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**Citation:** *Atherosclerosis*, Volume 181, Issue 2, August 2005, Pages 295-303, “In vivo detection of macrophages in a rabbit atherosclerotic model by time-resolved laser-induced fluorescence spectroscopy.”

#### **HIGHLIGHTS:**

In an animal study, a device that stimulates, collects and measures light emissions from body tissues in laboratory rabbits is able to detect the presence of inflammatory cells called macrophages. In humans, these cells have been found to congregate in atherosclerotic plaque that is susceptible to rupture and the formation of blockages. Study results appear in the August 2005 issue of *Atherosclerosis*.

#### **FLUORESCENCE SPECTROSCOPY PROVES CAPABLE OF DETECTING INFLAMMATORY CELLS IN BLOOD VESSELS**

**LOS ANGELES (August 11, 2005)** – Because atherosclerotic plaque typically builds up without symptoms and leads to more than 1 million deaths in America each year, the search is on to develop early detection devices that will enable physicians to offer treatment before the disease progresses to advanced stages.

Now, in a study involving laboratory rabbits, a device that stimulates, collects and measures light emissions from body tissues has been able to detect the presence of inflammatory cells that are associated with critical atherosclerotic plaques in humans – plaques that are vulnerable to rupture. The study is described in the August 2005 issue of the journal *Atherosclerosis*.

Recent atherosclerosis research has found that the composition of plaque and its “vulnerability” to rupture may be more significant than the degree of arterial blockage as a precursor to heart attack and stroke. The lining (intima) of a normal artery consists of several thin layers of cells and connective tissue. Segments containing stable atherosclerotic plaque become thickened with collagen while sections of vulnerable plaque are infiltrated by macrophages. In humans, the inflammatory process weakens the plaque’s thin, fibrous cap, often leading to rupture of the plaque and blockage of blood vessels.

An experimental time-resolved laser-induced fluorescence spectroscopy (TR-LIFS) device developed by researchers at Cedars-Sinai Medical Center was used to detect the presence of inflammatory cells in the aortas of animals, with results compared to those from pathology studies.

“This study demonstrates that TR-LIFS can be used to identify macrophage infiltration in the fibrous cap, a key marker of plaque inflammation,” said Laura Marcu, Ph.D., director of the Biophotonics Research and Technology Development Laboratory in Cedars-Sinai’s Department of Surgery. “While previous studies have reported that fluorescence spectroscopy could identify atherosclerotic plaques, we believe this is the first to demonstrate that a fluorescence-based technique is also sensitive to differences in macrophage content versus collagen content. We found that intima rich in macrophages can be distinguished from intima rich in collagen with high sensitivity and specificity.”

Marcu led the study with colleagues from Cedars-Sinai, the University of California, Los Angeles, and Johns

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Hopkins University.

Laser-induced fluorescence spectroscopy is based on the fact that when molecules in cells are stimulated by light, they respond by becoming excited and re-emitting light of varying colors. Just as a prism splits white light into a full spectrum of color, laser light focused on tissues is re-emitted in colors that are determined by the properties of the molecules. When these emissions are collected and analyzed (fluorescence spectroscopy), they provide information about the molecular and biochemical status of the tissue.

Time resolution adds a greater degree of specificity, measuring not only the wavelength of the emission but the time that molecules remain in the excited state before returning to the ground state. This information is valuable because some emissions overlap on the light spectrum but have different “decay” characteristics.

“The goal of our current research is to define how well the TR-LIFS technique can detect the features associated with plaque vulnerability, but our long-term objective is to develop a minimally invasive, intravascular probe that will monitor plaque over time or guide therapeutic interventions to prevent plaque rupture,” Marcu said.

The TR-LIFS system consists of a laser, a two-way fiber-optic probe through which the laser light is delivered to the tissue and the fluorescence is collected, a spectrometer, a digital oscilloscope, and a computer workstation that provides user interface, coordination of components and interpretation software.

The study was supported by National Institutes of Health Grant R01 HL 67377.

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