Abstract: Wouldn’t it be great to perform a surgery without incision or bleeding? “Histotripsy” is a new non-invasive ultrasound ablation technique that fractionates and removes tissue using focused high intensity ultrasound pulses by controlling acoustic cavitation. “Histo” means soft tissue in Greek, and tripsy means “breakdown”. Using ultrasound pulses applied from outside the body and focused to the diseased tissue, histotripsy produces a cluster of energetic microbubbles at the target tissue using the endogenous gas pockets. These microbubbles, each similar in size to individual cells, function as “mini-scalpels” to fractionate cell and tissue structures. The overlying tissue between the target tissue and the skin is not damaged and no incision is needed. These microbubbles can be clearly visualized on ultrasound imaging system, which are used to guide and monitor the histotripsy treatment. Histotripsy has potential for many clinical applications where non-invasive tissue removal is desired. I will talk about the mechanism and instrumentation development of histotripsy as well as potential clinical applications of histotripsy including cancer, cardiovascular disease, and immunotherapy.

Ablation zones generated by histotripsy in the live pig brain (pointed by arrow) with high precision and control. A) single ablation zones; B) Check-board ablation zones; C) block “M” ablation zone.

About the speaker: Zhen Xu is a tenured Associate Professor and Associate Chair of Graduate Education at the Department of Biomedical Engineering at the University of Michigan. She received the B.S.E. degree in biomedical engineering from Southeast University, Nanjing, China, in 2001, and her M.S. and Ph.D. degrees from the University of Michigan in 2003 and 2005, respectively, both in biomedical engineering. Her research is focusing on ultrasound therapy, particularly the applications of histotripsy for noninvasive surgeries. She received the IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society Outstanding Paper Award in 2006; American Heart Association (AHA) Outstanding research in Pediatric Cardiology in 2010; National Institute of Health (NIH) New Investigator Award at the First National Institute of Biomedical Imaging and Bioengineering (NIBIB) Edward C. Nagy New Investigator Symposium in 2011, and The Federic Lizzi Early Career Award from The International Society of Therapeutic Ultrasound (ISTU) in 2015. She is currently an associate editor for IEEE Transactions on Ultrasound, Ferroelectrics, and Frequency Control (UFFC), WIE chair for IEEE UFFC, and board member of ISTU. She is a principal investigator of grants funded by National Institute of Health, Department of Defense, Office of Navy Research, American Cancer Association, The Hartwell Foundation, Focused Ultrasound Foundation, and The Coulter Foundation.