Smart lasers could make cancer biopsies painless, help speed new drugs to market

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Biopsies in the future may be painless and noninvasive, thanks to smart laser technology being developed at Michigan State University.

To test for skin cancer, patients today must endure doctors cutting away a sliver of skin, sending the biopsy to a lab and anxiously awaiting the results. Using laser microscopes that deploy rapid, ultra-short pulses to identify molecules, doctors may soon have the tools to painlessly scan a patient's troublesome mole and review the results on the spot, said Marcos Dantus.

The results touting this new molecule-selective technology can be found in the current issue of Nature Photonics, which Dantus co-authored with Sunney Xie of Harvard University.

"Smart lasers allow us to selectively excite compounds – even ones with small spectroscopic differences," said Dantus. "We can shape the pulse of the lasers, excite one compound or another based on their vibrational signatures, and this gives us excellent contrast."

In the past, researchers could approach this level of contrast by introducing fluorescent compounds. With the breakthrough using stimulated Raman scattering microscopy, fluorescent markers are unnecessary.

"Label-free molecular imaging has been the holy grail in medicine," Dantus said. "SRS imaging gives greater specificity and the ability to

map a particular chemical species in the presence of an interfering species, such as cholesterol in the presence of lipids."

Additional potential applications include allowing researchers to closely examine how compounds penetrate skin and hair. Smart lasers also can better identify how drugs penetrate tissue and how drugs and tissue interact, thus mitigating the chances of potential side effects and helping reduce the time required to bring new drugs to market.

Dantus also is using smart laser imaging technology at MSU for detecting traces of hazardous substances from a distance.

"The ability to image with molecular specificity and sensitivity opens a number of applications in medicine as well as in homeland security," he said.

Collaboration for the paper began when Harvard graduate student Christian Freudiger contacted BioPhotonic Solutions, a high-tech company Dantus launched in 2003 based on his research at MSU. Dantus was not only able to provide the laser pulse shaper Harvard needed to conduct the research, but he also was able to lend his expertise as well as the support of his MSU laboratory, Dantus said.

"I like to say that we enable technology," he said. "Controlling ultrashort pulses, which once required Ph.D. experts, can now be done with push-button simplicity by a small computer-controlled box. This instrument is now being used in the most prestigious research laboratories in the world."

Provided by Michigan State University

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