Minimally Invasive Therapy Strategies and Multimodal Contrast-Enhanced Imaging Technologies by Biomedical Ultrasound

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Abstract: Ultrasound – a real-time, high-resolution, portable, non-ionizing and cost-effective imaging technique, continues to proliferate in the preclinical and clinical environment. Unfortunately, contrast and consequently, sensitivity and specificity of ultrasound imaging is relatively low compared to other imaging modalities. My research focuses on overcoming these limitations by exploiting the synergies between ultrasound and other technologies. For example, by combining with contrast agents and/or light, ultrasound imaging is able to achieve high sensitivity as well as high specificity, and also provide additional functional information. This combination has a great potential leading to more effective diagnosis of diseases such as cancer, and allowing for minimally invasive localized therapies such as tissue reduction. In the first part of the talk, I will introduce my work on developing a minimally invasive "microsurgery" strategy utilizing the bioeffects induced by ultrasound and microbubbles to achieve cardiac tissue reduction for hypertrophic cardiomyopathy. This strategy provides a great potential as a minimally invasive alternative to the current invasive surgery practice. In the second part of the presentation, I will cover my ongoing research and future plans on (1) designing customized ultrasound imaging sequences for optically triggered perfluorocarbon nanodroplets (PFCnDs), a theranostic ultrasound and photoacoustic agent, to probe tumor microenvironment, (2) exploiting the system's ultrasound-guided photoacoustic imaging capability to achieve early melanoma micrometastasis detection, (3) exploring ultrasound-guided photoacoustic imaging and elasticity imaging of implanted devices for tissue engineering applications.

Bio: Yiying Zhu received her Ph.D. in Biomedical Engineering (2017) and M.S.E. in Electrical Engineering (2013) both from the University of Michigan, where she was recipient of the Endowment for the Development of Graduate Education (2016) recognizing the impact of her dissertation research. She received her B.S. in Electrical Engineering from the University of Birmingham (UK), and B.S.E. in Telecommunication Engineering from Huazhong University of Science and Technology (China) in 2011.

Dr. Zhu is currently a postdoctoral fellow at the Georgia Institute of Technology School of Electrical and Computer Engineering, where she works at the Ultrasound Imaging and Therapeutics Research Laboratory. The laboratory is an integral part of Georgia Institute of Technology and Emory University School of Medicine, focusing on contemporary challenges in biomedical imaging and therapeutics. Dr. Zhu is the recipient of a Peer Reviewed Cancer Research Program Horizon Award from the Department of Defense.

Dr. Zhu's research interest is to advance ultrasound-based technology that exploits the promising synergy between ultrasound and light with nano contrast agents for personalized medicine.