Stephen Alexander Lee, Ph.D.

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Education

Columbia University, New York, NY
Ph.D. Biomedical Engineering 2022
M.Phil. Biomedical Engineering 2018
M.S Biomedical Engineering 2018

University of North Carolina at Chapel Hill, Chapel Hill, NC
B.S. Biomedical Engineering 2015

Positions

Postdoctoral Fellow, Polytechnique Montreal 2023-Present
Advisor: Dr. Jean Provost
Focus: Ultrasound Localization Microscopy: imaging of capillary stalling in stroke
- NSERC Vanier-Banting Postdoctoral Fellowship (2023-2025)
- Institut TransMedTech Living Lab postdoctoral fellowship (2022-2024)

Doctoral Student, Columbia University 2016-2022
Advisor: Dr. Elisa Konofagou
Focus: Focused Ultrasound Neuromodulation of the Peripheral Nervous System
- NIH NIDA R36DA054475 (2022 - 2023)

Research Assistant, University of North Carolina at Chapel Hill 2014-2015
Advisor: Dr. Gianmarco Pinton
Focus: Ultrasound imaging of traumatic brain injury

Research Assistant, Chinese University of Hong Kong 2014
Advisor: Dr. Poon Wai Sang
Focus: mesenchymal stem cells for traumatic brain injury

Funding

Vanier-Banting Postdoctoral Fellowship 2023-2025
- National Science and Engineering Research Council of Canada

Living Lab Excellence postdoctoral scholarship 2023-2024
- Institute TransMedTech

R36DA054475 Dissertation Grant 2021-2022
- NIH National Institute on Drug Abuse

Awards

Yuen-huo Hung and Chao-chin Huang Award 2023
- Columbia University, Department of Biomedical Engineering

Young Investigator Award 2022
- 8th International Symposium on Focused Ultrasound, Bethesda, MD

Student Award Finalist 2022
- International Society for Therapeutic Ultrasound, Toronto, ON, Canada

1st Place Student Best Paper Award 2019
- IEEE International Ultrasound Symposium, Glasgow, Scotland

1st Place Student Poster Competition 2019
- Columbia University BME Symposium, New York, NY

Frank Morrel Endowed Memorial Scholarship 2019
- Marine Biological Laboratory, Woods Hole, MA

Milton L. Shifman Endowed Scholarship 2019
- Marine Biological Laboratory, Woods Hole, MA

Student Travel Award 2017
- IEEE International Ultrasound Symposium, Washington, DC

Dunlevie Honors Undergraduate Research Award 2014
- UNC Chapel Hill Honors Program, Chapel Hill, NC

Publications

Peer-reviewed

1. Michael Mougharbel, Jonathan Porée, Stephen A. Lee, Paul Xing, Alice Wu, Jean Claude-Tardif and Jean Provost. Angular-coherence-weighted, motion-corrected, harmonic high contrast Ultrafast cardiac imaging using a novel unified framework. IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, (accepted)
2. Alexis Leconte, Jonathan Poree, Brice Rauby, Alice Wu, Paul Xing, Stephen A. Lee, Chloe Bourquin, Gerardo Ramos-Palacios, Abbas Sadikot, Jean Provost, A Tracking prior to Localization workflow for Ultrasound Localization Microscopy. IEEE Transactions on Medical Imaging, 2024.
3. **Stephen A. Lee**, Jonathan Porée, Alexis Leconte, Alice Wu, Jean Provost, Ultrasound Localization Microscopy of the brain: the missing micro vasculature. 21st IEEE International Symposium on Biomedical Imaging, 2024.
4. **Stephen A. Lee**, Hermes A. S. Kamimura, Mila Smith, and Elisa E. Konofagou. Functional cerebral neurovascular mapping during focused ultrasound peripheral neuromodulation of neuropathic pain. IEEE Transactions on Biomedical Engineering, 2024. **[Web Featured & Cover Page]**
5. Samuel Desmarais, Gerardo Ramos-Palacios, Jonathan Poreé, Alexis Leconte, Stephen A. Lee, Abbas Sadikot, Jean Provost. Equivalent-Time-Active-Cavitation-Imaging Enables Vascular-Resolution Blood-Brain-Barrier-Opening-Therapy Planning. Physics in Medicine & Biology, 2024.
6. Xiaoyue Judy Li, Md Murad Hossain, Stephen A. Lee, Niloufar Saharkhiz, Elisa E. Konofagou. Harmonic motion imaging-guided focused ultrasound ablation: comparison of three focused ultrasound interference filtering methods. Ultrasound in Medicine & Biology, 2024.
7. Erica P. McCune, Stephen A. Lee, Elisa E. Konofagou. Interdependence of Tissue Temperature, Cavitation, and Displacement Imaging During Focused Ultrasound Nerve Sonication. IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, 2023.
8. Benjamin Hoffman, Yoshichika Baba, Stephen A Lee, Chi-kun Tong, Elisa E Konofagou, and Ellen Lumpkin. Focused ultrasound excites action potentials in mammalian peripheral neurons in part through the mechanically gated ion channel PIEZO2. Proceedings on the National Academy of Sciences, 2022.
9. **Stephen A Lee** and Elisa E Konofagou. FUS-net: U-net-based FUS interference filtering. IEEE Transactions on Medical Imaging, 2021
10. Hermes AS Kamimura, Niloufar Saharkhiz, Stephen A Lee, and Elisa E Konofagou. Synchronous temperature variation monitoring during ultrasound imaging and/or treatment pulse application: a phantom study. IEEE Open Journal of Ultrasonics, Ferroelectrics, and Frequency Control, 2021.
11. Chen Shi, Victoria Andino-Pavlovsky, Stephen A Lee, Tiago Costa, Jeffrey Elloian, Elisa K Konofagou, and Kenneth L Shepard. Application of a sub-0.1-mm3 implantable mote for in vivo real-time wireless temperature sensing. Science Advances, 2021.
12. Shuo Li, Sumana Raychaudhuri, Stephen Alexander Lee, Marisa M Brockmann, Jing Wang, Grant Kusick, Christine Prater, Sarah Syed, Hanieh Falahati, Raul Ramos, et al. Asynchronous release sites align with nmda receptors in mouse hippocampal synapses. Nature Communications, 12(1):1-13, 2021
13. Niloufar Saharkhiz, Richard Ha, Bret Taback, Xiaoyue Judy Li, Rachel Weber, Alireza Nabavizadeh, Stephen A Lee, Hanina Hibshoosh, Vittorio Gatti, Hermes AS Kamimura, et al. Harmonic motion imaging of human breast masses: an in vivo clinical feasibility. Scientific reports, 10(1):1-13, 2020.
14. **Stephen A Lee**, Hermes AS Kamimura, Mark T Burgess, and Elisa E Konofagou. Displacement imaging for focused ultrasound peripheral nerve neuromodulation. IEEE Transactions on Medical Imaging, 2020.
15. **Stephen A Lee**, Hermes AS Kamimura, and Elisa E Konofagou. Displacement imaging during focused ultrasound median nerve modulation: A preliminary study in human pain sensation mitigation. IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, 2020.
16. Min Gon Kim, Hermes AS Kamimura, Stephen A Lee, Christian Aurup, Nancy Kwon, and Elisa E Konofagou. Image-guided focused ultrasound modulates electrically evoked motor neuronal activity in the mouse peripheral nervous system in vivo. Journal of Neural Engineering, 17(2):026026, 2020.
17. Thomas Tiennot, Hermes AS Kamimura, Stephen A Lee, Christian Aurup, and Elisa E Konofagou. Numerical modeling of ultrasound heating for the correction of viscous heating artifacts in soft tissue temperature measurements. Applied physics letters, 114(20):203702, 2019.
18. Matthew E Downs, Stephen A Lee, Georgiana Yang, Seaok Kim, Qi Wang, and Elisa E Konofagou. Non-invasive peripheral nerve stimulation via focused ultrasound in vivo. Physics in Medicine & Biology, 63(3):035011, 2018.
19. David Espindola, Stephen Lee, and Gianmarco Pinton. Shear shock waves observed in the brain. Physics review applied, 8:044024, 2017.

Unpublished

20. **Stephen A. Lee**, Alexis Leconte, Alice Wu, Joshua Kinugasa, Jonathan Porée, Andreas Linninger, and Jean Provost. Functional Assessment of Cerebral Capillaries using Single Capillary Reporters in Ultrasound Localization Microscopy. (in review)
21. **Stephen A. Lee,** Erica P. McCune, Hermes A.S. Kamimura, Samuel G. Blackman, Christopher Winfree, Elisa E. Konofagou. Focused ultrasound nerve stimulation for human pain analgesics. (in review).

Pre-prints

22. **Stephen A. Lee**, Alexis Leconte, Alice Wu, Joshua Kinugasa, Jonathan Porée, Andreas Linninger, and Jean Provost. Functional Assessment of Cerebral Capillaries using Single Capillary Reporters in Ultrasound Localization Microscopy. ArXiv. 2024.
23. Sua Bae, Stephen A. Lee, Elisa E. Konofagou. Detection of Blood Volume Reduction and Vasoconstriction Following Focused Ultrasound Blood-Brain Barrier Opening Using Ultrasound Flow Imaging. BioRxiv. 2023.
24. Michael Mougharbel, Jonathan Porée, Stephen A. Lee, Paul Xing, Alice Wu, Jean Claude-Tardif and Jean Provost. Angular-coherence-weighted, motion-corrected, harmonic high contrast Ultrafast cardiac imaging using a novel unified framework, Arxiv. 2023

Conference Proceedings

25. Stephen A. Lee, Hermes A.S. Kamimura, Elisa E. Konofagou. Focused Ultrasound median nerve stimulation can modulate nociceptive pain. IEEE International Ultrasonics Symposium, 1-3. 2020.
26. Stephen A. Lee, Hermes A.S. Kamimura, Elisa E. Konofagou. Simultaneous nerve displacement mapping for human peripheral neuromodulation. IEEE International Ultrasonics Symposium, 2155-2157. 2020.
27. Hermes A.S. Kamimura, Stephen A. Lee, Yuuske Niimi, Christian Aurup, Min Gon Kim, Elisa E. Konofagou. Focused ultrasound stimulation of the median nerve modulates somatosensory evoked responses. IEEE International Ultrasonics Symposium. 2019.
28. Stephen A. Lee, Hermes A.S. Kamimura, Mark T. Burgess, Antonios Pouliopoulos Elisa E. Konofagou. Real-time displacement and cavitation imaging of non-invasive neuromodulation of the peripheral nervous system via focused ultrasound. IEEE International Ultrasonics Symposium, 1-4. 2018.
29. Stephen A. Lee, Matt E. Downs, Niloufar Saharkhiz, Yang Han, Elisa E. Konofagou. Imaging of tissue displacement during focused ultrasound neuromodulation in vivo. IEEE International Ultrasonics Symposium 1-1, 2017.

Patents

1. [US Patent 11,020,617] Methods and systems for peripheral nerve neuromodulation using non ablative focused ultrasound with electromyography (EMG) monitoring
2. [Provisional] ULM micro capillaries imaging (10249569-117USPR)

Professional Activities

Research Mentorship

- Alexis Leconte (PhD Student, 2022-present), Current: PhD student at Polytechnique Montreal
- Alice Wu (PhD Student, 2022-present), Current: PhD student at Polytechnique Montreal
- Oleksandra Gulenko (PhD Student, 2023 – present), Current: PhD student at Polytechnique Montreal
- Theodore Brierre (Master's, 2023 – present), Current: Master's at Université Paris Cité
- Simon Desrochers (Undergrad, 2023 – present), Current: Undergrad, Polytechnique Montreal
- Pierre-Olivier Bouchard (Undergrad, 2023 – present), Current: Undergrad Polytechnique Montreal
- Joshua Kinugasa (Undergrad, 2023), Current: Undergrad at Chiba University
- Michael Mougharbel (Master's, 2022-2023), Current: Master's at Polytechnique Montreal
- Samuel Desmarias (Master's, 2022-2023), Current: PhD student at TU Delft
- Mila Smith (Undergrad, 2021-2022), Current: Undergrad at New York University
- Erica McCune (PhD Student, 2020 – 2022), Current: PhD student at Columbia University
- Seongyeon Kim (PhD Student, 2022), Current: PhD student at Columbia University
- Pavithran Guttipati (Medical Student, 2021), Current: MD student at Columbia University
- Seaok Diana Kim (undergraduate, 2016 - 2018), Current: MD student at Tufts University
- Nina Harano (high school 2018-2019), Current: PhD at New York University
- Saruul Zorigt (high school, 2018-2019), Current: Research Assistant at NYU Abu Dhabi
- Jose Gabriel Javellana (high school, 2018-2019), Current: Undergrad at U Philippines
- Bea Hormigos (high school, 2018), Current: undergraduate at U Philippines
- Odmaa Bayaraa (high school, 2017), Current: PhD at Duke University
- Loc Ho (high school, 2017), Current: undergraduate at NYU

Teaching

Manai Institute of Science and Technology, Tokyo, Japan
- 3D printing and design (2019)
- Ethics of biomedical research (2018, 2019)
- Introduction to LaTeX (2018, 2019)
- Acoustic Levitation (2018)

Columbia University
- [BMEN E3910] Biomedical Engineering Senior Design, Columbia University (2018-2019)

UNC Chapel Hill
- [PHYS 52] Making the Right Connections (2014)

Outreach
- Girls Science Day Leader (2 workshops), Photographer
- World Science Festival Volunteer

Service
- IEEE Ultrasonics Ferroelectrics and Frequency Control Latin American Outreach Initiative Volunteer
- IEEE Ultrasonics Ferroelectrics and Frequency Control Animator, Video Editor
- UFFC-S Student Representatives Volunteer
- Ad hoc peer reviewer at IEEE Transactions on Biomedical Circuits and Systems, Regional Anesthesia & Pain Medicine, Quantitative Imaging in Medicine and Surgery, Scientific Reports

Presentations

Talks

1. Stephen A Lee, Joshua Kinugasa, Alexis Leconte, Jonathan Poree, Samuel Mihelic, Andreas Linninger, Jean Provost. Single Capillary Reporters (SCaRe) in Super-Resolution Ultrasound Resolution Microscopy. 2024 IEEE Joint International Ultrasonics Sympoisum (IUS) (Taipei, Taiwan) September 22-26.
2. Stephen A Lee. Joshua Kinugasa, Alexis Leconte, Jonathan Poree, Samuel Mihelic, Andreas Linninger, Jean Provost. An Open-Source Benchtop for Localization and Tracking (BLT). 2024 IEEE Joint International Ultrasonics Sympoisum (IUS) (Taipei, Taiwan) September 22-26.
3. Stephen A Lee. Super resolution ultrasound localization microscopy: Imaging and modeling approaches to brain biomarker discovery, LPPD Seminar, University of Illinois Chicago. June 6, 2024. **[Invited]**
4. Stephen A Lee. Jonathan Poree, Alexis Leconte, Jean Provost. Ultrasound Localization Microscopy of the brain: the missing micro vasculature. 21st IEEE International Symposium on Biomedical Imaging (Athens, Greece), May 27-30, 2024
5. Stephen A Lee. Ultrasound Localization Microscopy: from microvascular modeling to imaging capillaries. Modelisation vasculaire et metabolique du cerveau a grande echelle (Montreal, Canada) October 12 - 19, 2023
6. Stephen A Lee, Erica P. McCune, Hermes A.S. Kamimura, Christopher J Winfree, and Elisa E Konofagou. 8th International Symposium on Focused Ultrasound (Washington D.C., USA) October 23 - 28
7. Stephen A. Lee, Yoshichika Baba, Yalda Moayedi-Esfahani, and Elisa E Konofagou. 2022 IEEE International Ultrasonics Symposium (IUS) (Venice, Italy) October 10 - 13
8. Stephen A Lee, Erica P McCune, Hermes AS Kamimura, Christopher J Winfree, and Elisa E Konofagou. FUS alters pain perception in neuropathic pain patients. 21st Annual International Symposium on Therapeutic Ultrasound (Toronto, Canada) June 7 - 10, 2022
9. Stephen A Lee, Hermes AS Kamimura, and Elisa E Konofagou. High frequency functional ultrasound imaging of focused ultrasound nerve stimulation. 2021 IEEE International Ultrasonics Symposium (IUS) (virtual) Sept 11 - 12, 2021
10. Stephen A Lee. Focused ultrasound neuromodulation of the peripheral nervous system. Virtual Seminars in Biomedical Science (Imperial College London) Feb 18th, 2021 **[Invited]**
11. Stephen A Lee, Hermes AS Kamimura, and Elisa E Konofagou. Modulation of pain in humans via ultrasound peripheral nerve stimulation. 7th International Symposium on Focused Ultrasound (virtual) Nov 9 - 13, 2020
12. Stephen A Lee, Hermes AS Kamimura, and Elisa E Konofagou. Focused ultrasound median nerve stimulation can modulate nociceptive pain. 2020 IEEE International Ultrasonics Symposium (IUS) (virtual) Sept 6 - 11, 2019
13. Stephen A Lee, Hermes AS Kamimura, and Elisa E Konofagou. Simultaneous nerve displacement mapping for human peripheral neuromodulation. 2019 IEEE International Ultrasonics Symposium (IUS) (Glasgow, Scotland) Oct 6 - 9, 2019
14. Stephen A Lee, Hermes AS Kamimura, and Elisa E Konofagou. Real-time displacement imaging for neuromodulation in healthy humans. 19th International Symposium of ISTU, 5th European Symposium of FUS (Barcelona, Spain) Jun 13 - 15, 2019
15. Stephen A Lee, Ken Shepard, Ellen Lumpkin, and Elisa Konofagou. PULSE: Phased-array ULtraSound for Electroceuticals. Joint ElectRx TNT PI Meeting March 13-15, 2019
16. Stephen A Lee, Hermes AS Kamimura, Mark T Burgess, Antonis Pouliopoulos, and Elisa E Konofagou. Real-time displacement and cavitation imaging of non-invasive neuromodulation of the peripheral nervous system via focused ultrasound. 2018 IEEE International Ultrasonics Symposium (IUS) (Kobe, Japan) Oct 22 - 25, 2018

17. Stephen A Lee, Matthew E Downs, Niloufar Saharkhiz, Yang Han, and Elisa E Konofagou. Imaging of tissue displacement induced during focused ultrasound neuromodulation in vivo. The Journal of the Acoustic Society of America 142(4), 2668-2668, 2017
18. Stephen A Lee, Matthew E Downs, Niloufar Saharkhiz, Yang Han, and Elisa E Konofagou. Imaging of tissue displacement during focused ultrasound neuromodulation in vivo. 2017 IEEE International Ultrasonics Symposium (IUS) (Washington DC, USA) Sep 12 - 16, 2017

Poster

1. Stephen A Lee, Jonathan Poreé, Gerardo Ramos-Palacios, Abbas Sadikot, Andreas Linninger, and Jean Provost. Microbubble mapping via spatiotemporal focused reflection matrix. 2023 IEEE International Ultrasonics Symposium (IUS) (Montreal, Canada) September 3 - 9, 2023
2. Stephen A Lee and Elisa E Konofagou. FUS-net: A U-Net based FUS interference RF filtering network. 2021 IEEE International Ultrasonics Symposium (IUS) (virtual) Sept 11 - 12, 2021
3. Stephen A Lee, Hermes AS Kamimura, and Elisa E Konofagou. Simultaneous nerve displacement mapping for human peripheral neuromodulation. 2019 IEEE International Ultrasonics Symposium (IUS) (Glasgow, Scotland) Oct 6 - 9, 2019
4. Stephen A Lee, Hermes AS Kamimura, Min G Kim, Mark T Burgess, Antonios Poulioupoulos, Elisa E Konofagou. Real-time displacement and cavitation imaging of non-invasive neuromodulation of the peripheral nervous system via focused ultrasound.Neuroscience (San Diego, CA, USA) Nov 3 - 7, 2018
5. Stephen A Lee, Matthew E Downs, Niloufar Saharkhiz, Yang Han, and Elisa E Konofagou. Imaging of tissue displacement during focused ultrasound neuromodulation in vivo. New York Academy of Sciences (NYAS) (New York, NY) September 2017