Imaging Drug Effects on Tumors

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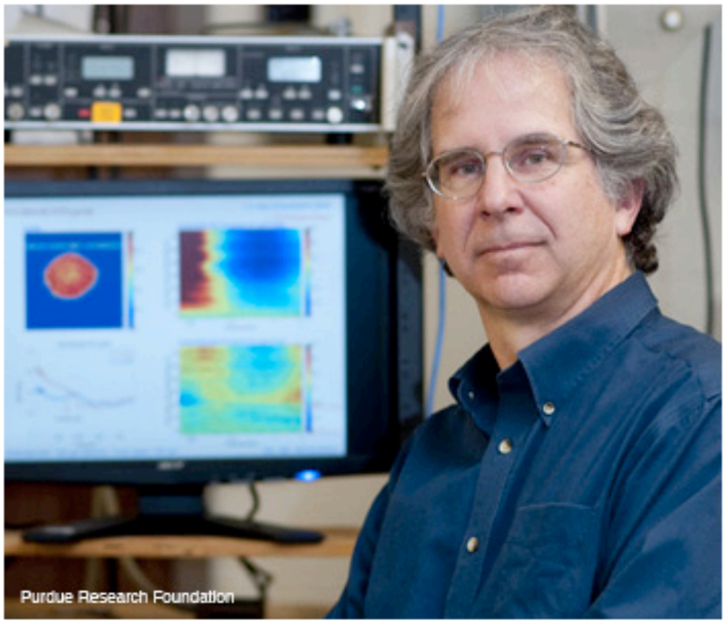
Holographic tissue dynamics spectroscopy—a method developed by Purdue researcher David Nolte with colleagues at Purdue—allows researchers to look at motion inside living tissue. It could provide a way to detect the effects of new drugs on cancerous tumors. At the recent LabAutomation Conference in Palm Springs, Calif., U.S.A., Nolte says, "It generated a lot of excitement because it is a new form of high-content screeningÂ that works without labels that could be valuable in drug discovery." (See "Motility Contrast Imaging in Three-Dimensional Tissue-Based Drug Screening," by D. Nolte et al., LabAutomation2011.)



David Nolte with spectrograms created using holographic tissue dynamics spectroscopy. The spectrograms show how cells react to drugs.

The system can detect subcellular motion in living tissue in three dimensions. It uses a digital holographic imaging technique that can see motion as deep as 1 mm below the surface.

The researchers used multicellular tumors with proliferating cells surrounding an oxygen-depeleted core. When they shine a laser on the tumor, the speckle images shimmer due to natural movement in the cells. Fluctuation spectroscopy allows them to capture information about cellular function in the tissue based on the changing speckle.

"After making the hologram, my colleagues and I use fluctuation analysis to measure the time-dependent changes in the hologram," Nolte said. "Fluctuation spectroscopy breaks down the changes into different frequencies, and we can tell how a cell's membrane, mitochondria, nucleus and even cell division respond to drugs. We measure the frequency of the light fluctuations as a function of time after a drug is applied."

The resulting frequency-versus-time spectrogram provides a "fingerprint" of how cell motion responds to a drug, much as a voice-print spectrogram captures unique signatures of a voice.

The ability of the research to offer high throughput is particularly exciting for drug researchers. Nolte says the technology could create 384 spectrograms in six hours. The patented technology is available for licensing from the Purdue Research Foundation Office of Technology Commercialization.

Yvonne Carts-Powell is a freelance science writer who specializes in optics and photonics.