kill bacteria. The researchers also found higher levels of eosinophils were linked to improved survival and lower numbers of bacteria in the blood of mice with widespread bacterial infections.

The toxic proteins released by eosinophils are not always helpful to the body, however, and can damage nearby tissues. The inflammation in some types of asthma and Crohn's disease, a chronic inflammatory disease of the bowel, is attributed to eosinophils. In fact, Simon and his team first found evidence of these DNA-protein traps in tissue taken from the digestive tracts of people with Crohn's disease.

Earlier studies suggested another type of white blood cell – the neutrophil – also expels DNA and granule proteins to kill bacteria. However, this DNA comes from the nucleus and its release causes the neutrophil to die. The eosinophil is able to survive after expelling its mitochondrial DNA.

The researchers hope to learn more about how eosiniphils expel mitochondrial DNA. They speculate that the explosive mechanism might rely on stored energy, similar to the way plants release pollen into the air. "We don't know how eosinophils are capable of catapulting mitochondrial DNA so quickly," says Gleich.

Future investigation may focus on how this energy is generated and how this new knowledge can be applied to the treatment of bacterial infections and inflammatory diseases related to eosinophils.

Provided by University of Utah