

## “Ultrasound-Enhanced Drug Delivery for the Treatment of Cardiovascular Disease”

**Christy Holland, PhD**

Professor

Department of Internal Medicine  
University of Cincinnati



Dr. Holland attended Wellesley College where she was a double major (B.A.) in Physics and Music in 1983. She completed M.S. (1985), M.Phil. (1986), and Ph.D. (1988) degrees at Yale University in Engineering & Applied Science. She is currently a Professor in both the College of Medicine and the College of Engineering and Applied Sciences at the University of Cincinnati (UC) with joint appointments in the Department of Internal Medicine, Division of Cardiovascular Health and Disease, and the Department of Biomedical Engineering (BME). Prof. Holland serves as Scientific Director of the Heart, Lung, and Vascular Institute, a key component of efforts to align the UC

College of Medicine and UC Health efforts around research, education, and clinical programs. She is a fellow of the Acoustical Society of America, the American Institute of Ultrasound in Medicine, the American Institute for Medical and Biological Engineering, and the Executive Leadership in Academic Medicine®. Prof. Holland continues to serve as Editor-in-Chief of Ultrasound in Medicine and Biology, the official Journal of the World Federation for Ultrasound in Medicine and Biology, a post she assumed in 2006. She served as President of the Acoustical Society of America from 2015 to 2017. She is actively involved in teaching biomedical engineering and biomedical ultrasound in the BME undergraduate and graduate curricula and received teaching awards in the UC Colleges of Engineering and Medicine in 2008 and 2009. She served as the Director of Graduate Studies for BME in 2007-2009. She mentors and advises students within and outside of BME educational programs. Prof. Holland's research interests include ultrasound-enhanced thrombolysis for stroke therapy, ultrasound-mediated drug delivery, bioeffects of diagnostic and therapeutic ultrasound, and acoustic cavitation. She directs the Image-guided Ultrasound Therapeutics Laboratories in the UC Cardiovascular Center, which focus on applications of biomedical ultrasound including sonothrombolysis, ultrasound-mediated drug and bioactive gas delivery, development of echogenic liposomes, early detection of cardiovascular diseases, and ultrasound-image guided tumor ablation.

### ABSTRACT

Cardiovascular disease is the number one cause of death worldwide and thrombo-occlusive disease is a leading cause of morbidity and mortality. Ultrasound has been developed as both a diagnostic tool and a potent promoter of beneficial bioeffects for the treatment of cardiovascular disease. Ultrasound exposure can induce the release, delivery and enhanced efficacy of a thrombolytic drug (rt-PA), antibiotics, or bioactive gases from microbubbles. By encapsulating drugs into micron-sized and nano-sized liposomes, the therapeutic can be shielded from degradation within the vasculature until delivery is triggered by ultrasound exposure. Microbubbles oscillate when exposed to ultrasound and create stresses directly on nearby tissue or induce fluid effects that effect drug penetration into vascular tissue, lyse thrombi or direct drugs to optimal locations for delivery. Insonification accelerates clot breakdown in combination with rt-PA and ultrasound contrast agents, which nucleate sustained bubble activity, or stable cavitation. Mechanisms for ultrasound enhancement of thrombolysis and sonobactricide, with a special emphasis on acoustic cavitation and radiation force, will be reviewed.

**Friday, October 23rd**

**12:00 Noon**

Seminar will be presented virtually via Zoom:

<https://go.unc.edu/f3QHx>