

A more accurate and noninvasive look at cancerous tumors

July 10 2012, by Christina Cavanaugh

(Medical Xpress) -- Chao Zhou believes his work with combining imaging technologies has the potential to improve surgeries that remove malignant breast tumors.

“As many as 40 percent of breast cancer patients now have to undergo a second surgery, because part of the tumor is left behind during the first,” says Zhou, an assistant professor of electrical and computer engineering.

By combining two technologies—optical coherence tomography (OCT) and confocal microscopy—Zhou says doctors can more precisely pinpoint a tumor’s location and remove it entirely on the first try.

One advantage of this hybrid approach, he says, is that it allows tissue to be imaged without being damaged or removed from the body. Tissue suspected of being cancerous is now typically removed, sectioned and stained—a technique known as histopathology—before it can be examined.

The combination of OCT and confocal microscopy can also provide information about embryonic forms without requiring samples to be removed from organisms.

Imaging in real time

OCT enables 3-D tissue imaging based on recognition and analysis of the

light-scattering patterns caused by internal structures. Confocal microscopy, a form of optical microscopy, produces high-resolution [images](#) but cannot penetrate tissue as deeply. Optical coherence microscopy (OCM) combines the two and increases resolution and imaging depth by compiling only coherent light, which is in focus.

“The goal of [my research](#) is to provide in situ, real-time imaging of tissue microstructures with a resolution approaching that of histopathology,” says Zhou, who is affiliated with Lehigh’s bioengineering program.

Before joining the faculty in June, Zhou was a senior postdoctoral associate at the Massachusetts Institute of Technology, where he pioneered the use of OCT in cancer detection.

He received a Pathway to Independence research award in 2011 from the National Institute of Biomedical Imaging and Bioengineering in the National Institutes of Health.

Until now, says Zhou, doctors have evaluated tumor margin by taking a frozen section or histopathology. These techniques do not provide instant results.

OCT, by contrast, achieves real-time imaging. By combining OCT and OCM, Zhou can alternate between high and low magnifications when viewing the same fresh, unsliced tissue samples. He has been able to identify clusters of cancerous cells within a larger sample based on the tissue’s appearance under a microscope.

“We’re also using OCT and OCM to look at developmental biology,” Zhou said. “In current practice, if you want to examine a developing embryo or animal, you have to sacrifice it and cut it up. Our goal is to be able to image embryonic structures in a less destructive way.

“We can image [interior cross-sections of] the systolic and diastolic rhythms of an embryonic fly’s heart, and compare a normal heart to one with cardio-arrhythmia,” Zhou said. Because the heart rhythm is being imaged, it is vital that the organism be living; this can be accomplished with OCT. Zhou plans to extend his imaging of embryonic forms to other organisms.

“OCT, when combined with OCM, can get in vivo, 3-D structural and functional images without needing to remove and process tissues,” Zhou says. “OCT and OCM allow us to lay the foundations for providing real-time information in surgical suites and the pathology lab.”

Provided by Lehigh University

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