Curriculum Vitae

Christy K. Holland

Professor
Internal Medicine, Division of Cardiovascular Diseases and Biomedical Engineering
Scientific Director, Heart, Lung, and Vascular Institute
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Education

Ph.D., Engineering and Applied Science, Yale University	1989
M.Phil., Engineering and Applied Science, Yale University	1987
M.S., Engineering and Applied Science, Yale University	1985
B.A., Physics and Music (Cum Laude), Wellesley College	1983
Junior year abroad, Universität Freiburg and Hochschule für Musik Freiburg (Beethoven und Schubert)	1982

Professional Experience

Scientific Director, Heart, Lung, and Vascular Institute University of Cincinnati, College of Medicine	2016 -
Director of Research, Heart, Lung, and Vascular Institute University of Cincinnati, College of Medicine	2014-2016
Associate Director of Research, Heart, Lung, and Vascular Institute University of Cincinnati, College of Medicine	2013-2014
Professor, Internal Medicine, Division of Cardiovascular Health and Diseases, Biomedical Engineering, and Radiology	2010 -
Professor, Depts. of Biomedical Engineering and Radiology University of Cincinnati, Colleges of Engineering and Medicine	2009-2010
Associate Professor, Depts. of Biomedical Engineering and Radiology University of Cincinnati, Colleges of Engineering and Medicine Director of Graduate Studies (2008-2009) Tenured 09/2005 Director of Research (2001-2007)	2001-2009
Adjunct Associate Professor, Dept. of Aerospace Engineering and Engineering Mechanics, University of Cincinnati	1999-2001
Research Associate Professor, Dept. of Radiology University of Cincinnati, College of Medicine (Medical Physics)	1994-2001
Acoustics Consultant, Trustees for the Bowling/Pfizer Heart Valve Settlement Fund, federal court appointed scientific advisory committee	1994, 2001
Associate Research Scientist, Dept. of Diagnostic Radiology, Yale School of Medicine (Ultrasound Physics)	1991-1994
Post-Doctoral Associate, Joint appointment with Dept. of Diagnostic Radiology, Yale School of Medicine and Dept. of Mechanical Engineering, Yale University (Diagnostic Ultrasound)	1989-91
Architectural Acoustics Consultant, Cesar Pelli & Associates (Modified Ley Student Center at Rice Univ., Houston, Texas)	1985-86
Research Assistant, Department of Mechanical Engineering, Yale University (Thresholds of cavitation produced by pulsed ultrasound)	1983-89

Professional Society and Study Section Activities

Acoustical Society of America, Fellow:
- Elected as President Elect, President, Past President (2014-2017)
- Chair, ASA Editor in Chief Search Committee (2014)
- Elected to Executive Council (1999-2002)
- Cavitation Working Group (Technical Report S1/WG22), published in 2000
- Physical Acoustics Technical Committee (1997 - 2006)
- Biomedical Acoustics Technical Committee (1996 - present)
- Membership Committee (2008 - 2011)
- Nominating Committee (1996)
- Ethics Committee (1996)
- Committee on Public Relations (1994 - 2010)

American Institute of Ultrasound in Medicine, Fellow:
- Elected as Officer, Secretary (2001 - 2005)
- Elected to Board of Governors (1998 - 2001)
- Co-Chair, Mechanical Bioeffects Conference (Aspen, CO: August 1998)
- Organizing Committee, Bioeffects Conference (Keystone, CO: August 2005)
- Organizing Committee, Workshop on Effects of Non-linear Propagation on Output Display Indices (TI and MI), (1998)
- Bioeffects Committee (1994-1997)

IEEE Ultrasonics, Ferroelectrics, and Frequency Control, Member

American Heart Association, Member

Reviewer for the following journals (1989 - 2006):
- Ultrasound in Medicine and Biology
- Journal of the Acoustical Society of America
- Physics in Medicine and Biology
- IEEE Ultrasonics, Ferroelectrics, and Frequency Control
- Applied Physics Letters
- Science
- Nature Biotechnology
- Placenta
- The Journal of Urology
- Journal of Endourology

Reviewer for the following National, State and Private Funding Agencies:
- NIH Biomedical Imaging Technology Study Section BMIT-B (*ad hoc*) (June 2015)
- NIH Surgical Sciences, Biomedical Imaging, and Bioengineering Integrated Review Group, SBIB (*ad hoc*) (February 2013)
- NIH Biomedical Imaging Technology Study Section BMIT-A (*ad hoc*) (February 2012)
- NIH National Institute of Neurological Disorders and Stroke Special Emphasis Panel, ZNS1 SRB – E (*ad hoc*) (August 2012)
- NIH BMIT/CMIP/MEDI member conflict review panel (*ad hoc*) (February 2011)
- NIH National Institute of Neurological Disorders and Stroke NSD-A study section (*ad hoc*) (2009, October 2010)
- NIH Neurotechnology study section (*ad hoc*) (2008 - 2010)
- NIH Diagnostic Imaging study section (*ad hoc*) (1995 - present)

The National Science Foundation (*ad hoc*) (1999 - 2009)
The Wellcome Trust (*ad hoc*) (1999 - 2009)
NSF United States Civilian Research and Development Foundation (CRDF) Biomedical and Behavioral Sciences Program (1997 - 2002)
NIH National Institute of Diabetes and Digestive and Kidney Diseases study section (*ad hoc*) for Program Project Grant (1997)
Louisiana Board of Regents Research and Development Program of the Education Quality Support Fund (1997)
National Science Foundation "Multidisciplinary Research and Education in Cost-Reducing Health Care Technologies" (1997)

Honors

Fellow, Executive Leadership in Academic Medicine, Drexel University (2016-2017)
Cross Cutting Research Individual Award, College of Medicine, University of Cincinnati (2015)
Fellow, American Institute for Medical and Biological Engineering (2015)
Joseph H. Holmes Basic Science Pioneer Award, American Institute of Ultrasound in Medicine (2013)
Thought Provocateur on "Technology," *Life of the Mind* inaugural speaker, University of Cincinnati (April 19, 2011)
Student Council Mentoring Award, Acoustical Society of America (2010)
Richard Akeson Excellence in Teaching Award, College of Medicine, University of Cincinnati (2008-2009)
Master Educator Award, College of Engineering, University of Cincinnati (2008)
Distinguished Researcher Award, College of Engineering, University of Cincinnati (2007)
Editor-in-Chief, Ultrasound in Medicine and Biology (2006 - present)
Associate Editor, Ultrasound in Medicine and Biology (2003-2006)
Honorable Mention, University of Cincinnati Faculty Emerging Entrepreneur Award for Outstanding Achievement (2004)
Attended The Whitaker Foundation Academic Leadership Program (June, 2003)
Fellow, Acoustical Society of America (2001)
Fellow, American Institute of Ultrasound in Medicine (2000)
American Institute of Ultrasound in Medicine Presidential Recognition Award (2000)
International Union for Pure and Applied Biophysics Young Scientist Award, Pushchino, USSR (1990)
Emanuel Gratenstein Fellowship, Yale University (1983)
Sigma Xi (1983)
Graduated *Cum Laude*, Wellesley College (1983)

University of Cincinnati Service Activities

University Level

CCTST Integration Committee (2016-present)
University of Cincinnati Research Advisory Board (2016 - present)
Chair, University of Cincinnati Research Misconduct Committee (2016-2017)
University of Cincinnati Vice President for Research Search Committee (2015-2016)
Biomedical Engineering Task Force (2015-2016)
Intellectual Property Committee (2006 - 2009), Chair (2009 – 2011)
Information Technology Infrastructure Committee (2005 - 2008)
Decanal Review Committee, College of Engineering (2003)

College Level

UC Heart, Lung, and Vascular Institute Executive Committee (2017 – present)

Medical Scientist Training Program Admissions Committee (2016 – present)
Medical Scientist Training Program Promotion Board (2012 – present)
College of Medicine Research Cabinet (2015 - 2017)
Executive Committee of the Physician Scientist Training Program (2011 – 2012)
Committee on Committees, College of Medicine (2010 - 2016)
Labor Verification Reporting Task Force Chair (2012)
Faculty Forum Executive Committee, College of Medicine (2000 - 2011)
Ultrasound Credentialing Subcommittee Chair, University Hospital, 2002. Developed training guidelines for physicians who evaluate ultrasound diagnostic examinations in the Emergency Department and developed an implementation plan for such guidelines.
UCBME Head Search Committee, UCBME-elected member, 2002
Steering Committee, Rowe Center for Women Engineers, College of Engineering (2001-2002)
Women Faculty Advisory Committee, College of Medicine (1997 - 98)
Committee on Research, College of Medicine, Co-Chair (1995-1997)
Core Facilities subcommittee; Facilitation of Research subcommittee

Departmental Level

Member, Faculty Development Council, Dept. of Internal Medicine (2016 – present)
Member, Research Governance Council, Dept. of Internal Medicine (2013 – present)
Vice Chair, Research Governance Committee, Dept. of Internal Medicine (2011 - 2013)
Director of the Image-Guided Ultrasound Therapeutics Laboratories (2010 - present)
Director of BME Graduate Studies (2007 – 2009)
Chair, UCBME Appointment, Reappointment, Promotion and Tenure Committee (2006 - 2009).
Chair, UCBME Faculty Search Committee for Medical Imaging Faculty (2004) Recommended and successfully recruited T. Douglas Mast, Ph.D.
Chair, UCBME Faculty Search Committee for Senior MR Physicist, Center for Imaging Research, 2002. Recommended and successfully recruited Jing-Huei Lee, Ph.D.
Director of Research Administration, Department of Biomedical Engineering (2001 - 2007)
Women in Discovery Executive Committee (an exhibit at the Cincinnati Museum Center on the work of Marie Curie and the discovery of radioactivity) (2001)
Chair of Committee on Research, Department of Radiology, (1996 - 2001)
Scientific Advisory Committee, Imaging Research Center, Children's Hospital Medical Center (1995 - 2001)

Publications

(Names of Students and Postdoctoral Fellows are underlined.)

Peer-reviewed journal articles

1. K. Kooiman, S. Roovers, S. A. G. Langeveld, R. T. Kleven, H. Dewitte, M. A. O'Reilly, J.-M. Escoffre, A. Bouakaz, M. D. Verweij, K. Hynynen, I. Lentacker, E. Stride, **C. K. Holland**, "Ultrasound-responsive cavitation nuclei for therapy and drug delivery," *Ultrasound Med Biol* (In Press, 2020).

2. H. Shekhar, W. Panmanee, M. Lafond, A. Palaniappan, C T. McDaniel, D. J. Hassett, **C. K. Holland**, "Lipid-shelled microbubbles for nitric oxide delivery: Sonobactericide," *Frontiers in Pharmacology* (In Press, 2020).

3. K. R. Lattwein, H. Shekhar, J. J. P. Kouijzer, W. J. B. van Wamel, **C. K. Holland**, K. Kooiman, "Sonobactericide: An emerging treatment strategy for bacterial infections," *Ultrasound Med Biol* 46:193-215 (2020), https://doi.org/10.1016/j.ultrasmedbio.2019.09.011.

4. P. H. Kee, M. R. Moody, S.-L. Huang, H. Kim, X. Yin, T. Peng, S. T. Laing, M. E. Klegerman, M. H Rahbar, D. Vela, C. Genstler, K. J. Haworth, **C. K. Holland**, D. D. McPherson, "Stabilizing peristent restenosis using a novel therapeutic carrier," *JACC: Basic to Translational Science* (Published online November 2019) https://doi.org/10.1016/j.jacbts.2019.09.005.

5. V. Bollen, S. A. Hendley, J. D. Paul, A. D. Maxwell, K. J. Kaworth, **C. K. Holland**, K. B. Bader, "*In vitro* thrombolytic efficacy of single- and five-cycle histotripsy pulses and rt-PA," *Ultrasound Med Biol* 46:336-349 (2020), https://doi.org/10.1016/j.ultrasmedbio.2019.10.009.

6. R. T. Kleven, H. Shekhar, K. Karani, K. J. Haworth, and **C. K. Holland**, "Effect of duty cycle on the thrombolytic efficacy of 220 kHz ultrasound and rt-PA in vitro", *Phys Med Biol* 64:165015 (2019), https://doi.org/10.1088/1361-6560/ab293b.

7. H. Shekhar, R. T. Kleven, A. Palaniappan, T. Peng, K. B. Karani, S. Huang, D. D. McPherson, **C. K. Holland** "Efficacy of 220 kHz sonothrombolysis with rt-PA and echocontrast agents *in vitro*," *Scientific Reports* 9:9902 (2019), https://doi.org/10.1038/s41598-019-46112-z.

8. H. Shekhar, A. Palaniappan, T. Peng, M. R. Moody, K. J. Haworth, S. Huang, D. D. McPherson, **C. K. Holland**, "Lipid-shelled microbubbles for ultrasound-triggered release of Xenon," *Neurotherapeutics* (Published online 24 April 2019), https://doi.org/10.1007/s13311-019-00733-4.

9. K. P. Mercado-Shekhar, H. Su, D. S. Kalaikadal, J. N. Lorenz, R. M. Manglik, **C. K. Holland**, A. N. Redington, K. J. Haworth, "Acoustic droplet vaporization-mediated dissolved oxygen scavenging in blood mimicking fluids, plasma, and blood," *Ultrasonics Sonochemistry* 56:144-124 (2019), https://doi.org/10.1016/j.ultsonch.2019.03.029.

10. K. T. Rich, **C. K. Holland**, M. P. Rao, T. D. Mast, "Characterization of cavitation-radiated acoustic power using diffraction correction," *J Acoust Soc Am* 144:3563-3574 (2018), https://doi.org/10.1121/1.5083831.

11. K. P. Mercado-Shekhar, R. Kleven, Hermes A. Rivera; R. Lewis; K. B. Karani, H. J. Vos, T. A. Abruzzo, K. J. Haworth, **C. K. Holland**, "Effect of clot stiffness on recombinant tissue plasminogen activator lytic susceptibility in vitro," *Ultrasound Med Biol* 44:2710-2727 (2018), https://doi.org/10.1016/j.ultrasmedbio.2018.08.005.

12. K. R. Lattwein, H. Shekhar, W. J. B. van Wamel, T. Gonzalez, A. B. Herr, **C. K. Holland**, K. Kooiman, "An *in vitro* proof-of-principle study of sonobactericide," *Scientific Reports* 3:3411 (2018), http://dx.doi.org/10.1038/s41598-018-21648-8.

13. H. Shekhar, N. J. Smith, J. L. Raymond, **C. K. Holland**, "Effect of temperature on the size distribution, shell properties, and stability of Definity®, *Ultrasound Med Biol* 44:434-446 (2018), https://doi.org/10.1016/j.ultrasmedbio.2017.09.021.

14. K. B. Bader, K. J. Haworth, A. D. Maxwell, **C. K. Holland**, "Post hoc analysis of passive cavitation imaging for classification of histotripsy-induced liquefaction in vitro," *IEEE T Med Imaging* 37:106-115 (2018), http://dx.doi.org/10.1109/TMI.2017.2735238.

15. S. Huang, H. Shekhar, **C. K. Holland**, "Comparative lytic efficacy of rt-PA and ultrasound in porcine versus human clots," *PLOS ONE* 12:e0177786 (2017), http://dx.doi.org/10.1371/journal.pone.0177786.

16. H. Shekhar, S. Huang, K. B. Bader, T. Peng, S. Huang, D. D. McPherson, **C. K. Holland**, "In vitro thrombolytic efficacy of echogenic liposomes loaded with tissue plasminogen activator and octafluoropropane gas," *Phys Med Biol* 62:517-538 (2016), http://dx.doi.org/10.1088/1361-6560/62/2/517.

17. K. J. Haworth, K. B. Bader, K. T. Rich, **C. K. Holland**, T. D. Mast, "Quantitative frequency-domain passive cavitation imaging," *IEEE Transactions on UFFC* 64:177-191 (2016), http://dx.doi.org/10.1109/TUFFC.2016.2620492.

18. J. Raymond, Y. Luan, T. Peng, S.-L. Huang, D. D. McPherson, M. Versluis, N. de Jong, **C. K. Holland**, "Loss of gas from echogenic liposomes exposed to pulsed ultrasound" ," *Phys Med Biol* 61:8321-8339 (2016), http://dx.doi.org/10.1088/0031-9155/61/23/8321.

19. J. T. Sutton, K. J. Haworth, S. K. Shanmukhappa, M. Moody, M. Klegerman, J. Griffin, D. Patton, D. D. McPherson, **C. K. Holland**, "Delivery of bevacizumab to atheromatous porcine carotid tissue using echogenic liposomes," *Drug Delivery* 23:3594-3605 (2016), http://dx.doi.org/10.1080/10717544.2016.1212441.

20. K. B. Bader, K. J. Haworth, H. Shekhar, A. D. Maxwell, T. Peng D. D. McPherson, **C. K. Holland**, "Efficacy of histotripsy combined with rt-PA in vitro," *Phys Med Biol* 61:5253-5274 (2016), http://dx.doi.org/10.1088/0031-9155/61/14/5253.

21. M. A. Kandadai, P. Mukherjee, H. Shekhar, G. J. Shaw, I. Papautsky, **C. K. Holland** "Microfluidic manufacture of rtPA-loaded echogenic liposomes," *Biomedical Microdevices* 18:48 (2016), http://dx.doi.org/10.1007/s10544-016-0072-0.

22. K. B. Bader, M. J. Crowe, J. L. Raymond, **C. K. Holland**, "The effect of frequency-dependent attenuation on predicted histotripsy waveforms in tissue mimicking phantoms," *Ultrasound Med* Biol 42:1701-1705 (2016), http://dx.doi.org/10.1016/j.ultrasmedbio. 2016.02.010.

23. K. B. Bader, **C. K. Holland**, "Predicting the growth rate of nanoscale nuclei by histotripsy pulses," *Phys Med Biol* 61:2947-2966 (2016), http://dx.doi.org/10.1088/0031-9155/61/7/2947.

24. K. Radhakrishnan, **C. K. Holland**, K. J. Haworth, "Scavenging dissolved oxygen via acoustic droplet vaporization," *Ultrason Sonochem* 31:394-403 (2016), http://dx.doi.org/10.1016/j.ultsonch.2016.01.019.

25. K. J. Haworth, J. L. Raymond, K. Radhakrishnan, M. R. Moody, S. Huang, T. Peng, H. Shekhar, M. E. Klegerman, H. Kim, D. D. McPherson, **C. K. Holland**, "Trans-stent ultrasound imaging and cavitation detection," *Ultrasound Med Biol* 42:518-527 (2016), http://dx.doi.org/10.1016/j.ultrasmedbio.2015.08.014.

26. M. E. Klegerman, A. K. Naji, K. J. Haworth, Y. Zou, E. Golunski, T. Peng, G. L. Britton, S.-L. Huang, **C. K. Holland**, D. D. McPherson, "Ultrasound-enhanced bevacizumab release from echogenic liposomes for inhibition of atheroma progression," *J Liposome Res* 26:47-56 (2016), http://dx.doi.org/10.3109/08982104.2015.1029494.

27. K. J. Haworth, V. A. Salgaonkar, N. M. Corregan, **C. K. Holland**, T. D. Mast, "Using passive cavitation images to classify high-intensity focused ultrasound lesions," *Ultrasound Med Biol* 41:2420-2434 (2015), http://dx.doi.org/10.1016/j.ultrasmedbio.2015.04.025.

28. J. L. Raymond, Y. Luan, R. van Rooij, S.-L. Huang, D. D. McPherson, M. Versluis, N. de Jong, **C. K. Holland**, "Impulse response method for characterization of echogenic liposomes," *J Acoust Soc Am* 137:1693-1703 (2015), http://dx.doi.org/10.1121/1.4916277.

29. K. B. Bader, G. Bouchoux, T. Peng, M. E. Klegerman, D. D. McPherson, **C. K. Holland**, "Thrombolytic efficacy and enzymatic activity of rt-PA-loaded echogenic liposomes," *J Thromb Thrombolys* 40:144-155 (2015), http://dx.doi.org/10.1007/s11239-015-1204-8.

30. M. A. Kandadai, J. M. Meunier, K. Hart, **C. K. Holland**, G. J. Shaw, "Plasmin-loaded echogenic liposomes for ultrasound-mediated thrombolysis," *Translational Stroke Research* 5:78-87 (2015), http://dx.doi.org/10.1007/s12975-014-0376-4.

31. K. J. Haworth, C. R. Weidner, T. A. Abruzzo, J. T. Shearn, M. Rao, **C. K. Holland**, "Compressive mechanical and fibrin properties of endovascular coil-clot complexes," *J Neurointerv Surg* 7:291-296 (2015), http://dx.doi.org/10.1136/neurintsurg-2013-011076.

32. K. B. Bader, M. J. Gruber, **C. K. Holland**, "Shaken and stirred: enhancing thrombolysis with ultrasound," *Ultrasound Med Biol* 41:187-196 (2014), http://dx.doi.org/ 10.1016/j.ultrasmedbio.2014.08.018.

33. K. Radhakrishnan, K. J. Haworth, T Peng, D. D. McPherson, **C. K. Holland,** "Loss of echogenicity and onset of cavitation from echogenic liposomes: Pulse repetition frequency independence," *Ultrasound Med Biol* 41:208-221 (2014), http://dx.doi.org/ 10.1016/j.ultrasmedbio.2014.08.021.

34. J. T. Sutton, J. L. Raymond, M. C. Verleye, G. J. Pyne-Geithman, **C. K. Holland**, "Pulsed ultrasound enhances the delivery of nitric oxide from bubble liposomes to ex vivo porcine carotid tissue," *Int J Nanomed* 9:4671-83 (2014) http://dx.doi.org/10.2147/IJN.S63850.

35. G. Bouchoux, R. Shivashankar, T. A. Abruzzo, **C. K. Holland**, "In silico study of low-frequency transcranial ultrasound fields in acute ischemic stroke patients," *Ultrasound Med Biol* 40:1154-1166 (2014) http://dx.doi.org/10.1016/j.ultrasmedbio.2013.12.025.

36. M. J. Gruber, K. B. Bader, **C. K. Holland**, "Ultraharmonic and broadband threshold measurements for echogenic liposomes and Definity® in human plasma using 120-kHz pulsed ultrasound," *J Acoust Soc Am* 135:646-653 (2014) http://dx.doi.org/10.1121/1.4843175.

37. H. Kim, G. L. Britton, T. Peng, **C. K. Holland**, D. D. McPherson, S.-L. Huang, "Nitric oxide-loaded liposomes for vasospasm treatment following subarachnoid hemorrhage," *Int J Nanomedicine* 9:155-165 (2014) http://dx.doi.org/10.2147/IJN.S48856.

38. J. L. Raymond, K. J. Haworth, K. B. Bader, K. Radhakrishnan, J. K. Griffin, S.-L. Huang, D. D. McPherson, C. K. Holland, "Broadband attenuation measurements of phospholipid-shelled ultrasound contrast agents," *Ultrasound Med Biol* 40:410-421 (2014) http://dx.doi.org/10.1016/j.ultrasmedbio.2013.09.018.

39. K. Radhakrishnan, K. B. Bader, K. J. Haworth, J. A. Kopechek, J. L. Raymond, S.-L. Huang, D. D. McPherson, **C. K. Holland**, "Relationship between cavitation and loss of echogenicity from

ultrasound contrast agents," *Phys Med Biol* 58:6541-6563 (2013), http://dx.doi.org/10.1088/0031-9155/58/18/6541.

40. J. T. Sutton, K. J. Haworth, G. J. Pyne-Geithman, **C. K. Holland**, "Ultrasound Mediated Drug Delivery for Cardiovascular Disease," *Expert Opinion on Drug Delivery* 10:573-592 (2013), http://dx.doi.org/10.1517/17425247.2013.772578.

41. J. T. Sutton, N. I. Ivancevich, S. R. Perrin, D. C. Vela, **C. K. Holland,** "The effect of clot composition on ultrasound-enhanced thrombolysis in an ex vivo porcine thrombosis model," *Ultrasound Med Biol* 39:813-824 (2013), http://dx.doi.org/10.1016/j.ultrasmedbio.2012.12.008.

42. J. A. Kopechek, K. J. Haworth, K. Radhakrishnan, S. Huang, M. E. Klegerman, D. D. McPherson, **C. K. Holland**, "The impact of microbubbles on measurement of drug release from echogenic liposomes," *Ultrasonics Sonochemistry,* 20:1121-1130 (2013), http://dx.doi.org/10.1016/j.ultsonch.2012.12.005.

43. K. B. Bader, **C. K. Holland**, "Gauging the likelihood of stable cavitation from ultrasound contrast agents," *Phys Med Biol* 58:127-144 (2012), http://dx.doi.org/10.1088/0031-9155/58/1/127.

44. G. Bouchoux, K. B. Bader, J. J. Korfhagen, J. L. Raymond, S. Ravishankar, T. A. Abruzzo, **C. K. Holland**, "Experimental validation of a finite-difference model for the prediction of transcranial ultrasound fields based on CT images," *Phys Med Biol* 57:8005-8022 (2012), http://dx.doi.org/10.1088/0031-9155/57/23/8005.

45. K. Radhakrishnan, K. J. Haworth, S. Huang, M. E. Klegerman, D. D. McPherson, **C. K. Holland**, "Stability of echogenic liposomes as a blood pool ultrasound contrast agent in a physiologic flow phantom," *Ultrasound Med Biol* 38:1970-1981 (2012), http://dx.doi.org/10.1016/j.ultrasmedbio.2012.06.012.

46. S. T. Laing, M. Moody, B. Smulevitz, H. Kim, P. Kee, S. Huang, **C. K. Holland**, D. D. McPherson, M. E. Klegerman, "Ultrasound-enhanced thrombolytic effect of tissue plasminogen activator-loaded echogenic liposomes in an in vivo rabbit aorta thrombus model," *Arteriosclerosis, Thrombosis, and Vascular Biology* 31:1357-1359 (2011), http://dx.doi.org/10.1016/j.thromres.2011.11.010.

47. K. J. Haworth, T. D. Mast, K. Radhakrishnan, M. T. Burgess, J. A. Kopechek, S. Huang, D. D. McPherson, **C. K. Holland**, "Passive cavitation imaging with pulsed ultrasound insonations," *J Acoust Soc Am* 132:544-553 (2012), http://dx.doi.org/10.1121/1.4728230.

48. J. M. Meunier, **C. K. Holland**, T. M. Porter, C. J. Lindsell, G. J. Shaw, "Combination treatment with rt-PA is more effective than rt-PA alone in an in vitro human clot model," *Current Neurovasc Res* 8:305-312 (2011) http://dx.doi.org/10.2174/156720211798120963.

49. J. A. Kopechek, K. J. Haworth, J. L. Raymond, T. D. Mast, S. R. Perrin, Jr., M. E. Klegerman, S.-L. Huang, T. M. Porter, D. D. McPherson, **C. K. Holland**, "Acoustic characterization of echogenic liposomes: frequency-dependent attenuation and backscatter, *J Acoust Soc Am* 130: 3472-3481 (2011) http://dx.doi.org/10.1121/1.3626124.

50. K. E. Hitchcock, N. M. Ivancevich, K. J. Haworth, D. N. Caudell Stamper, D. Vela, J. T. Sutton, G. J. Pyne-Geithman, **C. K. Holland**, "Ultrasound-enhanced rt-PA thrombolysis in an *ex vivo* porcine carotid artery model," *Ultrasound Med Biol* 37: 1240-1251 (2011) http://dx.doi.org/10.1016/j.ultrasmedbio.2011.05.011.

51. G. J. Shaw, J. M. Meunier, C. J. Lindsell, A. M. Pancioli, **C. K. Holland**, "Making the Right Choice: Optimizing rt-PA and eptifibatide lysis, an *in vitro* study," *Thrombosis Res* 126:e305-e311 (2011) http://dx.doi.org/10.1016/j.thromres.2010.07.020.

52. S. T. Laing, M. Moody, B. Smulevitz, H. Kim, P. Kee, S. Huang, **C. K. Holland**, D. D. McPherson, "Ultrasound-enhanced thrombolytic effect of tissue plasminogen-loaded liposomes in an in vivo rabbit aorta thrombus model," *Arteriosclerosis Thromb and Vasc Biol* 31:1357-1359 (2011) http://dx.doi.org/10.1161/ATVBAHA.111.225938.

53. K. E. Hitchcock, **C. K. Holland**, "Ultrasound-assisted thrombolysis for stroke therapy: Better thrombus break-up with bubbles," *Stroke* 41:S50-S53 (2010) http://dx.doi.org/10.1161/STROKEAHA.110.595348.

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(Names of Students and Postdoctoral Fellows are underlined.)

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Invited Presentations

1. **C. K. Holland**, "Choose the right people and help them realize their worth," *J Acoust Soc Am*, 146:2818 (2019), https://doi.org/10.1121/1.5136760.

2. **C. K. Holland**, "Bioeffects elicited by acoustic cavitation," *J Acoust Soc Am*, 146:2989 (2019), https://doi.org/10.1121/1.5137346.

3. **C. K. Holland**, H. Shekhar, M. Lafond, "Lipid-shelled microbubbles for ultrasound-triggered release of bioactive gases to treat stroke and cardiovascular disease," *J Acoust Soc Am* 145:1745 (2019), https://doi.org/10.1121/1.5101398.

4. K. B. Bader, S. A. Hendley, B. Bollen, A. D. Maxwell, K. J. Haworth, **C. K. Holland**, "Histotripsy-enhanced thrombolysis," *J Acoust Soc Am* 145:1746 (2019), https://doi.org/10.1121/1.5101403.

5. **C. K. Holland**, H. Shekhar, A. Palaniappan, T. Peng, M. R. Moody, K. J. Haworth, S. Huang, D. D. McPherson, "Lipid-shelled microbubbles for ultrasound-triggered release of Xenon for neuroprotection," The 24th European Symposium on Ultrasound Contrast Imaging, Rotterdam, The Netherlands (January 17, 2019).

6. **C. K. Holland,** "Ultrasound-mediated drug delivery for the treatment of cardiovascular disease," Plenary lecture at V LXI Congreso National de Física - V Congreso Latinamericano de Física, Puebla, Mexico (October 10, 2018).

7. **C. K. Holland**, A. Palaniappan, H. Shekhar, "Lipid-shelled microbubbles for ultrasound-triggered release of Xenon to treat stroke," ASENT Annual Meeting (March 8, 2018).

8. **C. K. Holland**, "Microbubble pumps: Ultrasound theragnostic agents," AAAS Annual Meeting (February 17, 2018).

9. K. R. Lattwein, H. Shekhar, W. J. B. van Wamel, T. Gonzalez, A. B. Herr, **C. K. Holland**, K. Kooiman, "Sonobactericide – An adjunct therapy for infective endocarditis: An *in vitro* proof-of-concept," *Ultrasound Med Biol* 43:S233 (2017).

10. **C. K. Holland**, "Best practices for publishing in scientific journals," *Ultrasound Med Biol* 43:S77 (2017).

11. **C. K. Holland**, "Ultrasound-mediated drug delivery for cardiovascular disease," *Ultrasound Med Biol* 43:S57 (2017).

12. **C. K. Holland**, "Microbubble pumps: Ultrasound theragnostic agents," University of Texas Southwestern, Department of Radiology Grand Rounds, (October 21, 2017).

13. K. J. Haworth, K. B. Bader, K. T. Rich, **C. K. Holland**, and T. D. Mast, "Frequency-domain passive cavitation imaging," *J Acoust Soc Am* 141:3458 (2017), http://doi.org/10.1121/1.4987172.

14. **C. K. Holland**, T. D Mast, K. J. Haworth, T. A. Abruzzo "Biomedical research at the image-guided ultrasound therapeutics laboratories," *J Acoust Soc Am* 141:3681 (2017), http://doi.org/10.1121/1.4987998.

15. **C. K. Holland**, Plenary talk, "Microbubble pumps: Ultrasound theragnostic agents," International Congress on Sound and Vibration, Athens, Greece (July 11, 2016).

16. **C. K. Holland**, Plenary talk, "Microbubble pumps: Ultrasound theragnostic agents," DAGA 2016, Jahrestagung für Akustik, Aachen, Germany (March 16, 2016).

17. **C. K. Holland**, "Sonothrombolysis: Current status," 21st European Symposium on Ultrasound Contrast Imaging, Rotterdam, The Netherlands (Jan 21, 2016).

18. **C. K. Holland**, H. Shekhar, K. B. Bader, "Microbubble pumps: Ultrasound theragnostic agents," *J Acoust Soc Am* 138:1819 (2015); http://dx.doi.org/10.1121/1.4933773.

19. **C. K. Holland**, "Microbubble pumps: Ultrasound theragnostic agents," American Association of Physicists in Medicine 57th Annual Meeting and Exhibition (July 15, 2015).

20. **C. K. Holland**, "Ultrasound-mediated drug delivery: Better with bubbles," Interuniversity Cardiology Institute Seminar, Erasmus University Medical Center, Rotterdam, The Netherlands (Nov 20, 2014).

21. **C. K. Holland**, "Ultrasound-mediated drug delivery: Better with bubbles," Sunnybrook Research Institute Physical Sciences Seminar, University of Toronto (July 22, 2014).

22. **C. K. Holland**, "Thrombolysis with microbubbles," *J Ultrasound Med* 33:S45 (2014).

23. **C. K. Holland**, "Diagnostic and therapeutic ultrasound: Better with bubbles," Acoust Soc Am School 2014 (May 4, 2014).

24. **C. K. Holland**, "Medical imaging student and faculty seminar," Biomedical Engineering, Duke University (May 13, 2014).

25. **C. K. Holland**, "Beneficial bubbles: Ultrasound-mediated drug delivery," Biomedical Engineering, University of North Carolina at Chapel Hill (May 14, 2014).

26. **C. K. Holland**, "Beneficial bubbles: Ultrasound-mediated drug delivery," Chevron Centennial Lecture, Department of Mechanical Engineering, University of Texas, Austin, Texas, January 31, 2014.

27. J. T. Sutton, J. L. Raymond, M. C. Verleye, G. J. Pyne-Geithman, J. Rubinstein, **C. K. Holland**, "Ultrasound-mediated delivery of bioactive nanobubbles to vascular tissue," *J Acoust Soc Am* 134:4048 (2013).

28. **C. K. Holland**, "Sonothrombolysis: Impact of clot model," World Federation of Ultrasound in Medicine and Biology Meeting, Sao Paulo, Brazil (May 4, 2013).

29. **C. K. Holland**, "Ultrasound-mediated drug delivery from an ultrasound bioeffects perspective," World Federation of Ultrasound in Medicine and Biology Meeting, Sao Paulo, Brazil (May 4, 2013).

30. **C. K. Holland**, J. T. Sutton, N. M. Ivancevich, S. R. Perrin, Jr., D. C. Vela, "Animal models of sonothrombolysis and drug delivery," *J Ultrasound Med* 32:S7 (2013).

31. G. Bouchoux, K. B. Bader, J. J. Korfhagen, J. L. Raymond, S. Ravishankar, T. A. Abruzzo, **C. K. Holland**, "Validation of a finite-difference acoustic propagation model of transcranial ultrasound, J Acoust Soc Am 132:1927 (2012).

32. **C. K. Holland,** J. Sutton, S. Perrin, Jr., K. Haworth, G. Pyne-Geithman, "Ultrasound-enhanced thrombolysis," World Congress on Medical Physics and Biomedical Engineering, Beijing, Peoples Republic of China, May 28, 2012.

33. **C. K. Holland**, "Microbubbles in ultrasound: Their role beyond contrast agents," Oriental Congress of Cardiology, Shanghai, People's Republic of China, May 25, 2012.

34. **C. K. Holland**, "Submitting your paper to *Ultrasound in Medicine and Biolo*gy," Institute of Acoustics, Nanjing University, May 22, 2012.

35. **C. K. Holland**, "Ultrasound-mediated drug delivery," 9th International Symposium on Modern Acoustics, Nanjing, Jiangsu, People's Republic of China, May 20, 2012.

36. **C. K. Holland**, "Submitting your paper to *Ultrasound in Medicine and Biolo*gy," Guangdong Province Association of Medical Ultrasound, Third Affiliated Hospital, Sun Yat-Sen University, Guangzhou, Guangdong Province, People's Republic of China, May 12, 2012.

37. **C. K. Holland**, "Microbubbles in ultrasound: Their role beyond contrast agents," Guangdong Province Association of Medical Ultrasound, Third Affiliated Hospital, Sun Yat-Sen University, Guangzhou, Guangdong Province, People's Republic of China, May 12, 2012.

38. **C. K. Holland**, "Submitting your paper to *Ultrasound in Medicine and Biolo*gy," Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, People's Republic of China, May 11, 2012.

39. **C. K. Holland**, "Microbubbles in ultrasound: Their role beyond contrast agents," Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, Shenzhen, People's Republic of China, May 11, 2012.

40. **C. K. Holland**, "Microbubbles in Ultrasound: A role beyond contrast agents?" *J Ultrasound Med* 31:S64 (2012).

41. **C. K. Holland,** "Ultrasound-enhanced thrombolysis," Canadian Institutes of Health Research Symposium, Toronto, Canada, November 14, 2011.

42. **C. K. Holland**, "Choose the right people," Ready, Set, Go Workshops for a Successful Academic Career, University of Cincinnati, October 6, 2011.

43. **C. K. Holland**, "Ultrasound Image-Guided Therapeutics Laboratories: An Introduction," Department of Pharmacology Seminar, September 14, 2011.

44. **C. K. Holland,** "'B' is for Biomedical Engineering," *Life of the Mind* on "Technology," University of Cincinnati (April 19, 2011)

45. K. E. Hitchcock, N. M. Ivancevich, K. J. Haworth, D. N. Caudell Stamper, D. Vela, J. T. Sutton, G. J. Pyne-Geithman, **C. K. Holland**, "Ultrasound-enhanced thrombolysis in an ex vivo porcine carotid artery model," *J Acoust Soc Am* 128:2440 (2010).

46. **C. K. Holland**, "Targeting therapeutics with ultrasound," Mackay Memorial Hospital, Tamshui branch, Taipei county, Taiwan, October 4, 2010.

47. **C. K. Holland**, "Submission of papers to *Ultrasound in Medicine and Biology*: A Round table discussion," National Taiwan University, Taipei, Taiwan, October 4, 2010.

48. **C. K. Holland**, "Ultrasound-mediated drug delivery using echogenic liposomes," Taiwan Society of Ultrasound in Medicine, Taipei, Taiwan, October 2, 2010.

49. **C. K. Holland**,"Expanding the impact of therapeutic ultrasound," National Yang-Ming University, Institute of Biomedical Engineering, Taipei, Taiwan, October 1, 2010.

50. **C. K. Holland**, "Ultrasound-mediated drug delivery using echogenic liposomes," Cardiovascular Center of Excellence Seminar, College of Medicine, University of Cincinnati, September 16, 2010.

51. **C. K. Holland**, "Ultrasound-mediated drug delivery using echogenic liposomes," Department of Physics and the National Center for Physical Acoustics Seminar, University of Mississippi, September 14, 2010.

52. **C. K. Holland**, "The submission and review process of academic publishing," Round table discussion, National Center for Physical Acoustics, University of Mississippi, September 14, 2010.

53. **C. K. Holland**, "Expanding the impact of therapeutic ultrasound," *J Ultrasound Med* 29:S69 (2010).

54. **C. K. Holland,** J. A. Kopechek, K. E. Hitchcock, D. Caudell, G. Pyne-Geithman, S. Huang, D. D. McPherson, "Ultrasound-mediated drug delivery using echogenic liposomes," 15th European Symposium on Ultrasound Contrast Imaging, Rotterdam, Netherlands (Jan 21, 2010).

55. **C. K. Holland**, "Sonothrombolysis: *In vitro, Ex vivo, In vivo*," Third Autumn School on Therapeutic Ultrasound, Cargese, Corsica, France (Sep 30, 2009).

56. **C. K. Holland**, "Ultrasound enhanced thrombolysis," *Ultrasound Med Biol* 35(8S):S33 (Aug 30, 2009).

57. **C. K. Holland**, "Ultrasound mediated drug delivery," *Ultrasound Med Biol* 35(8S):S8 (Aug 31, 2009).

58. **C. K. Holland**, "Ultrasound thrombolysis and drug delivery," *J Ultrasound Med* 28(3):S114 (April 5, 2009)

59. **C. K. Holland,** "Ultrasound-enhanced thrombolysis," Student chapter of the Biomedical Engineering Society, University of Cincinnati, (October 23, 2008).

60. **C. K. Holland**, D. A. Smith, J. M. Meunier, G. J. Shaw, S. L. Huang, D. D. McPherson, "Targeting thrombolysis with ultrasound-sensitive liposomes," *Int. J. Stroke* 3 (Suppl 1):36 (2008).

61. **C. K. Holland**, A. Y. Ammi, J. M. Meunier, G. J. Shaw, K. R. Wagner, "Ultrasound thrombolysis," *Int J Stroke* 3 (Suppl 1):437 (2008).

62. **C. K. Holland**, "Interactions between clot and ultrasound: Better blood clot break-up with bubbles," *Cerebrovasc Dis* 26:8 (2008).

63. **C. K. Holland** and D. D. McPherson, "Echogenic liposomes for image-guided drug delivery," *J Acoust Soc Am* 123:3112 (2008).

64. **C. K. Holland,** "Ultrasound contrast in sonothrombolysis," Stroke Team Seminar, Neurology Dept., University of Cincinnati, Cincinnati, OH (June 24, 2008).

65. **C. K. Holland**, "Ultrasound contrast in sonothrombolysis," *J Ultrasound Med* 27(3):S74 (March 15, 2008).

66. **C. K. Holland,** "The role of cavitation in ultrasound-enhanced membrane permeability and drug activity," IEEE Ultrasonics Symposium, New York, NY (October 28, 2007).

67. **C. K. Holland,** "Better Blood Clot Break up with Bubbles: Ultrasound Enhanced Thrombolysis," Division of Nephrology and Hypertension Seminar, University of Cincinnati, Cincinnati, OH (October 26, 2007).

68. **C. K. Holland,** "The role of cavitation in ultrasound-enhanced membrane permeability and drug activity," National Heart Lung and Blood Institute, National Institutes of Health (October 25, 2007).

69. **C. K. Holland**, "Better Blood Clot Breakup With Bubbles: Ultrasound-Enhanced Thrombolysis," Ohio State University Biomedical Engineering Research Seminar, Columbus, OH (October 11, 2007).

70. **C. K. Holland**, "Better Blood Clot Breakup With Bubbles: Ultrasound-Enhanced Thrombolysis," *J Ultrasound Med* 26:S57 (2007).

71. **C. K. Holland,** "The evolution of contrast agents: From therapeutics to diagnostics," Department of Physics, SungKyunKwan University, Seoul, Korea (June 1, 2006).

72. **C. K. Holland**, "Ultrasound-assisted drug delivery and thrombolysis," Medison Inc., Seoul, Korea (May 31, 2006).

73. **C. Holland**, T. Porter, D. McPherson, "Ultrasound-assisted drug delivery and thrombolysis," *Ultrasound Med Biol* 32:P45, World Federation of Ultrasound in Medicine and Biology Meeting, Seoul, Korea (May 30, 2006).

74. **C. K. Holland,** "The evolution of contrast agents: From therapeutics to diagnostics," The Leading Edge Symposium, Atlantic City, NJ (May 23, 2006).

75. **C. K. Holland,** "The evolution of contrast agents: From therapeutics to diagnostics," Dept. of Systems Biology and Physiology, University of Cincinnati, Cincinnati, OH (Apr 26, 2006).

76. **C. K. Holland,** "The evolution of contrast agents: From therapeutics to diagnostics," Department of Radiology, University of Texas Health Science Center, San Antonio, TX (Mar 30, 2006).

77. **C. K. Holland,** "The evolution of contrast agents: From therapeutics to diagnostics," Vanderbilt University Institute of Imaging Science, Nashville, TN (Jan 27, 2006).

78. **C. K. Holland,** "The evolution of contrast agents: From therapeutics to diagnostics," Memphis BioImaging Symposium, Memphis, TN, USA (Nov 3-4, 2005).

79. **C. K. Holland,** "Ultrasound enhancement of membrane permeability and drug activity," Mayneord Phillips Summer School on Ultrasound and Other Minimally Invasive Therapies, Oxford University, Oxford, UK (July 4-8, 2005).

80. **C. K. Holland**, "BME Research Opportunities," Summer Surgery Experience at UC program (June 23, 2005).

81. **C. K. Holland,** "Risk and Safety," American Institute of Ultrasound in Medicine Preconvention Course on Diagnostic Ultrasound Principles and Instruments: Fundamentals and Advances (June 18, 2005).

82. **C. K. Holland**, "Ultrasound-assisted Thrombolysis for Stroke Therapy," Department of Mechanical Engineering Distinguished Lecture Series, University of Texas, Austin, TX (March 23, 2005).

83. **C. K. Holland**, "Ultrasound-assisted drug delivery: From bioeffects to therapeutic benefit," *J Ultrasound Med*, 23:S84 (2004).

84. **C. K. Holland**, "Biomedical Engineering: A platform for research and innovation in ultrasound," *J Acoust. Soc Am*, 115:2563 (2004).

85. **C. K. Holland**, "Robert Apfel's contribution to clinical diagnostic ultrasound: The mechanical index, *J Acoust Soc Am*, 115:2418 (2004).

86. **C. K. Holland, "**Ultrasound-Assisted Thrombolysis for Stroke Therapy," Biomedical Engineering Research Seminar Series, Rensselaer Polytechnic Institute, (October 29, 2003).

87. **C. K. Holland,** R. A. Roy, P. W. Biddinger, C. J. Disimile, C. Cawood, **"**Cavitation mediated rat lung bioeffects from diagnostic ultrasound," International Congress on Acoustics, Rome, Italy (September 6, 2001).

88. **C. K. Holland,** "Bioeffects in Tissues with Gas Bodies," AIUM Categorical Course, J. Ultrasound in Med., 20:S101 (2001).

89. **C. K. Holland,** "Bioeffects in the Lung and Intestine," Thirty-Second Annual Meeting of the British Medical Ultrasound Society, Eastbourne, U.K. (December 7, 2000).

90. **C. K. Holland**, "The Mechanical Index – An Overview," Thirty-Second Annual Meeting of the British Medical Ultrasound Society, Eastbourne, U.K. (December 7, 2000).

91. **C. K. Holland**, "The Safety of Diagnostic Ultrasound," Society for Pediatric Radiology Annual Meeting, Ft. Meyers, FL (May 1, 2000)

92. **C. K. Holland**, “Assessing Arterial Stenosis by Tracking Turbulence,” Condensed Matter Seminar, Dept. of Physics, University of Cincinnati (November 17, 1999).

93. **C. K. Holland**, “Mechanical Bioeffects of Diagnostic Ultrasound in Lung and Intestine,” Dept. of Aerospace Engineering & Engineering Mechanics, Introduction to Biomechanics, 20-251-627 (November 16, 1999).

94. **C. K. Holland**, "What you should know about Doppler Artifacts and Bioeffects," Midwest Society for Pediatric Radiology Annual Meeting, Cincinnati, OH (October 19, 1999).

95. **C. K. Holland**, R. E. Apfel, "Fundamentals of the Mechanical Index and Caveats in its Application," *J Acoust Soc Am* 105:1324 (1999).

96. **C. K. Holland**, "Diagnosing Arterial Disease with Turbulence," Department of Surgery Noon Conference, University of Cincinnati (December 10, 1997).

97. **C. K. Holland,** “Turbulence in Arteries,” Research seminar for the REACH program, University of Cincinnati (July 16, 1997).

98. **C. K. Holland**, “Noninvasive Assessment of Turbulent Flow in Arteries,” Ben Felson Lecture Presentations, Radiology Dept., University of Cincinnati (April 5, 1997).

99. **C. K. Holland**, “Bioeffects in Rat Lung from Diagnostic Ultrasound,” Ben Felson Lecture Presentations, Radiology Dept., University of Cincinnati (March 30, 1996).

100. **C. K. Holland**, “Ultrasound Physics III,” Trauma/Critical Care Division, Department of Surgery, University of Cincinnati (February 13, 1996).

101. **C. K. Holland**, “Ultrasound Physics II,” Trauma/Critical Care Division, Department of Surgery, University of Cincinnati (January 30, 1996).

102. **C. K. Holland**, “Ultrasound Physics I,” Trauma/Critical Care Division, Department of Surgery, University of Cincinnati (January 16, 1996).

103. **C. K. Holland**, "Potential bioeffects of ultrasound in lungs and intestines," *Medical Physics* 23:1069 (1996).

104. **C. K. Holland**, "Biophysical bubble dynamics: Theory and prediction in bio-like fluids" The Conference for Ultrasonics in Biophysics and Bioengineering, Allerton Park, Monticello, Illinois, University of Illinois at Urbana-Champaign (1996).

105. **C. K. Holland**, "Bioeffects and the Thermal Index," AAPM Summer School, Connecticut College, New London, CT (1995).

106. **C. K. Holland**, "Bioeffects and the Mechanical Index," AAPM Summer School, Connecticut College, New London, CT (1995).

107. **C. K. Holland**, "Doppler and His Effect on Medical Imaging," Howard Hughes Medical Institute Special Lecture, Swarthmore College, Swarthmore, PA (April 11, 1995).

108. **C. K. Holland**, “Lower Extremity Volumetric Blood Flow Measurement in Normal Subjects,” Ben Felson Lecture Presentations, Radiology Dept., University of Cincinnati (April 1, 1995).

109. **C. K. Holland**, “Direct Evidence of Cavitation *In Vivo* From Diagnostic Ultrasound,” Medical Physics Seminar, Dept. of Radiology, University of Cincinnati (March 22, 1995).

110. **C. K. Holland**, “Doppler Physics and Bioeffects,” Dept. of Aerospace Engineering & Engineering Mechanics, Introduction to Biomechanics, 20-251-627 (October 20, 1994).

111. **C. K. Holland**, “Ultrasound Physics,” Dept. of Aerospace Engineering & Engineering Mechanics, Introduction to Biomechanics, 20-251-627 (October 18, 1994).

112. R. E. Apfel, **C. K. Holland**, L. A. Crum, and R. A. Roy, "Acoustic cavitation from diagnostic ultrasound," *J Acoust Soc Am* 91:2430 (1992).

113. **C. K. Holland**, "*In vitro* cavitation: Bubble thresholds in water with a controlled nuclei environment," The Conference for Ultrasonics in Biophysics and Bioengineering, Allerton Park, Monticello, Illinois, University of Illinois at Urbana-Champaign (1991).

114. **C. K. Holland**, "A simple index for estimating the likelihood of transient cavitation from diagnostic ultrasound," *Medical Physics* 17:556 (1990).

115. **C. K. Holland**, "Gauging the likelihood of transient cavitation from clinical diagnostic ultrasound," *International Symposium on the Mechanisms of Acoustical Bioeffects*, Pushchino, USSR (1990), (Received International Union for Pure and Applied Biophysics Young Scientist Award).

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NIH/NINDS $521,887, year 1 direct costs
Ultrasound-Assisted Thrombolysis for Stroke Therapy
The goal of this project is to elucidate the mechanism underlying ultrasound-enhanced thrombolysis and to provide important new information to assist the design of targeted agents that will improve thrombolysis in acute stroke treatment.

2) R01 HL135092 (PI: McPherson) 09/01/17 – 08/31/22 1.2 cal mos (10%) $3,741,010 Total
NIH/NHLBI (Holland, PI of UC subcontract) $276,373 year 1 subK direct costs
Echogenic targeted liposomes: Transfection/Drug Delivery
The goal of this project is to develop targeted, echogenic agents with therapeutic loading that would allow clinicians to stage atherosclerosis and apply directed therapy to improve physiologic flow.

3) R01 HL133334 (PI: Bader) 12/01/17 - 11/30/22 1.2 cal mos (10%) $3,771,235 Total
NIH/NHLBI (Holland, PI UC subcontract) $153,323 year 1 subK direct costs
Localized thrombus ablation with histotripsy and echogenic liposomes
Our long-term objective is to develop a combined ablation and targeted thrombolytic histotripsy technique that lyses stiff thrombi in the deep veins, decreases the risk of pulmonary embolism, and improves long-term prognosis.

4) K25 HL133452 (PI: Haworth) 07/01/16 - 06/30/20 0 cal mos $639,441 Total
NIH/NHLBI (Holland, mentor)
Ultrasound-mediated oxygen scavenging for inhibition of reperfusion injury
This goal of this project is to develop a novel, ultrasound-based technique to sequester oxygen from the blood to limit free radical formation and reduce reperfusion injury.

5) R01HL148451 (PI: Haworth) 07/01/2019 – 06/30/2024 3.0 cal mos
NIH/NHLBI $572,270 year 1 direct costs
Ultrasound-mediated Controlled Hypoxemic Reperfusion for Inhibition of Reperfusion Injury
The goal of this project is to develop a catheter-based system for reducing oxygen during reperfusion to reduce reperfusion injury.
Role: Co-Investigator

Pending Support

2) R01EB028766 (PI: Haworth) 09/01/2019 – 08/31/2024 4.2 cal mos
NIH/NIBIB $633,794 year 1 direct costs
Guiding histotripsy ablation of hypoxic tumors using quantitative monitoring of cavitation activity
The goal of this project is to develop real-time ultrasound image-guidance for mechanical ablation of hypoxic tumors.
Role: Co-Investigator

Past Support

25) R01 NS047603 Supplement (PI: Holland) 8/1/2016 – 7/31/2018 0 cal mos $173,534 Total
NIH/NINDS Research Supplement to Promote Diversity $109,832 year 1 direct costs
The goal of this research supplement is for Karla Mercado to develop ultrasound elasticity imaging as a technique to predict the rt-PA lytic susceptibility and the potential for ultrasound enhancement for the various types of thrombi that occur in stroke patients. This research is expected to contribute towards the development of imaging techniques to guide the choice of appropriate therapies for stroke patients.

24) CCTST Just in Time Core Funds (PI: Holland) 01/01/2014 – 06/30/2014 $7,389 Total
UC/CCHMC CCTST $7,389 direct costs
Detection of ultrasound-mediated bevacizumab delivery to porcine carotid arteries
A primary critique of our NIH R01 application entitled, "Arresting Carotid Atheroma with Acoustically Active Agents," was a lack of preliminary data supporting the feasibility of delivery of BEV to the vascular tissue. Careful development of an immunohistochemistry pathology protocol to highlight BEV delivery to porcine carotid tissue is vital to resubmission of this R01.

23) 2 R01 HL074002 (McPherson) 4/1/10 – 3/31/14 1.2 cal mos (10%) $1,095,100 Total
NIH/NHLBI (Holland, PI of UC subcontract) $153,462, year 1 direct costs
Echogenic Targeted Liposomes for Transfection/Drug Delivery
The goal of this project is to develop targeted, echogenic agents with therapeutic loading that would allow clinicians to stage atherosclerosis and apply directed therapy to improve physiologic flow.

22) R01 HL059586 (McPherson) 12/1/08 - 11/30/12 1.8 cal mos (15%) $1,455,433 Total
NIH/NHLBI (Holland, PI of UC subcontract) $97,828, year 1 direct costs
Targeted Liposomes for Acoustic Cardiovascular Imaging
The goal of this project is to optimize the highlighting and enhancing characteristics of our echogenic liposomal formulation in order to determine, quantitate, and characterize the stage, extent, and pathophysiologic development of atherosclerosis, allowing directed therapy to improve physiologic flow following clinical intervention.

21) P50 NS044283 (Broderick) 02/15/09 – 4/30/13 0.96 cal mos (8%)
NIH/NINDS (Shaw, PI of project)
SPOTRIAS-II: Recanalization therapies and markers of stroke outcome
Project 3: TRUST (Transcranial Ultrasound Treatment for Stroke)
The long-term overall goal of this Specialized Program of Translational Research in Acute Stroke (SPOTRIAS) is to enhance and accelerate recovery of acute stroke patients by focused and innovative rapid interventions for ischemic and hemorrhagic stroke. Project 3: Preclinical Models of Transcranial Ultrasound Thrombolysis (TRUST Study). The goal of TRUST is to determine the optimal parameters for transcranial ultrasound thrombolysis in an in-vitro human clot model, and verify minimization of ultrasound bioeffects by measurement of the acoustic field within cadaveric human skulls.

20) CVCoE Pilot Grant (Holland/Rubinstein) 5/1/2012 – 4/30/2013 $10,900
Ultrasound-triggered vasoreactivity using nitric oxide-loaded echogenic liposomes
The goal of this project is to release nitric oxide from echogenic liposomes and deliver this potent vasoactive gas to a vascular tissue bed, inducing vasorelaxation.

19) CVCoE Pilot Grant (Holland/Bogdanov) 5/1/2012 – 4/30/2013 $10,000
Ultrasound-triggered phase-shift emulsions for thrombolysis
The goal of this project is to develop ultrasound phase shift emulsions to enhance thrombolysis.

18) CVCoE Pilot Grant (Shaw/Holland) 5/1/2012 – 4/30/2013 $10,000
Plasmin-containing echogenic liposomes (P-ELIP) for acute thrombolytic therapy
The goal of this project is to develop echogenic lipsomes encapsulating plasmin for the ultrasound-enhanced treatment of acute ischemic stroke.

17) R21EB008483 (Mast) 2/01/09 – 1/31/11 0.24 cal mos (2%) $150,000 Total
NIH/NIBIB
Passive cavitation imaging for ultrasound guidance and control of thermal ablation

The major goal of this project is to develop passive cavitation imaging methods for guidance and control of thermal ablation to improve efficacy and safety of ultrasound ablation of liver cancer and soft tissue tumors.

16) Neuroscience Institute Grant (Holland) 01/01/07 – 12/31/07 $23,407
The Neuroscience Institute, Cincinnati, OH $23,407 annual direct costs
Ultrasound-enhanced Thrombolysis in an Ex Vivo Rat Carotid Artery
The goal of this project is to elucidate the utility and potential risks of ultrasound-enhanced thrombolysis using echogenic liposomes

15) R43CA124283-01 (PI: Barthe) 09/26/06 - 08/31/08 1% effort $322,847 Total
NIH/NCI (Mast, PI of UC subcontract) $38,743 annual direct costs (UC subcontract only)
Integrated Image-Guided Ultrasound Ablation System for Cancer Management
Role: Co-Investigator
The goal of this SBIR project is to develop an integrated, image-guided ultrasound therapy system for soft tissue ablation, including cancer therapy.

14) 1RO1 NS047603-01S1 (Holland/Porter) 1/1/05-12/31/06 70% Porter effort
NIH/NINDS $70,318 annual direct costs $92,994 Total
Ultrasound-Assisted Thrombolysis for Stroke Therapy
The goal of this minority supplement project is to characterize the acoustic behavior of echogenic liposomes, particularly to determine the most efficient way to release encapsulated rt-PA at the site of a thrombus for ischemic stroke therapy.

13) R01-DC05250-03 (Boyce) 12/1/01-11/30/06 5% effort
NIH $250,000, annual direct costs
Acoustic of Vocal Tract Shapes for Liquids
The major goal of this project is to provide 3D MR images of the vocal tract and midsagittal ultrasound images of the tongue in 20 normal subjects during the production of the American English liquids /r/ and /l/.

12) (Abruzzo, PI; Holland, Co-PI) 7/1/05 – 6/31/06 5% effort $10,000 Total
AIUM Education and Research Grant $10,000 annual direct costs
Ultrasound mediated selective intra-cerebral drug delivery for the treatment of cerebral vasospasm
The goal of this project is to develop acoustically activated echogenic liposomes loaded with papaverine, a phosphodiesterase inhibitor which functions as a potent cerebral vasodilator. that would allow clinicians to apply directed therapy to treat vasospasm, a consequence of hemmorhagic stroke.

11) (Holland: Co PI) 1/1/01-12/31/04 15% effort $998,094 Total
Whitaker Foundation $275,300 annual direct costs
Creation of a Biomedical Engineering Department and Associated Graduate and Research Programs at the University of Cincinnati.
The major goal of this project is to create M.S. and Ph.D. educational programs at the University of Cincinnati in Biomedical Engineering.

10) R29-HL58761-03 (Holland, PI) 4/1/98-3/31/03 50% effort $ 523,386 Total
NIH $92,277, annual direct costs
Mechanical Bioeffects in Lung Due to Diagnostic Ultrasound
The goal of this project is to clarify the potential risks involved in the use of diagnostic ultrasound scanners near aerated lung or in the presence of an echo contrast agent.

9) (Holland, PI) 7/1/02 – 12/31/03 25% effort $ 260,647 Total
Senmed Medical Ventures $197,498, annual direct costs
Development of a Transcranial Ultrasound Thrombolysis System for Stroke Therapy.
The goal of this project is to optimize ultrasound parameters that lead to high thrombolytic efficacy in vitro and to conduct a pilot demonstration in vivo using a porcine model.

8) (Holland, PI) 6/1/01 – 5/30/02 25% effort $ 181,274 Total
Senmed Medical Ventures $175,229, annual direct costs
Development of a Transcranial Ultrasound Thrombolysis System for Stroke Therapy
The goal of this project is to develop a prototype transcranial ultrasound thrombolysis system (TUTS) that utilizes low energy ultrasound to enhance drug-mediated thrombolysis

7) The Neuroscience Institute Seed Grant: "Transcranial Ultrasound Thrombolysis," C. K. Holland, P.I., $25,000, annual direct costs, 10% effort, 12/1/99 - 11/30/00, (no cost extension to 11/30/01).

6) NIH R13, “AIUM Mechanical Bioeffects Conference,” C. K. Holland, P. I. $19,500, annual direct costs, 5% effort, 8/98.

5) Radiology Department Research Challenge Seed Grant, “Assessing Arterial Stenoses by Tracking Turbulence,” C. K. Holland, P. I., $8,900, 20% effort, 2/15/98 – 12/31/99.

4) Biomedical Engineering Seed Grant, University of Cincinnati, "Passive, pulse-powered, *in vivo* blood membrane testing device," David B. Melvin, Christy K. Holland, Donald C. Stouffer, Peter J. Disimile, and H. Thurman Henderson, co-P. I.'s, $30,000, 5% effort, 3/96-1/97.

3) Whitaker Foundation: "Quantitative Assessment of Arterial Stenoses Using Doppler Ultrasound and Magnetic Resonance Imaging," C. K. Holland, P.I., $60,000 annual direct costs, 25% effort, 4/93-7/96. $276,120 Total

2) Yale University School of Medicine BRSG Fluid Research Funds: "Investigation of the Potential Bioeffects from Diagnostic Ultrasound Exposure in Rat Lungs," C. K. Holland, P.I., $8500, 8/93-9/94.

1) NIH: “Assessment of Cavitation from Diagnostic Ultrasound,” R. E. Apfel, P. I., $124,962, annual direct costs, 10% effort, 4/92-4/95.

Teaching Appointments

Professor, Biomedical Engineering and Radiology, Univ. of Cincinnati (Introduction to Biomedical Engineering; Senior Research Captstone; Biomedical Ultrasound)	2009-
Associate Professor, Dept. of Biomedical Engineering, Univ. of Cincinnati (Introduction to Biomedical Engineering; Medical Imaging)	2001-2009
Research Associate Professor, Dept. of Radiology, Univ. of Cincinnati (Ultrasound Physics; Radiologic Instrumentation and Engineering)	1994-2001
Associate Research Scientist, Dept. of Diagnostic Radiology, Yale University (Ultrasound Physics for Radiology Residents)	1991-94
Postdoctoral Associate, Depts. of Mechanical Engineering and Diagnostic Radiology, Yale University (Ultrasound Physics for Sonographers)	1989-91
Visiting Lecturer, School of Architecture, Yale University (Architectural Acoustics)	1987
Teaching Fellow, Dept. of Applied Physics, Yale University, (Computer Laboratory, and Physics of Musical Instruments)	1985-87
Instructor, "Wintersession", Wellesley College (Music Appreciation)	1983
Teaching Assistant, Dept. of Music, Wellesley College (Music Theory)	1982-83

Courses Developed and Taught (Semesters, 2012-2018):

BME Senior Capstone, 20-BME 5001, 8 cr. This required course for BME students in the Experimental Research Track provides students with an opportunity to conduct a pilot study in a biomedical research laboratory. The course includes creating and conducting an experimental protocol, data analysis and interpretation, as well as statistical analysis. The final outcome is a scientific oral presentation and manuscript. Fall Semester 2014.

BME Senior Capstone, 20-BME 5002, 8 cr. This required course for BME students in the Experimental Research Track provides students with an opportunity to conduct a pilot study in a biomedical research laboratory. The course includes creating and conducting an experimental protocol, data analysis and interpretation, as well as statistical analysis. The final outcome is a scientific oral presentation and manuscript. Spring Semester 2012, 2013, 2014, 2015, 2016, 2018.

Biomedical Ultrasound, 20-BME 6010, 3 cr., Diagnostic ultrasound imaging and therapeutic ultrasound technologies. Topics include principles of ultrasound generation, propagation, and scattering, ultrasound transducers and beamforming, B-scan imaging, Doppler and hemodynamics, exposimetry, cavitation, drug delivery, hyperthermia, and other clinical applications. Spring Semester 2013, 2015, 2016 (independent study), 2017.

Introduction to Biomedical Engineering in the Clinical Environment, 20-BME 2000, 3 cr., Introduction to clinical applications of medical devices and medical device development, UCBME, Fall Semester 2012, 2013, 2014, 2015, 2016, 2017.

Courses Developed and Taught (Quarters: 2002-2011):

Introduction to Biomedical Engineering in the Clinical Environment, 20-BME 210, 3 cr., Introduction to clinical applications of medical devices and medical device development, UCBME, Autumn Quarters 2008 – 2011.

Biomedical Engineering Seminar, 20-BME 702, 1 cr. Seminar lectures by BME faculty and invited

speakers from academic, research and industrial institutions on current biomedical engineering problems. Part I, 2004, 2005, 2007, 2009, 2011.

Career Building Blocks, 20-BME 703, 1 cr. Graduate research seminar augmented with exercises to understand the academic and industrial research environment, Part II, 2004, 2005, 2007, 2009, 2011.

BME Experimental Research Capstone, 20-BME 502, 8 cr. This required course for BME students in the Experimental Research Track provides students with an opportunity to conduct a pilot study in a biomedical research laboratory. The course includes creating and conducting an experimental protocol, data analysis and interpretation, as well as statistical analysis. The final outcome is a scientific oral presentation and manuscript. 2011.

Neuroscience and Music, 16-MTHC 680, 3 cr. Our study concentrates on research into musical perception and cognition from a neuroscience perspective. What is the neural basis for our music theory concepts and our musicality in general? Students acquire an introductory-level knowledge of brain science and learn how to read critically scientific research articles in this field. Provide one lecture on the human perception of pitch and dissonance. 2011, 2014, 2017.

Medical Imaging without Ionizing Radiation, 20-BME 611, 3 cr. The Physics and Instrumentation of Diagnostic Ultrasound, Magnetic Resonance Imaging (MRI), Functional MR and MR Spectroscopy, Spring Quarters 2002-2010.

Biomedical Engineering Survey, 20-BME 601, 1 cr. Introduction to graduate research topics in biomedical engineering, UCBME, provided one lecture on medical ultrasound research Autumn Quarters, 2002-2009.

Introduction to Biomedical Engineering in the Clinical Environment, 20-BME 110, 3 cr., Introduction to clinical applications of medical devices and medical device development, UCBME, Winter Quarter 2005, 2006, 2007, (course moved to the sophomore year, Autumn Quarter 2008).

Introduction to Biomedical Engineering II, 20-BME 102, 1 cr. Introduction to clinical applications of medical devices and medical device development, Part I, UCBME, Winter Quarters 2002-2004

Introduction to Biomedical Engineering III, 20-BME 103, 1 cr. Introduction to clinical applications of medical devices and medical device development, Part II, UCBME, Spring Quarters 2002-2004

Medical Imaging with Ionizing Radiation, 20-BME 610, 3 cr. The Physics and Instrumentation of Diagnostic Radiology with X-rays, Computed Tomography, and Radioisotope Imaging. Co-taught with Chandrasiri Samaratunga, Ph.D., Radiology, Winter Quarter 2003

Compilation of Student Evaluations (scale of 5 – 1 with 5 being excellent)

Semest-er/ Yr	Level	Course Title and Number	Number Students	Average Eval.	CoE Average Eval.
A ‘18	UG	Intro. To BME in the Clinical Clinical Environment, 20-BME 2000	72	3.9	4.0
S ‘18	UG	BME Senior Capstone, 20-BME 5002	16	4.2	4.1
A ‘17	UG	Intro. To BME in the Clinical Clinical Environment, 20-BME 2000	79	3.4	4.0
S ‘17	GS	Biomedical Ultrasound	6	4.6	4.1

A ‘16	UG	Intro. To BME in the Clinical Clinical Environment, 20-BME 2000	91	4.4	4.0
S ‘16	UG	BME Senior Capstone, 20-BME 5002	17	4.7	4.0
A ‘15	UG	Intro. To BME in the Clinical Clinical Environment, 20-BME 2000	75	4.0	4.0
S ‘15	GS	Biomedical Ultrasound	8	4.3	3.8
S ‘15	UG	BME Senior Capstone, 20-BME 5002	9	4.8	3.8
A ‘14	UG	BME Senior Capstone, 20-BME 5001	9	4.5	3.9
A ‘14	UG	Intro. To BME in the Clinical Clinical Environment, 20-BME 2000	72	4.0	3.9
S ‘14	UG	BME Senior Capstone, 20-BME 5002	10	4.7	4.1
A ‘13	UG	Intro. To BME in the Clinical Clinical Environment, 20-BME 2000	55	3.9	4.1
S ‘13	GS	Biomedical Ultrasound	10	4.5	-
S ‘13	UC	BME Senior Capstone, 20-BME 5002	20	3.9	-
A ‘12	UG	Intro. To BME in the Clinical Clinical Environment, 20-BME 2000	61	3.6	3.9
W ‘12	UG	Experimental Research Capstone, 20-BME 502	22	-	-
Qtr/ Yr	**Level**	**Course Title and Number**	**Number Students**	**Average Eval.**	**CoE Average Eval.**
A ‘11	UG	Intro. to BME in the Clinical Environment, 20-BME 210	62	3.9	3.9
A ‘10	UG	Intro. to BME in the Clinical Environment, 20-BME 210	51	2.7	3.9
S ‘10	GS	Medical Imaging without Ionizing Radiation, 20-BME 611	8	4.2	3.8
A ‘09	UG	Intro. to BME in the Clinical Environment, 20-BME 210	42	4.4	3.9
S ‘09	GS	Medical Imaging without Ionizing Radiation, 20-BME 611	4	4.5	4.0
S ‘09	GS	Career Building Blocks Graduate Seminar, 20-BME 703	21	4.7	4.0
W ‘09	GS	Career Building Blocks Graduate Seminar, 20-BME 702	21	Not collected	3.9
A ‘08	UG	Intro. to BME in the Clinical Environment, 20-BME 210	42	4.4	3.9
S ‘08	GS	Medical Imaging without Ionizing Radiation, 20-BME 611	5	4.8	3.9
S ‘07	GS	Career Building Blocks Graduate Seminar, 20-BME 703	10	4.1	4.0
S ‘07	GS	Medical Imaging without Ionizing Radiation, 20-BME 611	10	4.6	4.0
W ‘07	UG	Intro. to BME in the Clinical Environment, 20-BME 110	68	3.5	4.0
W ‘07	GS	Career Building Blocks Graduate Seminar, 20-BME 702	9	3.9	4.0

S ‘06	GS	Medical Imaging without Ionizing Radiation, 20-BME 611	5	4.8	4.0
W ‘06	UG	Intro. to BME in the Clinical Environment, 20-BME 110	48	3.9	4.0
S ‘05	GS	Medical Imaging without Ionizing Radiation, 20-BME 611	5	4.8	4.0
W ‘05	GS	Career Building Blocks Graduate Seminar, 20-BME 702	11	4.5	4.0
W ‘05	UG	Intro. to BME in the Clinical Environment, 20-BME 110	45	4.1	4.0
S ‘04	GS	Medical Imaging without Ionizing Radiation, 20-BME 611	5	4.9	4.0
S ‘04	UG	Intro. to BME III, 20-BME 103	46	3.0	4.0
W ‘04	UG	Intro. to BME II, 20-BME 102	46	3.5	4.0
S ‘03	GS	Medical Imaging without Ionizing Radiation 20-BME 611	7	4.9	4.0
S ‘03	UG	Intro. to BME III 20-BME 103	30	4.0	4.0
W ‘03	GS	Medical Imaging with Ionizing Radiation 20-BME 610	7	4.3	4.0
W ‘03	UG	Intro. to BME II 20-BME 102	37	3.5	4.0

Radiology Residents Lectures 1994-2003, University of Cincinnati:
Ultrasound Physics and Instrumentation: Basic physical concepts, transducers and real time systems, Doppler, hemodynamics, bioeffects, imaging and Doppler artifacts

Radiology Dept., Mechanical, Industrial and Nuclear Engineering Dept, and Physics Dept. 1995-2000:
Radiologic Instrumentation and Engineering, 26-971-95: Basic physical concepts, transducers and real time systems, Doppler, hemodynamics, bioeffects, imaging and Doppler artifacts

Postdoctoral Fellows, Students, and Clinical Fellows Advised

Postdoctoral Fellows:

Name	Department	Project Title	Dates	Source of Support/ Current Employer
17. Chadi Zemzemi, Ph.D.	Internal Medicine, Division of Cardiovascular Health and Disease	Passive cavitation imaging of localized thrombus ablation with histotripsy and echogenic liposomes	1/19 - present	NIH R01 HL133334
16. Maxime Lafond, Ph.D.	Internal Medicine, Division of Cardiovascular Health and Disease	Ultrasound-mediated anti-inflammatory delivery in the coronaries post stent deployment	4/18 - present	NIH R01 HL135092
15. Nuria Salido, Ph.D.	Internal Medicine, Division of Cardiovascular Health and Disease	Passive cavitation imaging of ultrasound-mediated drug delivery in the cardiovascular system	2/18 - present	NIH R01 HL135092
14. Karla Mercado-Shekhar, Ph.D.	Internal Medicine, Division of Cardiovascular Health and Disease	Transcranial ultrasound elasticity imaging of thrombi	8/16 – 3/19	NIH 2RO1 NS047603 Supplement
13. Arunkumar Palaniappan, Ph.D.	Internal Medicine, Division of Cardiovascular Health and Disease	Development of Xe-loaded echogenic liposomes for stroke therapy	11/16 – 5/18	NIH 2RO1 NS047603
12. Himanshu Shekhar, Ph.D.	Internal Medicine, Division of Cardiovascular Health and Disease	Development of rt-PA-loaded and NO-loaded echogenic liposomes for stroke therapy	7/14 – 3/19	NIH 2RO1 NS047603
11. Kenneth Bader, Ph.D.	Internal Medicine, Division of Cardiovascular Health and Disease	Transcranial ultrasound thrombolysis/ Histrotripsy thrombolysis	9/11 – 8/16	Assistant Professor, Radiology Department, University of Chicago

Name	Department	Project Title	Dates	Source of Support/ Current Employer
10. Guillaume Bouchoux, Ph.D.	Internal Medicine, Division of Cardiovascular Health and Disease	Transcranial ultrasound thrombolysis	10/11 – 7/14	Researcher, l'Institut national de la santé et de la recherche médicale (INSERM), Lyon, France
9. Kevin Haworth, Ph.D.	UCBME	Targeted Immunoliposomes for Acoustic Cardiovascular Imaging	10/09 – 8/12	Research Assistant Professor, Division of Cardiovascular Diseases, Internal Medicine, University of Cincinnati
8. Nikolas Ivancevich, Ph.D.	UCBME	Transcranial ultrasound thrombolysis	4/09 – 7/11	Senior Scientist, Siemens Medical, Bothell, WA
7. Azzdine Ammi, Ph.D.	UCBME	Transcranial ultrasound thrombolysis	4/06 – 12/08	Research Assistant Professor, University of Oregon, Portland, OR
6. Tyrone Porter, Ph.D., Acoustical Society of America Hunt Postdoctoral Fellow	UCBME	Targeted Immunoliposomes for Acoustic Cardiovascular Imaging	8/03 – 8/06	Associate Professor with Tenure, Boston University, Dept. of Aerospace and Engineering Mechanics, Boston, MA
5. Jason Meunier, Ph.D.	Emergency Medicine	A Visual Study of Ultrasound Enhanced Thrombolysis in an In-Vitro Clot Model	8/04 – 7/09	Clinical Research Coordinator, Cincinnati Education and Research for Veterans Foundation, Inc.
4. Louis McAdory, M.D.,Ph.D.	Radiology	Transcranial ultrasound thrombolysis	7/04 – 8/05	Consultant, Department of Radiology, Singapore General Hospital
3. Jason Cheng, Ph.D.	Emergency Medicine	A Visual Study of Ultrasound Enhanced Thrombolysis in an In-Vitro Clot Model	2/03 - 6/04	Medical Physicist, National Cancer Institute, National Institutes of Health
2. Constantin Coussios, Ph.D.	UCBME	Transcranial Ultrasound Thrombolysis	11/01 – 12/02	Associate Professor with tenure in Biomedical Engineering and Tutorial Fellow of Magdalen College, Institute of Biomedical Engineering, Department of Engineering Science, University of Oxford

Name	Department	Project Title	Dates	Source of Support/ Current Employer
1. John Stroud, Ph.D.	Radiology	Assessing arterial stenoses by tracking turbulence with Doppler ultrasound	6/95 – 7/97	Naval Research Laboratory, Acoustical Sensing Branch, Coastal Systems Station, Panama City, FL

Graduate Students:

Trainee Name	Training Period (Degree)	Prior Academic Degree Institution	Prior Academic Degree	Prior Academic Degree Year	Title of Research Project	Source of Support of Current Trainees / Current Position of Past Trainees
17. Robert Kleven	7/15 - Present	Central College, Pella, IA	BA	2013	Ultrasound-enhanced thrombolysis in porcine thromboembolism and intracerebral hemorrhage models	BME MD/PhD Student, NIH RO1 NS059586
16. Shenwen Huang, M.D., Ph.D.	7/12 – 8/17	Massachusetts Institute of Technology	BS	2010	The effect of 120-kHz ultrasound on thrombolytic efficacy in porcine thromboembolism models	M4 Medical Student, Ruth L. Kirschstein Institutional Predoctoral Training Grant (T32)
15. Kirby Lattwein, MS, Erasmus University, Rotterdam, The Netherlands	4/16 – 8/16	US Naval Academy	BS	2009	Sonobactericide therapy to treat *staphylococcus aureus*	PhD Student at Erasmus University, Rotterdam, The Netherlands, Nederlandse Hartstichting Fellowship
14. Katie Schappacher	9/12 – 02/14	Ohio University	BS	2011	siRNA encapsulation and release from echogenic liposomes	Pharmacology PhD student, withdrew from lab
13. Jason Raymond, Ph.D.	9/09 – 5/15	Boston University	MS	2002	Bioactive gas encapsulation and release from echogenic liposomes	ASA Hunt Postdoctoral Fellow, Oxford University, UK

Trainee Name	Training Period (Degree)	Prior Academic Degree Institution	Prior Academic Degree	Prior Academic Degree Year	Title of Research Project	Source of Support of Current Trainees / Current Position of Past Trainees
12. Matthew Gruber, M.S.	9/08 – 12/14	University of Cincinnati	BS	2008	Ultrasound-mediated rt-PA thrombolysis	Working in industry in Cincinnati, OH
11. Jonathan Sutton, Ph.D.	8/08 – 05/14	William and Mary	BS	2008	Ultrasound-mediated drug delivery	Research Staff Member, Philips Research, Boston, MA
10. Kirthi Radhakrishnan, Ph.D.	9/07 – 11/13	India Institute of Technology	MS	2004	Relationship between cavitation, rapid loss of echogenicity and drug release from echogenic liposomes	Engineer at Philips, Andover, MA
9. Steven Perrin, II, M.S.	7/08 – 10/13	Case Western Reserve	MS	2007	Ultrasound-enhanced thrombolysis in a porcine intracerebral hemorrhage model	Withdrew from the BME program, working in industry in NY, NY
8. Christopher Weidner	11/08 – 9/11	University of Cincinnati	BS	2007	Effect of coil implantation on the fibrin network and stiffness of clots	Withdrew from the BME program, working in industry in Cincinnati, OH
7. Jonathan Kopechek, Ph.D.	8/06 – 8/11	Ohio State Univ.	BS	2006	The role of acoustic cavitation in ultrasound-triggered drug release from echogenic liposomes	Assistant Professor, University of Louisville, Louiseville, KY

Trainee Name	Training Period (Degree)	Prior Academic Degree Institution	Prior Academic Degree	Prior Academic Degree Year	Title of Research Project	Source of Support of Current Trainees / Current Position of Past Trainees
6. Kathryn Kitchcock, M.D., Ph.D.	7/06 – 6/10	University of Maryland	MS	2004	Ultrasound-enhanced drug delivery in a perfused *ex vivo* artery model	Assistant Professor, Radiation Oncology University of Florida, Gainesville, FL
5. Saurabh Datta, Ph.D.	8/03 – 9/07	UC, Dept. ECECS	MS	2003	The role of cavitation in enhancement of rt-PA thrombolysis	Senior Scientist, Siemens Medical, Mountain View, CA
4. Denise Smith, M.D., Ph.D.	9/03 – 6/07	Health Physics, Georgia Tech.	BS	1998	In vitro characterization of echogenic liposomes for ultrasonic delivery of recombinant tissue-type Plasminogen Activator (rt-PA)	Vascular Surgeon in San Diego, CA
3. Jun Tan	3/03 – 6/06	Automation Control Engineering, Huazhong Univ., China	BS	1999	Enhancement of Transcranial Ultrasound Thrombolysis with Cavitation	Withdrew from the BME Program, Statistical analyst at Amgen, Los Angeles, CA
2. Volodya Nahirnyak, Ph.D.	11/02-8/06	University of Cincinnati, Dept. Physics	MS	2003	Ultrasound-induced hyperthermia in ex vivo clotted blood and cranial bone	Staff Medical Physicist, National Center for Radiosurgery, Ukraine
1. Megan Miller Runk, M.S. UC Physics Dept.	6/98 – 11/99	UC	BS	1998	Assessing arterial stenosis by tracking turbulence with pulsed Doppler Ultrasound	Research Scientist, Ethicon Endo-Surgery

Medical Students

Trainee Name	Training Period (Degree)	Title of Research Project	Source of Support of Current Trainees / Current Position of Past Trainees
7. Matthew Phillips	6/19-8/19	Development and characterization of clots mimicking chronic deep vein thrombi	(M2) NIH R01 HL133334
6. Janki Shukla	6/18-8/18	Graphical user interface for passive cavitation imaging of ultrasound-mediated drug delivery in the coronaries post stent deployment	(M2) UC COM Medical Student Scholars Program and NIH R01 HL135092
5. Kunal Karani	8/17-6/18	Porcine model of thromboembolism	(M4) CCHMC Pediatric Radiology and NIH R01 NS047603
4. Robert Sibilia	6/15 – 8/15	Simulation of Ultrasound Cardiac Fields	UC COM Cardiology Resident
3. Nancy Hahn	2/00 – 8/00 and 5/01 – 8/01	Transcranial Ultrasound Thrombolysis	Withdrew from medical school
2. Kim Philippi, M.D.	6/00 – 8/00	Assessment of Location of Middle Cerebral Artery in Human Brain	Psychiatrist, Dallas Group Analytic Practice
1. Donnevan Blake, M.D.	6/00 – 8/00	Assessment of Turbulence in a Porcine Arteriovenous Fistula	Cardiologist, Cardiology Associates of Greenbay, WI

Undergraduate Students: (Underrepresented minority students are Italicized)

Name	Institution	Role	Dates
36. Gregory Macke	UC Electrical Engineering	Research Advisor for Co-op project: Calibration of transducer arrays used with Verasonics ultrasound imaging system	01/20-present
35. Samantha Ford	UC Biology and Neuroscience	Research Advisor for Research Experience for Women Undergraduates project: Ultrasound and rt-PA thrombolytic efficacy in a porcine intracerebral hemorrhage model	05/19-present
34. Sydney Collins	Biomedical Engineering, Duke University	Research Advisor for Summer Undergraduate Research Fellowship Program, *In vitro* characterization of nitric oxide-loaded microbubbles to treat biofilm	06/19-08/19
33. Karthikeyan Sakthivel	UC Medical Sciences	Research Advisor for honors project: Ultrasound-mediated lysis in a porcine intracerbral hemorrhage model	05/18-08/18
32. *Hermes Rivera*	Biomedical Engineering, University of Puerto Rico	Research Advisor for MSTP Summer Undergraduate Research Fellowship Program, Effect of degree of retraction on rt-PA lytic susceptibility *in vitro*	06/17 – 08/17

Name	Institution	Role	Dates
31. Ryden Lewis	Biomedical Engineering, University of Michigan	Research Advisor for MSTP Summer Undergraduate Research Fellowship Program, Ultrasound elasticity imaging of porcine and human thrombi	06/17 – 08/17
30. Nathaniel Smith	Physics and Mathematics, Depauw University	Research Advisor for MSTP Summer Undergraduate Research Fellowship Program, Effect of temperature on size distribution and attenuation of a commercial contrast agent and echogenic liposomes	06/16 – 08/16
29. *Jahrane Dale*	Biomedical Engineering, Columbia University	Research Advisor for MSTP Summer Undergraduate Research Fellowship Program, Robust Capon beamforming to improve axial resolution of the passive cavitation imaging algorithm	06/15 – 08/15
28. Ahmed Lababidi	Biology, University of Cincinnati	Research Advisor for Senior Capstone, Delivery of nitric oxide from bubble liposomes to ex vivo porcine femoral arterial tissue	01/15 – 05/15
27. Abby Bull	Physics, Gettysburg College	Research Advisor for Independent Study	01/15
26. Michael Crowe	Physics, Xavier University	Research Advisor for Independent Study, Effect of frequency-dependent attenuation on predicted histotripsy	08/14 – 05/15
25. *Rosette Nkulu*	Franklin College	Research Advisor for ASPET Summer Undergraduate Research Fellow, Acoustic characterization of Nitric Oxide-loaded echogenic liposomes	06/14 – 08/14
24. Daniella Patton	Biophysics, Xavier University	Research Advisor for Summer Undergraduate Research Fellowship Program, Image analysis for delivery of bevacizumab to atheromatous porcine carotid tissue using echogenic liposomes	06/14 – 12/14
23. Shane Duffield	UCBME	Research Advisor for Summer Undergraduate Research Fellowship Program, Development of a porcine d-dimer assay as a metric of rt-PA thrombolytic efficacy	06/13 – 08/13
22. Kelsey R. Wong	UC Berkeley	Research Advisor for MSTP Summer Undergraduate Research Fellowship Program, Correlation of thrombus structure and rt-PA thrombolytic efficacy	06/13 – 08/13
21. Joseph Griffen	UCBME	Research Co-op Advisor, Quantitative characterization of gas-loaded liposomes	9/12 – 12/12
20. Josi Herren	UCBME	Senior Capstone Research Advisor, Effect of pH on rt-PA efficacy in an in vitro human whole blood clot model	9/12 – 5/13
19. Michael Verleye	University of Notre Dame	Summer Research Advisor, 2012 UC GSUM Program, Ultrasound-triggered vasoreactivity using nitric oxide-loaded echogenic liposomes	6/12 – 8/12

Name	Institution	Role	Dates
18. Kathleen Hiltz	Washington University	Summer Research Advisor for 2012 MSTP SURF program, Acoustic characterization of bioactive gas-loaded echogenic liposomes	6/12 – 8/12
17. Brian Boomer	UCBME	Summer Research Advisor, Effect of pH on rt-PA activity: Analysis of buffer diffusion kinetics	6/12 – 8/12
16. *Ken Okoye*	UCBME	Research Co-op Advisor, Effect of pH on rt-PA activity	4/12 – 9/12
15. Andrew Davis	UCBME	Summer Research Advisor, Effect of pH on rt-PA activity	6/11 – 9/11
14. Tyler Fosnight	UCBME	Independent Study Research Advisor, Effects of physiologic overpressure on the inertial and stable cavitation thresholds of Definity®	6/10 – 12/10 and 9/11 – 3/12
13. Christine Bonini	Chemical Engineering, Princeton University	Summer Research Advisor, Acoustic properties of a microballoon-loaded silicone elastomer for use as an anechoic tank lining	6/07 – 9/07
12. Stephen Chrzanowski	UCBME	Co-op Research Advisor, Ultrasound mediated selective intra-cerebral drug delivery for the treatment of cerebral vasospasm	6/07 – 9/07
11. *Whitney Gaskins*	UCBME	Co-op Research Advisor, Ultrasound mediated selective intra-cerebral drug delivery for the treatment of cerebral vasospasm	3/07 – 6/07
10. Mohammed Siddiqi	UCBME	Co-op Research Advisor, Escalon Medical, Evaluation of the sensitivity of ultrasound-guided vascular access needles	9/05 – 3/06
9. Boyu Wang	UCBME	Co-op Research Advisor, Ultrasound mediated selective intra-cerebral drug delivery for the treatment of cerebral vasospasm	9/05 – 3/06 and 6/06 – 8/06
8. Lusia Jakubowska	Biotechnology, [August Cieszkowski's Agricutural University in Poznan, Poland]	Summer Research Advisor, Acoustic characterization of liposomes	6/02 – 8/02 and 6/04-8/04
7. Gaurav Shukla	Biomedical Engineering, Duke University	Summer Research Advisor, Transcranial ultrasound thrombolysis	6/01 – 8/01
6. Scott Lenobel	Biology, Rice University	Summer Research Advisor, '00: Assessment of arterial turbulence in a porcine arteriovenous fistula	6/00 – 8/00; 6/01 – 8/01 and 6/02 – 8/02
5. Christopher Disimile	Biology, University of Cincinnati	Research Advisor, Mechanical Bioeffects in Lung Due to Diagnostic Ultrasound	6/99 – 12/02

Name	Institution	Role	Dates
4. *Angela Moore*	Biomedical Engineering, University of Pennsylvania	Summer Student Research Advisor, REACH Program, Assessment of post-stenotic turbulence with Doppler ultrasound	6/97 – 9/97
3. Nicholas Reinhart	Nanotechnology, Rice University	Summer Student Research Advisor, Assessment of post-stenotic turbulence with Doppler ultrasound	6/96 - 9/96
2. Karin Gelfand	Mechanical Engineering, Stanford University	Summer Student Research Advisor: Assessment of post-stenotic turbulence with Doppler ultrasound	6/95 - 9/95
1. *Elisa Hettesheimer*	Radiology Technologist	Tutor in Physics for Ultrasound Technologists/Preparation for Diagnostic Ultrasound Registry Exam	8/94 - 8/95

High School Students:

Name	Institution	Dates
15. Kyle Bannerman	Cincinnati Country Day	06/16 – 08/16
14. Vaibhav Vagal	The Seven Hills School	06/16 – 08/16
13. Xiaoyu Lou	Cincinnati Country Day	06/15 – 08/15
12. Shristi Kapur	The Seven Hills School	06/14 – 08/14
11. Emily Walton	Summit Country Day High School	06/14 – 08/14
10. Mollie Rouan	The Seven Hills School	06/13 – 08/13
9. Aman Kumar	Mason High School	06/13 – 08/13
8. Lauren Driskell	The Seven Hills High School	06/12 – 08/12
7. Sanika Vaidya	Sycamore High School	06/12 – 08/12
6. Hunter Behne	Cincinnati Country Day	06/12 – 08/12
5. Bradley Hamoor	Cincinnati Country Day (Stanford University)	06/11 – 09/11
4. Peppar Cyr	The Seven Hills School (Princeton University)	06/09 – 09/09
3. Sebastian Koochaki	Cincinnati Country Day (Yale University, BS, Harvard University MD, PhD student)	06/09 – 09/09
2. Jane Abbottsmith	Summit Country Day, National Merit Scholar (SAT score: 1600); Princeton University, BA	06/07 – 09/07
1. Robert Herman	Cincinnati Country Day School, National Merit Scholar, [SAT = 1600]	06/98 – 08/98

Residents, Clinical Fellows and Faculty:

Name	Department	Project Title	Dates	Current Position
3. Vasisht Srinivasan, M.D.	Emergency Medicine (Fellow)	Ultrasound imaging of the brain during acute intracerebral hemorrhage	03/19 – present	UC Critical Care Fellow
2. George Shaw, M.D., Ph.D.	Emergency Medicine (4th year resident)	Transcranial Ultrasound Thrombolysis	9/00 – 6/02	Associate Professor with tenure, Emergency Medicine, University of Cincinnati

1. Lubabatu Abdurrahman, M.D.	Pediatric Cardiology, Cincinnati Children's Hospital Medical Center (Fellow)	Bioeffects of Diagnostic Ultrasound	6/95 – 5/98	Cardiologist, Dayton Children's Hospital, Dayton, OH

Faculty

Name	Position	Department	Dates
5. Ivan Rosado-Mendez, Ph.D.	Assistant Professor	Grupo de Dosimetria y Física Médica, Instituto de Física, UNAM, Mexico City, Mexico	10/18 – present
6. Klazina Kooiman, Ph.D.	Assistant Professor	Biomedical Engineering, Thorax Centre, Erasmus Medical Center, Rotterdam, The Netherlands	6/16 – present
4. Kevin Haworth, Ph.D.	Research Assistant Professor	Division of Cardiovascular Diseases, Internal Medicine, UC	8/12 – present
3. George Shaw, M.D., Ph.D.	Associate Professor with Tenure	Emergency Medicine, UC	7/02 – 06/15
2. John S. Allen, III, Ph.D.	Assistant Professor	Mechanical Engineering, University of Hawaii (NIH Center of Biomedical Research Excellence mentor)	5/08 – 5/09
1. Cheri Deng, PhD	Assistant Professor	Biomedical Engineering, Case Western Reserve, Member, Mentoring Committee, Academic Careers in Engineering and Science program, funded by an NSF ADVANCE Institutional Transformation Award, Patrick E. Crago, Ph.D., Chair BME	8/05 – 8/07

External Examiner for the following PhD dissertations:

1. Daniel Pajek, "The application of transcranial high intensity focused ultrasound to clot lysis," Ph.D. Dissertation, Department of Medical Biophysics, University of Toronto, Toronto, Ontario, Canada, July 21, 2014.

2. Tom J. A. Kokhuis, "Stembells: A novel stem cell delivery platform using microbubbles and ultrasound," Ph.D. Dissertation, Department of Biomedical Engineering, Erasmus University, Rotterdam, The Netherlands, November 19, 2014, 181 pages.

3. Ying Luan, "Ultrasound-triggered drug release from vibrating micorobubbles," Ph.D. Dissertation, Department of Biomedical Engineering, Erasmus University, Rotterdam, The Netherlands, November 19, 2014, 211 pages.

4. Susan Graham, "Ultrasound-triggered drug release from liposomes using nanoscale cavitation nuclei," Ph.D. Dissertation, Department of Engineering Science, University of Oxford, Oxford, England, April 13, 2015, 232 pages.

5. Ilya Skachkov, “Microbubbles for molecular imaging and drug delivery,” Ph.D. Dissertation, Department of Biomedical Engineering, Erasmus University, Rotterdam, The Netherlands, January 20, 2016, 160 pages.

6. Ragnhild Haugse, University of Bergen, Bergen, Norway, April 2020.