Light, Sound, nanoAction:
nanoparticle-augmented ultrasound-guided photoacoustic imaging

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A quantitative morphological, functional and molecular imaging technique capable of visualizing biochemical, pharmacological and other processes in vivo and repetitively during various stages of tumor progression and cancer treatment is desired for many fundamental, preclinical and clinical applications. Recently, we introduced several ultrasound-based imaging techniques capable of visualizing anatomical structures and functional information about the tissue. Furthermore, targeted contrast agents were developed to enable the cellular and molecular sensitivity of the developed imaging techniques.

In this presentation, combined ultrasound and photoacoustic imaging augmented with imaging contrast nanoagent will be introduced. Specifically, USPA imaging to simultaneously obtain the anatomical and molecular map of tumor in-vivo will be presented. An example using gold nanospheres (AuNPs) functionalized to target cancer biomarker (e.g., EGFR) will be given. Furthermore, we will demonstrate the role of USPA imaging in therapy planning, guidance and monitoring. For example, image-guided photothermal therapy of cancer using targeted metal nanoparticles will be discussed. Finally, design and synthesis of contrast nanoagents with properties desired for cellular/molecular USPA imaging will be presented and discussed.

The presentation with conclude with the discussion of advanced developments in morphological, functional and molecular USPA imaging. Applications of the nanoparticle-augmented USPA imaging ranging from macroscopic to microscopic visualization will be presented, and future directions will be described.