

# Madeleine Durkee

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Postdoctoral Scholar  
Committee on Medical Physics  
University of Chicago

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## Professional Positions

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2018-present	<b>Postdoctoral Scholar</b> <i>Department of Radiology, Committee on Medical Physics</i>	<b>University of Chicago</b> <i>Chicago, IL</i>
2013-2018	<b>Graduate Researcher/Research Assistant</b> <i>Biomedical Optics Lab</i>	<b>Texas A&amp;M University</b> <i>College Station, TX, USA</i>
2017	<b>Quality Manager &amp; Research Intern</b>	<b>enmodes GmbH</b> <i>Aachen, Germany</i>
2016-2017	<b>Instructor/Graduate Teaching Fellow</b> <i>BMEN 207: Computing for Biomedical Engineers</i> <i>BMEN 211: Biomedical Signals &amp; Systems</i> <i>BMEN 253: Medical Device Design I</i>	<b>Texas A&amp;M University</b> <i>College Station, TX, USA</i>
2013-2015	<b>Teaching Assistant</b> <i>BMEN Machine Shop</i> <i>BMEN 289: Biomedical Signals &amp; Systems</i> <i>BMEN 289: Computing for Biomedical Engineers</i>	<b>Texas A&amp;M University</b> <i>College Station, TX, USA</i>

## Education

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2018	<b>Ph.D.</b>	<b>Biomedical Engineering</b> Thesis title: Radiative Transport Modeling to Improve <i>In Vivo</i> Optical Detection of <i>Mycobacterium Tuberculosis</i> Thesis Advisor: Dr. Kristen C. Maitland	<b>Texas A&amp;M University</b>
2013	<b>B.E.</b>	<b>Biomedical Engineering</b>	<b>Vanderbilt University</b>

## Awards

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2020	Paul C. Hodges Research Award
2020	SPIE Medical Imaging: Poster Award in Digital Pathology- Honorable Mention
2020	NSF ACADEME Conference Travel Award
2020	University of Chicago BSD Career Advancement for Postdocs (CAP) Travel Award
2019-2021	NIH Loan Repayment Program (LRP) Award
2019	NSF ACADEME Workshop Travel Grant
2019	Texas A&M Association of Former Students Distinguished Graduate Student Award
2018	Senator Phil Gramm Doctoral Fellowship
2018	EnMed Biomedical Imaging Symposium: Best Poster
2018, 2016	BMEN Graduate Student Travel Grant Recipient
2017	Academy of Future Faculty Certificate
2017	Texas A&M University Biomedical Engineering Symposium: Best Oral Presentation
2017	Texas A&M University 3 Minute Thesis Competition Finalist
2017, 2016	Dwight Look College of Engineering Graduate Teaching Fellow
2016	SPIE Optics Outreach Games, 3 <sup>rd</sup> place
2016	SPIE Student Officer Travel Grant
2014-2016	Great Lakes National Scholarship

**Publications**

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*Peer-reviewed publications*

1. **Durkee, MS**, Abraham, R, Ai, J, Veselits, M, Clark, MR, Giger, ML, "Quantifying the effects of biopsy fixation and staining panel design on automatic instance segmentation of immune cells in human lupus nephritis," J. Biomed. Opt. (*Accepted*)
2. **Durkee, MS**, Cirillo, JD, Maitland, KC, "Fluorescence modeling of *in vivo* optical detection of *Mycobacterium tuberculosis*," Biomed. Opt. Express 10, 5445-5460 (2019)
3. **Durkee, MS**, Fletcher, GK, Carlson, C, Matheson, K, Swift, SK, Maitland, DJ, Cirillo, JD, Maitland, KC, "Light scattering by pulmonary alveoli and airway surface liquid using a concentric sphere model," Optics Letters, (2019)
4. **Durkee, MS**, Cirillo, JD, Maitland, KC, "Optical model of the murine lung to optimize pulmonary illumination," J. Biomed. Opt. 23(7) 071208 (2018)
5. **Durkee, MS**, Nash, LD, Nooshabadi, F, Cirillo, JD, Maitland, DJ, Maitland, KC, "Fabrication and Characterization of Optical Tissue Phantoms Containing Macrostructure," JoVE 132), e57031 (2018).
6. Nooshabadi, F, Yang, H-J, Cheng, Y, **Durkee, MS**, Xie, H, Rao, J, Cirillo, JD, and Maitland, KC (2016), Intravital excitation increases detection sensitivity for pulmonary tuberculosis by whole-body imaging with  $\beta$ -lactamase reporter enzyme fluorescence. J. Biophoton. doi:10.1002/jbio.201600132

*Proceedings*

7. **Durkee, MS**, Abraham, R, Ai, J, Fuhrman, JD, Clark, MR, Giger, ML, "Comparing Mask R-CNN and U-Net architectures for robust automatic segmentation of immune cells in immunofluorescence images of lupus nephritis biopsies," Proc. SPIE, Photonics West 2021: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues XIX (*Accepted*)
8. Abraham, R, **Durkee, MS**, Ai, J, Fuhrman, JD, Clark, MR, Giger, ML, "Application of U-Nets for the automatic segmentation of immune cells in high-dimensional microscopy images of kidney biopsies," Proc. SPIE, Photonics West 2021: Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues XIX (*Accepted*)
9. **Durkee, MS**, Abraham, R, Ai, J, Clark, MR, Giger, ML, "Managing class imbalance of immune cell populations in multi-class instance segmentation of immunofluorescence images of lupus nephritis biopsies," Proc. SPIE, Medical Imaging 2021: Digital Pathology (*Accepted*)
10. Abraham, R, **Durkee, MS**, Veselits, M, Ai, J, Fuhrman, JD, Clark, MR, Giger, ML, "Application and generalizability of U-Net segmentation of immune cells in inflamed tissue," Proc. SPIE, Medical Imaging 2021: Digital Pathology (*Accepted*)
11. Ferguson, BM, **Durkee, MS**, Abraham, R, Ai, J, Li, H, Lan, L, Bertini, J, Clark, MR, Giger, ML, "Radiomic texture analysis of immunofluorescence images of lupus nephritis biopsies to predict patient progression to end-stage renal disease," Proc. SPIE, Medical Imaging 2021: Digital Pathology (*Accepted*)
12. **Durkee, MS**, Abraham, R, Sibley, A, Cifu, B, Ai, J, Liarski, VM, Clark, MR, and Giger, ML, "Instance segmentation of immune cells in human lupus nephritis using deep learning: comparing performance on sample preparation and staining panels", Proc. SPIE 11243, Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues XVIII, 112430T (17 February 2020); <https://doi.org/10.1117/12.2545110>
13. **Durkee, MS**, Ferguson, BM, Abraham, R, Lan, L, Li, H, Clark, MR, and Giger, ML, "Preliminary radiomic texture analysis of high-channel fluorescence confocal images of triple-negative breast cancer biopsies", Proc. SPIE 11320, Medical Imaging 2020: Digital Pathology, 1132013 (16 March 2020); <https://doi.org/10.1117/12.2549755>
14. **Durkee, MS**, Sibley, A, Ai, J, Abraham, R, Liarski, VM, Clark, MR, and Giger, ML, "Improved instance segmentation of immune cells in human lupus nephritis biopsies with Mask R-CNN", Proc SPIE 11320, Medical Imaging 2020: Digital Pathology, 1132019 (16 March 2020); <https://doi.org/10.1117/122549751>

15. **Durkee, MS**, Cirillo, JD, and Maitland, KC, "A Fluorescence Model of the Murine Lung for Optical Detection of Pathogenic Bacteria," in *Clinical and Preclinical Optical Diagnostics*, J Brown, ed, Vol 10411 of SPIE Proceedings (Optical Society of America, 2017), paper 104110H

## **Presentations**

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1. **Durkee, MS**, Abraham, R, Ai, J, Fuhrman, JD, Clark, MR, Giger, ML, "Comparing Mask R-CNN and U-Net architectures for robust automatic segmentation of immune cells in immunofluorescence images of lupus nephritis biopsies," SPIE Photonics West 2021 (*Submitted*)
2. Abraham, R, **Durkee, MS**, Ai, J, Fuhrman, JD, Clark, MR, Giger, ML, "Application of U-Nets for the automatic segmentation of immune cells in high-dimensional microscopy images of kidney biopsies," SPIE Photonics West 2021 (*Submitted*)
3. **Durkee, MS**, Abraham, R, Ai, J, Clark, MR, Giger, ML, "Managing class imbalance of immune cell populations in multi-class instance segmentation of immunofluorescence images of lupus nephritis biopsies," Poster presentation, Medical Imaging: Digital Pathology, February 2021
4. Abraham, R, **Durkee, MS**, Veselits, M, Ai, J, Fuhrman, JD, Clark, MR, Giger, ML, "Application and generalizability of U-Net segmentation of immune cells in inflamed tissue," Poster presentation, Medical Imaging: Digital Pathology, February 2021
5. Ferguson, BM, **Durkee, MS**, Abraham, R, Ai, J, Li, H, Lan, L, Bertini, J, Clark, MR, Giger, ML, "Radiomic texture analysis of immunofluorescence images of lupus nephritis biopsies to predict patient progression to end-stage renal disease," Oral presentation, Medical Imaging: Digital Pathology, February 2021
6. **Durkee, MS**, Abraham, R, Sibley, A, Cifu, B, Ai, J, Liarski, VM, Clark, MR, and Giger, ML, "Instance segmentation of immune cells in human lupus nephritis using deep learning: comparing performance on sample preparation and staining panels", Poster presentation, Medical Imaging: Digital Pathology, February 2020
7. **Durkee, MS**, Ferguson, BM, Abraham, R, Lan, L, Li, H, Clark, MR, and Giger, ML, "Preliminary radiomic texture analysis of high-channel fluorescence confocal images of triple-negative breast cancer biopsies", Poster presentation, Medical Imaging: Digital Pathology, February 2020
8. **Durkee, MS**, Sibley, A, Ai, J, Abraham, R, Liarski, VM, Clark, MR, and Giger, ML, "Improved instance segmentation of immune cells in human lupus nephritis biopsies with Mask R-CNN", Oral presentation, Photonics West, February 2020
9. **Durkee MS**, Cirillo JD, Maitland KC, "Radiative transport modeling to improve *in vivo* optical detection of *Mycobacterium tuberculosis*," Poster presentation, Gordon Research Conference: Lasers in Medicine and Biology, July 2018
10. **Durkee MS**, Sule P, Cirillo JD, Maitland KC, "Enhancement of luminescence collection in whole-animal imaging using turning mirrors for multi-view acquisition" Poster presentation, Translational Biophotonics, May 2018
11. **Durkee MS**, Cirillo JD, Maitland KC, "Radiative transport modeling to improve optical detection of *Mycobacterium tuberculosis*," Poster presentation, EnMed Biomedical Imaging Symposium, April 2018
12. **Durkee MS**, Cirillo JD, Maitland KC, "A Fluorescence Model of the Murine Lung for Optical Detection of Bacteria," Oral presentation, Biomedical Engineering Annual Research Symposium, August 2017
13. **Durkee MS**, Cirillo JD, Maitland KC, "A Fluorescence Model of the Murine Lung for Optical Detection of Pathogenic Bacteria," Oral presentation, European Conference on Biomedical Optics, June 2017
14. **Durkee MS**, Cirillo JD, Maitland KC, "A Fluorescence Model of Murine Infection for Optical Detection of Pathogenic Bacteria," Poster presentation, International Graduate Summer School Biophotonics '17 June 2017
15. **Durkee MS**, Nooshabadi F, Nash LD, Maitland DJ, Cirillo JD, Maitland K, "Simulating Intravital Illumination of Murine Lung for Enhanced Detection of *Mycobacterium tuberculosis*," Poster presentation, Biomedical Engineering Society Annual Meeting, October 2016

16. **Durkee MS**, Nooshabadi F, Nash LD, Maitland DJ, Cirillo JD, Maitland K, “Illuminating the Lung for *in vivo* Detection of *Mycobacterium tuberculosis*,” Poster presentation, Gordon Research Conference: Lasers in Medicine and Biology, July 2016
17. **Durkee MS**, Nooshabadi F, Nash LD, Maitland DJ, Cirillo JD, Maitland K, “Illuminating the Lung for *in vivo* Detection of *Mycobacterium tuberculosis*,” Poster presentation, Translational Biophotonics, May 2016
18. **Durkee MS**, Nash LD, Nooshabadi F, Maitland DJ, Cirillo JD, Maitland KC, “Illuminating the Lung for *in vivo* Detection of *Mycobacterium tuberculosis*,” Oral presentation, TAMU Student Research Week, March 2016
19. **Durkee MS**, Griffin PJ, Nash LD, Maitland DJ, Cirillo JD, Maitland KC, “Modeling Intravital Illumination of the Lung,” Oral presentation, SPIE Photonics West, February 2016
20. **Durkee MS**, Griffin PJ, Nash LD, Maitland DJ, Cirillo JD, Maitland KC, “Optimization of Computational Optical Model and Tissue Phantom for Multiscale Imaging of Bacterial Infection,” Oral presentation, TAMU Student Research Week, April 2015
21. **Durkee MS**, Nash LD, Maitland DJ, Cirillo JD, Maitland KC, “A Structurally Relevant Lung Phantom for Optimization of Multiscale Imaging of Bacterial Infection,” Poster presentation, OSA Optics in the Life Sciences, April 2015
22. **Durkee MS**, Griffin PJ, Nash LD, Maitland DJ, Cirillo JD, Maitland KC, “Optical Tissue Phantom for Multiscale Imaging of Bacterial Infection *in vivo*,” Poster presentation, TAMU Biomedical Engineering Department Academic Review, March 2015
23. **Durkee MS**, Nooshabadi F, Nash LD, Maitland DJ, Cirillo JD, Maitland KC, “Computational Optical Modeling of the Lung for Detection of Bacterial Infection *in vivo*,” Poster presentation, Whitaker Poster Session, August 2014
24. **Durkee MS**, Tidwell H, Huang K, Planchard R, Kole A, Marasco CC, Wikswo JP, “Optimization of Heterodyne Chemistry for Complex Biochemical Reactions,” Poster presentation, Biomedical Engineering Society Annual Meeting, September 2013

### **Professional Memberships and Professional Development**

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<b>2022</b>	Conference Chair, Gordon Research Seminar, Optics and Photonics in Medicine and Biology ( <i>previously scheduled for 2020- COVID reschedule</i> )
<b>2020</b>	SPIE Career Lab Discussion Leader
<b>2019</b>	NSF ACADEME Future Faculty Workshop
<b>2019</b>	Session Chair, SPIE Photonics, West Optical Diagnostics and Sensing XIX: Toward Point-of-Care Diagnostics: Optical Imaging Approaches
<b>2018-present</b>	Member, Radiological Society of North America (RSNA)
<b>2015-present</b>	Member, Optical Society of America (OSA)
<b>2013-present</b>	Member, International Society for Optics and Photonics (SPIE)
<b>2010-2018</b>	Member, Biomedical Engineering Society (BMES)
<b>2009-2010</b>	Member, Society of Women Engineers (SWE)

### **University Activities and Service**

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#### *University of Chicago*

<b>2020</b>	Center for Data and Computing (CDAC) Summer Lab: Project mentor
<b>2019</b>	Postdoc Association: Annual Symposium Planning Committee
<b>2019</b>	ResearchHStart: Poster and oral presentation judge
<b>2019</b>	Expand Your Horizons (EYH) Workshop: Volunteer
<b>2019-present</b>	Reviewer: Heliyon (Cell Press)
<b>2018-present</b>	Reviewer: Journal of Medical Imaging

#### *Texas A&M University*

<b>2017-2018</b>	BME Graduate Student Association Class Representative
<b>2017-2018</b>	SPIE Chapter Webmaster

**2016** SPIE Chapter President  
**2015** SPIE Chapter Vice President  
**2015-2017** Biophysics: Image Life! Volunteer and activity coordinator  
**2014** SPIE Chapter Outreach Chair  
**2013-2018** Biophysics: Image Life! Outreach Program for Young girls in Science

***Vanderbilt University***

**2011-2013** BMES- Student Chapter President  
**2010-2011** BMES- Student Chapter Treasurer  
**2012-2013** Biomedical Engineering Mentor  
**2011-2013** V-squared Engineering Mentor  
**2011-2013** Project CURE volunteer  
**2011-2012** Technology Access Center Volunteer

**Research Mentoring**

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*Graduate Students*

**Gabriel Casella (2020-present)**  
**Rebecca Abraham (2018-present)**  
**Mena Shenouda (2020)**  
**Julian Bertini (2020)**

*Undergraduate Students*

**Bradie Ferguson (2019, 2020)** – CDAC Summer Intern Award  
**Sarah Swift (2017-2018)**  
**Kanci Matheson (2017-2018)**  
**Camella Carlson (2016-2018)** – Clare Boothe Luce Scholar, Astronaut Scholar  
**Dan Tran (2016-2018)**  
**Cynthia Co (2016-2017)**  
**Patrick Griffin (2013-2016)** - Undergraduate Student Research Grant (USRG)

*High School Students*

**Benjamin Cifu (2019)**