PROMOTION RECOMMENDATION
The University of Michigan
College of Engineering
Department of Biomedical Engineering
Medical School
Department of Pediatrics and Communicable Diseases

Approved by the Regents May 21, 2015

Zhen Xu, assistant professor of biomedical engineering, College of Engineering and Medical School, and assistant professor of pediatrics and communicable diseases, Department of Pediatrics and Communicable Diseases, Medical School, is recommended for promotion to associate professor of biomedical engineering, with tenure, Department of Biomedical Engineering, College of Engineering and Medical School, and associate professor of pediatrics and communicable diseases, without tenure, Department of Pediatrics and Communicable Diseases, Medical School.

Academic Degrees:

Ph.D.	2005	University of Michigan, Biomedical Engineering, Ann Arbor, MI
M.S.	2003	University of Michigan, Biomedical Engineering, Ann Arbor, MI
B.S.E.	2001	Southeast University, Biological Science and Medical Engineering, Nanjing, China

Professional Record:

2012 – present	Assistant Professor, Department of Pediatrics, University of Michigan
2009 – present	Assistant Professor, Department of Biomedical Engineering, University of Michigan
2007 – 2009	Assistant Research Scientist, Department of Biomedical Engineering, University of Michigan
2005 – 2006	Post-Doctoral Fellow, Department of Biomedical Engineering, University of Michigan

Summary of Evaluation:
Teaching: Professor Xu is an effective educator, both inside and outside of the classroom. As an expert in the area of medical imaging, she has taught both an undergraduate instrumentation lab (BME 458) and a graduate class on medical imaging systems (BME 516). Her Q1 and Q2 scores are consistently high and were 4.83 and 4.93, respectively, for the fall 2014 semester. Student comments indicate that she is clearly respected and valued as a teacher. Outside of the classroom, Professor Xu has mentored multiple undergraduate research projects, providing them the opportunity for hands-on work in her lab.

Professor Xu has also been an active mentor. She has graduated three Ph.D. students thus far and has two more who will finish in the next year or two. Additionally, she has advised or co-advised eight master's students. She has published extensively with her students, with no fewer than 20 publications in the past four years, a strong indicator of her dedication to graduate training.

Research: Professor Xu is one of the initial developers of histotripsy, a non-invasive ultrasound therapy that can break down soft tissues within the body. Histotripsy is sometimes likened to a "virtual scalpel" and since starting her appointment in 2009, Professor Xu has focused her efforts on developing translational applications of this technology. Her most significant advances have come in

applying histotripsy to the treatment of liver cancer, thrombosis (blood clots), and congenital heart defects. This work has resulted in an impressive number of publications, and the citations of her work indicate that she is highly regarded by engineers, scientists and clinicians in her field. Professor Xu has also given invited talks at a number of national and international meetings, underlining her position as a leader in the field.

In addition to publications, Professor Xu has been similarly successful in securing research funding from a number of sources, including NIH, the American Cancer Society, and the Coulter Foundation. She has brought in more than $15 million as the PI or a co-I in the past five years, and given the broad range of potential medical applications of her technology, she has tremendous potential for maintaining this level of success.

Recent and Significant Publications:

E. Vlaisavljevich, Y. Kim, S. Allen, G. Owens, S. Pelletier, C. Cain, K. Ives and Z. Xu, "Image-guided non-invasive ultrasound liver ablation using histotripsy: feasibility study in an *in vivo* porcine model," *Ultrasound in Medicine & Biology,* 39, 1398-1409, 2013.

A. D. Maxwell, C. A. Cain, T. L. Hall, J. B. Fowlkes and Z. Xu, "Probability of cavitation for single ultrasound pulses applied to tissues and tissue-mimicking materials," *Ultrasound in Medicine & Biology,* 39, 449-465, 2013.

A. D. Maxwell, T. Y. Wang, C. A. Cain, J. B. Fowlkes, O. A. Sapozhnikov, M. R. Bailey and Z. Xu, "Cavitation clouds created by shock scattering from bubbles during histotripsy," *The Journal of the Acoustical Society of America,* 130, 1888-1898, 2011.

A. D. Maxwell, G. Owens, H. S. Gurm, K. Ives, D. D. Myers, Jr. and Z. Xu, "Noninvasive treatment of deep venous thrombosis using pulsed ultrasound cavitation therapy (histotripsy) in a porcine model," *Journal of Vascular and Interventional Radiology,* 22, 369-377, 2011.

G. E. Owens, R. M. Miller, S. T. Owens, S. D. Swanson, K. Ives, G. Ensing, D. Gordon and Z. Xu, "Intermediate-term effects of intracardiac communications created noninvasively by therapeutic ultrasound (histotripsy) in a porcine model," *Pediatric Cardiology*, 33, 83-89, 2012.

Service: Professor Xu has been an asset to her department, the college and the university, and scientific societies to which she belongs. At the department level, she has served in a number of positions including as a member of the Graduate Education Committee, the Core Curriculum Committee, and the Bioelectrical Curriculum Working Group. Within the university, she has served as the liaison for the Women in Science and Engineering (WISE) program for several years and in 2012 and 2013 hosted the visit of NextProf participants to the department by arranging for laboratory tours and discussions on how to land tenure-track faculty jobs. In terms of national service, Professor Xu has chaired and organized sessions at international meetings and is an associate editor of the *IEEE Transactions in Ultrasonics, Ferroelectrics and Frequency Control.*

External Reviewers:

Reviewer A: "On a personal note, I have actually actively tried to recruit Dr. Xu for the past 4-5 years…We were ready to award her, not only Assistant Professor, but also a tenured position at [my institution] over 5 years ago, as she was beginning to obtain her R01 grants."

Reviewer B: "Her list of publications reveals that she has been very productive, focused on the goals and able to bring the results into the best journals in the field…Prof. Xu has brought histotripsy to medical applications; the transfer of engineering knowledge to the medical world is the most sought after skill of professionals in Biomedical Engineering. This is a good indicator of success."

Reviewer C: "With respect to the quality, productivity and scholarly impact of Dr. Xu's work, I find it impressive. Dr. Xu has published extensively in the area of histotripsy, which involves ultrasonic tissue fractionation due to the controlled induction of acoustic cavitation using short duration, high amplitude acoustic pulses. She has been a pioneer of this novel therapeutic technique since its inception."

Reviewer D: "I believe that Dr. Xu has excelled in all of the areas that an outstanding research university, like Michigan, expects their faculty to operate. Her metrics in publication, impact and grantsmanship are well beyond those expected for tenure at my institution. Her future trajectory appears to be very strong, as she is a leader in a very promising area and has developed clinical and animal studies that position her to continue pioneering in the field of histotripsy."

Reviewer E: "She is widely considered as a world expert in histotripsy with outstanding reputation. She has been able to build several novel avenues of histotripsy over the past five years including applications to cardiology and stroke as well as thrombolysis and cancer therapy. Therefore, she is one of the point persons in the field for therapeutic ultrasound and histotripsy as it pertains to liver tumor and heart defects treatment."

Summary of Recommendation: Professor Xu has made outstanding contributions in the area of ultrasound, biomedical imaging and histotripsy. In addition to research, she has made important contributions in service and is a valued educator and mentor. It is with the support of the College of Engineering Executive Committee that I recommend Zhen Xu for promotion to associate professor of biomedical engineering, with tenure, Department of Biomedical Engineering, College of Engineering and Medical School, and associate professor of pediatrics and communicable diseases, without tenure, Department of Pediatrics and Communicable Diseases, Medical School.

David C. Munson, Jr.
Robert J. Vlasic Dean of Engineering
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James O. Woolliscroft, M.D.
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