

Steven Paul Allen

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SYNOPSIS

I use magnetic resonance imaging (MRI) physics and engineering to study interactions between biologic systems and medical interventions. My recent work has been focused on developing focused ultrasound surgeries for neurological disease including pediatric brain tumors.

EDUCATION

Ph.D. Biomedical Engineering, University of Michigan August 2016
Dissertation: "Magnetic Resonance Imaging Guidance of Histotripsy Therapy"
M.S. Biomedical Engineering, University of Michigan May 2013
Thesis: Implementation of Fast, Spiral Imaging in a 7T Small Animal MRI Scanner"
B.S., Physics, Brigham Young University April 2010
Thesis: "Phase Sensitive and Dual-Angle Radiofrequency Mapping in ^{23}Na Magnetic Resonance Imaging"

RESEARCH AND TEACHING FIELDS

Magnetic Resonance Imaging	Focused Ultrasound Surgeries	Medical Physics
Medical Imaging Modalities	Signals and Systems	Ultrasound and Acoustics
Biomedical Instrumentation	MR Hardware	Undergraduate Physics

PRIMARY POSITIONS

Postdoctoral Research Associate, Biomedical Engineering, UVA	2019-2020
Postdoctoral Research Fellow, Robert Berne Cardiovascular Research Center, UVA	2017-2019
Postdoctoral Research Associate, Biomedical Engineering, UVA	2016-2017
Postdoctoral Research Assistant, Biomedical Engineering, U of M	2016
Graduate Student Instructor, Biomedical Engineering, U of M	2014-2016
Graduate Student Research Assistant, Biomedical Engineering, U of M	2010-2013

CONSULTING POSITIONS

Consultant, Histosonics, Inc	2016
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HONORS AND AWARDS

Training Fellowship, Robert M Berne Cardiovascular Research Center	2017-2019
Postdoctoral Teaching Fellowship, UVA School of Engineering and Applied Sciences	2017
Summer Research Fellowship, U of M Rackham Graduate School	2015
Young Investigator Award, 4 th International Focused Ultrasound Symposium	2014
Graduate Assistance in Areas of Nation Need (GAAN) Fellowship, U of M	2014, 2015

EXTRAMURAL FUNDING

UVA Brain Institute Pilot Grant “Thermal Dose Effects on the Diffusional Properties of Neuronal Tissue”	2019
Integrated Translational Health Research Institute of Virginia “Improved Safety and MRI Data Accuracy for Transcranial Focused Ultrasound Procedures Via a Novel Acoustic Coupling Bath”	2019
Focused Ultrasound Foundation “Development of Novel Acoustic Coupling Media to Improve Image Guidance and Treatment Safety in Transcranial Focused Ultrasound Procedures”	2019
Ivy Biomedical Innovation Fund “Suppressing the Coupling Water Bath for Improved Guidance of Focused Ultrasound Surgery”	2017
ORCA Undergraduate Student Mentoring Grant (BYU) “B1 Mapping Methods for Improved Sodium Quantification Using MRI”	2009

PROFESSIONAL LEADERSHIP

Trainee Representative	2020-2021
Interventional MRI Study Group	
International Society for Magnetic Resonance in Medicine	

TEACHING AND MENTORSHIP

UNDERGRADUATE DIRECTED RESEARCH

Anthony Nguyen, Biomedical Engineering, UVA

Project: “Doping Agents to Improve MR Imaging During Focused Ultrasound Thalamotomy”

Leigham Breckenridge, Biomedical Engineering, UVA

Project: “Simulation of a Novel, Adiabatic, 3D-Selective, Excitation Pulse”

CLASSROOM EXPERIENCE

Principles of Magnetic Resonance Imaging, UVA BME 8782 (Co-Instructor)	Fall 2017
BME Measurement Principles, UVA BME 6311 (Teaching Assistant)	Winter 2017
Circuits and Systems, U of M BIOMEDE 211 (Substitute Lecturer)	2015
Biomedical Instrumentation and Design, U of M, BIOMEDE 458/558 (Graduate Student Instructor)	Winters 2015, 2016
Medical Imaging Laboratory, U of M BIOMEDE 510 (Graduate Student Instructor)	Winter 2014
Medical Imaging Systems, U of M EECS 516 (Substitute Lecturer)	2011, 2012, 2013
Department of Physics Demonstration lab, BYU (Undergraduate Teaching Assistant)	2007-2009
Department of Physics Homework Lab, BYU, (Undergraduate Teaching Assistant)	2008-2009
Volunteer Tutor, BYU, Undergraduate Physics	2008-2010

PUBLICATIONS

JOURNAL ARTICLES (REFEREED)

- Allen S.P.**, Prada, F., Xu, Z.Y., et al. A Preclinical Study of Diffusion Weighted MRI Image Contrast as an Early Indicator of Thermal Ablation, *Magn Reson Med* 2019. **Under Review**
- Allen, S. P.**, Steeves, T. , Fergusson, A. , Moore, D. , Davis, R. M., Vlasisavljevic, E. and Meyer, C. H. (2019), Novel acoustic coupling bath using magnetite nanoparticles for MR-guided transcranial focused ultrasound surgery. *Med. Phys.* doi:[10.1002/mp.13863](https://doi.org/10.1002/mp.13863)
- Quah, K, Poorman, ME, **Allen, SP**, Grissom WA. Simultaneous multislice MRI thermometry with a single coil using incoherent blipped-controlled aliasing. *Magn Reson Med.* 2019; 00: 1– 13.
- Grissom, WA, **Allen, SP**. Reducing temperature errors in transcranial MR-guided focused ultrasound using a reduced-field-of-view sequence. *Magn Reson Med.* 2019; 00: 1– 9.
- Allen SP**, Feng X, Fielden SW, Meyer CH. “Correcting image blur in spiral, retraced in/out (RIO) acquisitions using a maximized energy objective.” *Magn Reson Med.* 2019;81:1806–1817.
- Sukovich, J.R., Cain, C.A., Pandey, A.S., Chaudhary, N., Camelo-Piragua, S., **Allen, S.P.**, Hall, T.L., Snell, J., Xu, Z., Cannata, J.M. and Teofilovic, D., 2018. In vivo histotripsy brain treatment. *Journal of Neurosurgery*, Oct, 2018. pp.1-8. (Early View).
- Lundt, J.E, **Allen, S.P.**, et al, “Noninvasive, Rapid Ablation of Tissue Volume Using Histotripsy.” *Ultrasound in Med. & Biol.* 2017; 43(12), 2834-2847.
- Allen, S. P.**, et al. "The response of MRI contrast parameters in in vitro tissues and tissue mimicking phantoms to fractionation by histotripsy." *Physics in Med. & Biol.* 62.17 (2017): 7167-7180.
- Fan, Y.; Guo, R.; Shi, X., **Allen, S.** et al. Modified Nanoemulsions with Iron Oxide for Magnetic Resonance Imaging. *Nanomaterials* 2016, 6, 223.
- Allen, S. P.**, et al. “MR-Based Detection of Individual Histotripsy Bubble Clouds Formed in Tissues and Phantoms.” *Magn Reson Med.* 76.5 (2016) 1486-1493
- Allen, S. P.**, et al. “Controlling cavitation-based image contrast in focused ultrasound histotripsy surgery.” *Magn Reson Med*, 73.1 (2015) 204-213.
- Vlasisavljevic, E., Kim, Y., **Allen, S.**, et al. Image-guided non-invasive ultrasound liver ablation using histotripsy: Feasibility study in an in vivo porcine model. *Ultrasound in Med. & Biol.* 39(8), 1398-1409.
- Kim, Y., Fifer, C.G., Gelehrter, S.K., Owens, G.E., Berman, D.R., Vlasisavljevic, E., **Allen, S.P.**, et al. “Developmental Impact and Lesion Maturation of Histotripsy-Mediated Non-Invasive Tissue Ablation in a Fetal Sheep Model.” *Ultrasound in Med. & Biol.* 39(6). June 2013.
- Allen, S. P.**, et al. (2011), Phase-sensitive sodium B_1 mapping. *Magn Reson Med*, 65.4 (2011): 1125–1130.

INVITED TALKS

“Paramagnetic Nanoparticles for MR-Guided Surgeries,” *The Nano-Symposium on Engineered Health*, Virginia Tech, Roanoke, VA 2018

CONFERENCE PROCEEDINGS

Allen, S.P. Steeves, T. Vlaisavjlevich, E. Fergusson A. Davis, R. Meyer, C.H. “Novel Acoustic Coupling Design to Improve MRI Guidance for Focused Ultrasound Surgery.” Proceedings of the 17th International Symposium on Therapeutic Ultrasound, Barcelona, 2019.

Allen, S.P. Steeves, T. Vlaisavjlevich, E. Fergusson A. Davis, R. Meyer, C.H. “Novel Acoustic Coupling Design to Improve MR Imaging Guidance for Focused Ultrasound Surgery.” Proceedings of the 28th Annual Meeting of ISMRM, Montreal. 2019.

Gilbo YK, Sporkin, H. Fielden, Mugler, J. Miller, G.W. **Allen, SP.** Meyer. C. “Detecting T1-based “Signal Reduction in Focused Ultrasound Heating of Bone using a 3D Spiral Ultra-Short Echo Time Sequence.” Proceedings of the 28th Annual Meeting of ISMRM, Montreal. 2019.

Allen, S.P. Feng, X. Elias, W.J. Pauly, K.B. Meyer, C. “Intraoperative, diffusion-weighted, MR imaging immediately after transcranial FUS thalamotomy.” 6th International Symposium on Focused Ultrasound 2018, Reston, VA, 2018, BR-13.

Allen, S.P. Feng, X. Elias, W.J. Meyer, C. “Intraoperative, diffusion-weighted, MR imaging for transcranial focused ultrasound thalamotomy.” 12th Interventional MRI Symposium, 2018, Boston, MA, 2018.

Feng, X. **Allen, S.P.** Fielden, S. Meyer, C. “Accelerated real-time 3D MR thermometry using a retraced spiral-in/out trajectory.” 6th International Symposium on Focused Ultrasound 2018, Reston, VA, 2018, BR-43.

Gilbo, Y. Sporkin, H. Fielden, S. Mugler, J. Miller, G. **Allen, S.P.** Pfeuffer, J. Keifer, B. Meyer, C. “T1-based Signal Reduction in Focused Ultrasound Heating of Bone using a 3D Spiral Ultra-Short Echo Time Sequence.” 6th International Symposium on Focused Ultrasound 2018, Reston, VA, 2018, P-YI-13.

Allen, S.P. Feng, X., Fielden, S. Meyer, C.H. “Improved Automatic Deblurring Using a Novel Objective Function Paired with a Retraced Spiral Acquisition Trajectory”. Proceedings of the 27th Annual Meeting of ISMRM, Paris. p. 2680, 2018.

Allen, S.P. Feng X., Sporkin, H., and Meyer, C. “Rapid Diffusion-Weighted Imaging Immediately After Sonication Using Outer-Volume Suppression Pulses and Single-Shot, Spiral Acquisition”. Proceedings of the 17th International Symposium on Therapeutic Ultrasound, Nanjing, 2017.

Allen, S.P., and Hall, T.L. "Feasibility of MRI monitoring of histotripsy therapy." *AIP Conference Proceedings*. Vol. 1821. No. 1. AIP Publishing, 2017.

Sukovich, J., **Allen, S.P.** et al.. “In Vivo Porcine Histotripsy Brain Treatments”. 5th International Focused Ultrasound Symposium. Bethesda. 2016: A34.

Lundt, J., **Allen, S.P.** et al.. “Effects of Dosing and Focal Spacing in Rapid Ablation of Large Tissue Volume Using Histotripsy with Electronic Focal Steering”. 5th International Focused Ultrasound Symposium. Bethesda. 2016: A42.

Sukovich, J, **Allen, S.P.** et al.. “Efficacy and Treatment Envelope of Transcranial Histotripsy Therapy without Using Aberration Correction”. 5th International Focused Ultrasound Symposium. Bethesda. 2016: A127.

Allen, S.P., Hall, T.L., Cain, C.A., Hernandez-Garcia, L. “Response of MR Contrast Parameters in Tissues and Tissue Mimicking Phantoms to Histotripsy” Proceedings of the 25th Annual Meeting of ISMRM, Singapore. 2016.

Lundt, J.E., **Allen, S.P.**, Sukovich J.R., Hall, T.L., Xu, Z.. “Non-Invasive Rapid Ablation of Large Tissue Volume Using Histotripsy”. Proceedings of the 16th International Symposium on Therapeutic Ultrasound, Tel Aviv, 2016.

Allen, S.P., Hernandez-Garcia, L., Cain, C.A., Hall, T.L. “MR-Based Quantification of Damaged Kidney Volume Incurred By Shockwave Lithotripsy”. Proceedings of the 16th International Symposium on Therapeutic Ultrasound, Tel Aviv, 2016.

Allen, S.P., Hernandez-Garcia, L., Cain, C.A., Hall, T.L. “Response of MR Contrast Parameters in Tissues and Tissue Mimicking Phantoms to Histotripsy”. Proceedings of the 16th International Symposium on Therapeutic Ultrasound, Tel Aviv, 2016.

Allen, S.P., Hernandez-Garcia, L., Cain, C.A., Hall, T.L. “Real-Time Feedback of Cavitation Ablation Therapy (Histotripsy)”. 4th International Focused Ultrasound Symposium. Bethesda. 2014: 89-LV.

Allen, S.P., Hernandez-Garcia, L., Cain, C.A., Hall, T.L. “Feasibility of MRI Monitoring of Histotripsy Therapy”. Proceedings of the 14th International Symposium on Therapeutic Ultrasound. Las Vegas, 2014: p. 235.

Allen, S.P., Hall, T.L., Cain, C.A., Hernandez-Garcia, L. “MR-Based Targeting of Histotripsy Therapy at 7T” Proceedings of the 21st Annual Meeting of ISMRM, Salt Lake City, p 1831.

Allen, S.P., Roberts, W.W., Hall, T.L., Cain, C.A., Hernandez-Garcia, L., “Characterization of the *In Vivo* Histotripsy Lesion Using High Field MRI.” Proceedings of the 20th Annual Meeting of ISMRM, Melbourne, p 1582.