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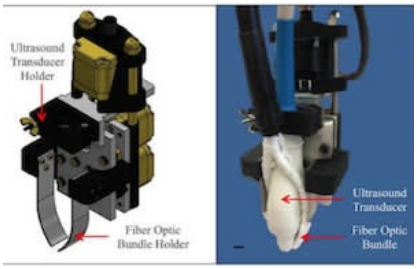
Novel biomedical imaging system combines optical, ultrasound technology



Purdue University researchers are developing a novel biomedical imaging system, known as photoacoustic tomography (PAT), that combines optical and ultrasound technology to improve diagnosis of life-threatening diseases. The system provides real-time compositional information of body tissue without the need for contrast agents and with better depth penetration compared with conventional optical techniques.

However, one cause for suboptimal PAT penetration depth is attenuation of incident light by soft tissue. The researchers believe creating optical manipulation techniques to maximise photon density could provide a solution. The results of their study describing an adjustable photoacoustic probe with improved light delivery and image quality were published online in the journal Photoacoustics.

The Purdue team has created a motorised photoacoustic holder that allows users to easily manoeuvre the fibre optic bundles to tune the depth where light is focused, improving the light penetration depth and signal-to-noise ratio of the images.

PAT is a noninvasive technique that works by converting absorbed optical energy into acoustic signal. Pulsed light is sent into body tissue, creating a small increase in temperature that causes the tissue to expand and create an acoustic response that can be detected by an ultrasound transducer. The ultrasound data is used to visualise the tissue.

"The nice thing about photoacoustic tomography is the compositional information," said study lead author Craig Goergen, an assistant professor in Purdue's Weldon School of Biomedical Engineering. "It provides information about where blood and lipid are located, along with other essential information."

The ultimate goal is to enhance the clinical care of patients.

PAT can be used to detect or monitor a myriad of diseases, including cardiovascular disease, diabetes, and cancer. Those are diseases that the U.S. Centers for Disease Control and Prevention lists as among the most common, costly, and preventable of all health problems. Heart disease and cancer each account for one in every four deaths a year in the United States.

"Trying to diagnose these diseases at an earlier time can lead to improved patient care," Goergen said. "We are in the process now of trying to use this enhanced imaging approach to a variety of different applications to see what it can be used for."

Among other potential uses for PAT is the mapping of lipid deposition within an arterial wall that can cause other health problems, measuring cardiac tissue damage and tumour biopsies. Using PAT for intraoperative tumour biopsies could help surgeons make sure they remove all the cancer from a patient, Goergen explained.

Source: Purdue University
Image credit: Purdue Research Foundation

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