Kyle T. Rich

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Education

2016 **Ph.D. candidate**, *Biomedical Engineering*.
University of Cincinnati, Cincinnati, OH (anticipated defense date: 02/2017)

2008 **Bachelor of Science (B.Sc.)**, *Physics*, minor: Mathematics.
Northern Kentucky University, Highland Heights, KY

Skills

Technical: Computational, mathematical and statistical modeling, signal processing, hypothesis testing & statistical analysis, experimental design, instrument control, data visualization

Languages & software: Matlab, Python (NumPy, SciPy, Matplotlib, Pandas*, scikit-learn*), R (ggplot2*), Mathematica, Git, LaTeX, Microsoft Office, Linux\Unix (* indicates basic experience)

Work Experience

2009–17 **Research Assistant**, *Biomedical Acoustics Laboratory*, University of Cincinnati.
- Developed analytic model to account for random diffraction effects in microbubble emission measurements, enabling estimates of microbubble-radiated acoustic power. Leveraged random processes simulations (Matlab) to validate model and assess accuracy of radiated acoustic power estimates to within ± 1 decibel (dB) accuracy
- Developed measurement and signal processing techniques for calibrating acoustic receivers for absolute pressure measurements. Numerically simulated (Python and Matlab) scattered, transmitted, and radiated acoustic field measurements to define parameters for accurate calibration with less than 10% error
- Fabricated and programmed (Matlab) novel devices for autonomous acoustic field raster scan, monitoring microbubble-generated acoustic emissions, and measuring electrical resistance of tissue
- Identified mechanisms of ultrasound-enhanced transdermal drug delivery (sonophoresis). Developed algorithms for spectral (Matlab) and statistical (R) analysis of >300 GB of data, leading to discovery of empirical relationship between cavitation-radiated acoustic power and skin permeabilization
- Disseminated results through 4 publications in peer-reviewed journals, presented data-driven results at national science meetings, and to technical and non-technical audiences

2013–14 **Assistant to Editor-in-Chief**, *Ultrasound in Medicine and Biology (UMB) journal*.
- Performed primary review of appx. 40 manuscripts submitted for publication per month

2011–13 **Research Fellow**, *National Science Foundation IGERT Biomembrane Research Traineeship*.
- Devised a research plan that was awarded funding over a 2 year period
- Participated in interdisciplinary collaborative, leading to the development of an *in vitro* skin model used for remote monitoring of skin permeability during sonophoresis

2008 **Research Assistant**, *Solid State Physics Lab*, Northern Kentucky University.
- Investigated bulk-produced $CoFe(x)O(y)$ (cobalt ferrite) for potential pressure sensors applications. Manufactured and characterized composites using WAXS and impedance spectroscopy

Teaching Experience

2008–10 **Teaching Assistant**, *University of Cincinnati.*
- Modeling and Analysis of Systems (BME 306)
- Biomedical Instrumentation (BME 310)
  - Conducted laboratory instruction on MATLAB-based modeling and analysis of biomedical engineering systems and processes including basic signal analysis, first- and second-order systems.

2008 **Teaching Assistant**, *Northern Kentucky University.*
- Introduction to Physics (PHY 220)
  - Conducted corollary lecture and study sections covering introductory topics in physics.

Publications

Peer-reviewed manuscripts

[P1] **K. T. Rich** and T. D. Mast, "A method for characterization of the acoustic power radiated by cavitation bubbles using a single-element receiver measurements." (in preparation)

[P2] K. J. Haworth, K. B. Bader, **K. T. Rich**, C. K. Holland, T. D. Mast, "Quantitative Frequency-Domain Passive Cavitation Imaging," *IEEE Trans. Ultrason., Ferroelect., Freq. Control.* (online 10/2016)

[P3] **K. T. Rich** and T. D. Mast, "Methods to calibrate the absolute receive sensitivity of single-element, focused transducers," *J. Acoust. Soc. Am.*, vol. 138, no. 3, pp. EL193–EL198, 2015.

[P4] **K. T. Rich** and T. D. Mast, "Accuracy of a bistatic scattering substitution technique for calibration of focused receivers," *J. Acoust. Soc. Am.*, vol. 138, no. 5, pp. EL469–EL473, 2015.

[P5] **K. T. Rich**, C. L. Hoerig, M. B. Rao, and T. D. Mast, "Relations between acoustic cavitation and skin resistance during intermediate- and high-frequency sonophoresis," *J. Control. Release*, vol. 194, pp. 266–277, 2014.

Conference abstracts, proceedings, and presentations

[C1] **K. T. Rich**, T. D. Mast, "A method to calibrate the absolute receive sensitivity of spherically focused, single-element transducers," *J. Acoust. Soc. Am.* 136, 2302 (2014).

[C2] **K. T. Rich**, C. L. Hoerig, and T. D. Mast, "Cavitation mechanisms in ultrasound-enhanced permeability of *ex vivo* porcine skin," *Proc. Mtgs. Acoust.*, vol. 18, no. 1, (2014).

[C3] **K. T. Rich**, S. Nye, M. Ericson, R. Hoerr, T. D. Mast. "Visualization of Ultrasound-Enhanced Delivery of Polystyrene Nanoparticles into Ex Vivo Human Skin via the Follicular Route," Regional Symposium on Applications of Biomembranes in Sci. and Tech. (2011)

Professional Affiliations and Positions

2013–15 University of Cincinnati Student Chapter of the Acoustical Society of America (Representative to National Committee, Chapter President)

2010-16 Sigma Xi (Associate Member)

2009–16 Acoustical Society of America (Student Member)

2007–08 Northern Kentucky University Physics Students Club (Vice President)

Honors & Awards

2013 University of Cincinnati, Editorial Assistantship: Ultrasound in Medicine and Biology

2011,12 National Science Foundation, IGERT Traineeship, Biomembrane Research

2010 American Institute of Physics, Physical Acoustics Summer School Scholarship

2008 University of Cincinnati, Graduate Student Scholarship

2008 Northern Kentucky University, Undergraduate Mentoring Scholarship