Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

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Non-contact, All Optical, Photoacoustic Microscopy

Invention Description

Photoacoustic microscopy (PAM), the imaging technique that generates acoustic waves caused by thermal expansion due to optical absorption, has been successfully utilized to provide absorption-based contrast at unparalleled depths. Recent advancements in PAM have enabled contrast-free image reconstructions of subcellular components with exceptional resolution. However, traditional PAM techniques still require a transducer to be in direct contact with the sample or a coupling medium to enable signal acquisition. This leads to poor translation into clinical applications.

Researchers at Arizona State University have developed an unprecedented new form of non-contact, all-optical PAM technology for precisely mapping tissue biomechanics. This technology enables the biomechanical properties of cells and tissues to be measured with sub-micron diffraction-limited resolution without the need for a transducer or coupling medium. Utilization of this non-contact PAM technology provides for mechanobiology interrogations at greater tissue depths with dramatically reduced signal acquisition times, improving the feasibility for clinical applications.

This technology could be a superior non-contact method of optical detection of the photoacoustic effect, enabling the next generation of PAM.

Potential Applications

- Clinical tool for imaging and measuring biomechanical properties of selected cells and tissues
  - Diagnostic tool in ophthalmology (keratoconus, myopia, etc.)
- Research tool for mechanobiology tissue and cellular investigations

Benefits and Advantages

- Does not require transducer in contact with the sample or a coupling medium
- Can determine biomechanical properties of the cornea non-invasively
- Dramatically reduced imaging time
- May enable submicron-resolution intracellular imaging of molecules
- Contrast free – DNA, RNA, the cytoplasm, and myelin sheath have strong absorption peaks in the UV, visible and NIR range and can act as endogenous chromophores
- Increases clinical translation of PAM

For more information about the inventor(s) and their research, please see

Dr. Smith's departmental webpage