

## Curriculum Vitae

# Shwetadwip Chowdhury, PhD

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### Education

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#### Duke University, Durham, North Carolina, USA

- Ph.D. in Biomedical Engineering 2010 – 2016
  - **Thesis:** *“Technical Developments in Structured Illumination Microscopy for Coherent and Multimodal Fluorescent Sub-Diffraction Resolution Imaging”*
  - Advisor: Prof. Joseph Izatt
- B.S.E in Biomedical Engineering 2006 – 2010

### Research Experience

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#### University of California, Berkeley

2017 – ongoing

Postdoctoral Research (NIH NRSA F32) Fellow in Computational Imaging Laboratory | advisor: Prof. Laura Waller

- Working at the interface of *engineering*, *physics*, and *signal-processing* to develop computational imaging devices for next-generation smart microscopy. My research targets data-driven computational methods for large-scale imaging of bio-samples through optical scatter.
- Actively collaborating with scientists and clinicians from institutions across the Bay area, such as Chan Zuckerberg Biohub and UC Davis Department of Pathology.

#### Duke University

2010 – 2016

Graduate (NIH T32 and Duke Chambers Fellow) student in Biophotonics Laboratory | advisor: Prof. Joseph Izatt

- Developed theory and implemented designs for *super-resolution microscopy*, *holography imaging*, and *low-coherence systems*. Dissertation work specifically targeted development of novel microscopes for multimodal super-resolution. Collaborated with biologists to demonstrate utility of simultaneous super-resolution of biological fluorescence and refractive-index.

#### Duke University

2008 – 2010

Undergraduate (Duke Pratt Research Fellow) student in Biomedical Interferometry Optics and Spectroscopy Laboratory (BiOS) | advisor: Prof. Adam Wax

- Developed spectroscopic optical coherence tomography (sOCT) technology for tomographic spectroscopy via scattering contrast. Explored clinical applications of sOCT to detect abnormal cell nuclei size or hemoglobin concentrations, which are biomarkers for cancer.

## Research Interests

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**Optical microscopy**

- Super-resolution microscopy
- Holography
- Light-field imaging
- Coherence-based imaging
- Optical design

**Computational imaging**

- Convex and nonconvex optimization
- Nonlinear inverse problems
- Big-data processing
- Computational phase retrieval

## Research Grants

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1. National Institutes of Health (NIH) Postdoctoral Individual National Research Service Award (NRSA) F32. | Score: 19  
 Project Name: "Structured Illumination Computational Microscopy with UV Surface Excitation (MUSE) for Multispectral Super-Resolution Histology" 2018

## Fellowships and Awards

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1. National Institutes of Health (NIH) Postdoctoral Individual National Research Service Award (NRSA) F32 2018
2. Thurstone Medical Imaging Fellowship 2014
3. OSA Large Student Chapter Excellence Award 2013
4. NIH T32 Medical Imaging Predoctoral Training Grant 2012
5. Honorable Mention Poster Presentation, 2012 Duke Fitzpatrick Institute for Photonics Annual Symposium 2012
6. Duke Fitzpatrick Institute for Photonics John Chambers Fellows 2010
7. Duke Pratt Engineering Fellowship 2008
8. Duke Deans List of Distinction 2006 – 2009
9. Intel Science Talent Search Semifinalist 2006

## Leadership and Service

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**Duke University OSA/SPIE Student Chapter** 2011 – 2015

### *President*

- Led collaborations with Duke University's Fitzpatrick Institute of Photonics (FIP) to initiate the corporate showcase as part of FIP's Annual Symposium series. This brought in corporate sponsorship and recruitment to Duke photonics community.
- Interfaced with Duke, OSA, and SPIE to fund student chapter activities, such as outreach, research, recruitment, etc.
- Built a summer photonics research program for students from local (and often disadvantaged) high-schools to work in Duke FIP labs.

**Secretary**

- Organized photonics outreach events to bring photonics awareness to local (and often disadvantaged) schools.
- Updated and maintained website with news of events, relevant professional activities, and upcoming speakers for the FIP seminar series.

**Public-school tutor**

2010 – 2013

Tutored students in algebra, geometry, calculus, and physics at schools in local disadvantaged public-school districts.

**Professional Activities**

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**Reviewer for following journals**

ongoing

**Nature Publishing:** Nature Communications and Scientific Reports

**OSA:** Optics Express, Biomedical Optics Express, Optica, Applied Optics, Optics Letters, Journal of OSA

**SPIE:** Journal of Biomedical Optics, Journal of Medical Imaging

**Professional affiliations: OSA, SPIE**

ongoing

**Technical Skills**

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**Computation and coding tools**

MATLAB, Python, JAVA, Maple, Mathematica

**Technologies**

SolidWorks, Fusion360, ZEMAX, ImageJ, Micromanager, Fiji, Icy, Git

**Environments**

Windows, Mac OS X, GNU/Linux

**Teaching and Supervision**

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**Supervision of students at UC Berkeley**

1. **David Ren**, UC Berkeley (ongoing)
2. **James Cimino**, UC Berkeley (ongoing)
3. **Dr. Li-hao Yeh**, UC Berkeley (2017-2019) (*now a researcher at CZI Biohub*)
4. **Matthew Wells** and **Jesus Deloya Garcia**, University of Puget Sound (2019)
5. **Lena Blackmon**, Stanford University (2018)

**Supervision of students at Duke University**

1. **Kevin Keppel**, Duke University (2015) (*continued to Pittsburgh University School of Medicine*)
2. **Jeffrey Chen**, Duke University (2014) (*continued to Rutgers New Jersey Medical School*)

**Guest Lectures**

1. **Introduction to Nano-biology** (ME290L) at UC Berkeley, 2018
2. **Introduction to Optical Engineering** (EE118) at UC Berkeley, 2017

## Invited talks

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1. "Computational microscopy for biological imaging", Wetzlar Network Computational Imaging Workshop, Wetzlar, Germany, October 2019
2. "High-resolution 3D refractive index tomography of multiple-scattering biology", UC Berkeley qB3 Seminar series, Berkeley, CA, October 2018
3. "Computational microscopy for smart and cost-effective imaging", Agilent Technologies SBI Workshop, Santa Clara, CA, June 2017

## Publications

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1. **S. Chowdhury**, M. Chen, R. Eckert, D. Ren, F. Wu, N. A. Repina, L. Waller, "High-resolution 3D refractive index microscopy of multiple-scattering samples from intensity measurements," *Optica*, 6(9), 1211-1219 (2019) [*Featured Cover Article of OSA Optica Volume 6, Issue 9*] 
2. L.H. Yeh, **S. Chowdhury**, N. A. Repina, L. Waller, "Speckle-structured illumination for 3D phase and fluorescence computational microscopy," *Biomedical Optics Express* 10(7), 3635-3653 (2019) [*Spotlight on Optics, Highlighted Article from OSA Journals*]
3. (**S. Chowdhury**<sup>★</sup>, L.H. Yeh<sup>★</sup>), L. Waller, "Computational structured illumination for high-content fluorescence and phase microscopy," *Biomedical Optics Express* 10(4), 1978-1998 (2019)  
(<sup>★</sup>) **Equal contribution**
4. **S. Chowdhury**, J. Chen, J. A. Izatt, "Structured illumination fluorescence microscopy using Talbot self-imaging effect for high-throughput visualization," preprint available on ArXIV
5. **S. Chowdhury**, W.J. Eldridge, A. Wax, and J.A. Izatt, "Structured illumination microscopy for dual-modality 3D sub-diffraction resolution fluorescence and refractive-index reconstruction," *Biomedical Optics Express*, 8(12), 5776-5793 (2017)
6. **S. Chowdhury**, W.J. Eldridge, A. Wax, and J.A. Izatt, "Refractive index tomography with structured illumination," *Optica*, 4(5), 537-545 (2017).
7. **S. Chowdhury**, W.J. Eldridge, A. Wax, and J.A. Izatt, "Structured illumination multimodal 3D-resolved quantitative phase and fluorescence sub-diffraction microscopy," *Biomedical Optics Express*, 8(5), 2496-2518. (2017).
8. **S. Chowdhury**, W.J. Eldridge, A. Wax, and J. Izatt, "Spatial frequency-domain multiplexed microscopy for simultaneous, single-camera, one-shot, fluorescent, and quantitative-phase imaging." *Optics Letters* 40(21) (2015).
9. **S. Chowdhury** and J. Izatt, "Structured illumination diffraction phase microscopy for broadband, subdiffraction resolution, quantitative phase imaging," *Optics Letters* 39, 1015-1018 (2014).
10. **S. Chowdhury** and J. Izatt, "Structured illumination quantitative phase microscopy for enhanced resolution amplitude and phase imaging," *Biomedical Optics Express* 4, 1795-1805 (2013).

11. **S. Chowdhury**, A. Dhalla, and J. Izatt, "Structured oblique illumination microscopy for enhanced resolution imaging of non-fluorescent, coherently scattering samples," *Biomedical Optics Express* 3, 1841-1854 (2012).
12. F. Robles, **S. Chowdhury**, and A. Wax, "Assessing hemoglobin concentration using spectroscopic optical coherence tomography for feasibility of tissue diagnostics," *Biomedical Optics Express* 1, 310-317 (2010).
13. S.H. Ying, B.A. Landman, **S. Chowdhury**, A.H. Sinofsky, A. Gambini, S. Mori, D.S. Zee, J.L. Prince "Orthogonal diffusion-weighted MRI measures distinguish region-specific degeneration in cerebellar ataxia subtypes". *Journal of Neurology* 1432-1459 (2009)

### Conference publications

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1. **S. Chowdhury**, D. Ren, J. Cimino, L. Waller, "Big-data reconstruction of 3D refractive index by multi-slice beam-propagation," in *SPIE BiOS Photonics West* (2020, San Francisco, USA), paper 11249-47
2. J. Cimino, **S. Chowdhury**, D. Ren, L. Waller, "Distributed computing pipeline for large-scale nonlinear optical diffraction tomography," in *SPIE BiOS Photonics West* (2020, San Francisco, USA), paper 11249-96
3. M. Wells, J. Deloya Garcia, **S. Chowdhury**, M. Kellman, L. Waller, R. Pepper, "Characterizing the feeding current of sessile microorganisms using digital holography," in *Bulletin of the American Physical Society* (2019, Seattle, USA), abstract NP05.00082
4. **S. Chowdhury**, M. Chen, R. Eckert, D. Ren, L. Waller, "High-resolution 3D refractive index reconstruction of multiple-scattering objects from intensity-only measurements," in *Focus on Microscopy Conference* (2019, London, UK), session MO-AF1-PAR-C
5. **S. Chowdhury**, M. Chen, R. Eckert, D. Ren, L. Waller, "High-resolution 3D refractive index reconstruction of multiple-scattering objects from intensity-only measurements," in *SPIE BiOS Photonics West* (2019, San Francisco, USA), paper 10887-6
6. L.H. Yeh, **S. Chowdhury**, L. Waller, "Computational structured illumination for high-content multimodal microscopy," in *SPIE BiOS Photonics West* (2019, San Francisco, USA), paper 10883-1
7. **S. Chowdhury**, R. Eckert, M. Chen, L. Waller, "High-resolution 3D Phase Microscopy from Intensity," in *OSA Biophotonics Congress, Microscopy Histopathology and Analytics* (2018, Miami, USA), paper MF3A. 5
8. L.H. Yeh, **S. Chowdhury**, L. Waller, "Computational structured illumination microscopy with scattering media for high-throughput fluorescent and phase imaging," in *Focus on Microscopy 2018 Singapore: Optical, Theory III: Holotomographic imaging and scattering*, paper 4
9. **S. Chowdhury**, L. Yeh, L. Waller, "Structured illumination with scattering media," in *SPIE BiOS Photonics West* (2018, San Francisco, USA), paper 10499-1
10. L.H. Yeh, **S. Chowdhury**, L. Waller, "3D structured illumination microscopy with algorithmic self-calibration," in *SPIE BiOS Photonics West* (2018, San Francisco, USA), paper 10499-4

11. **S. Chowdhury** and J. Izatt, "Structured illumination for 3D subdiffraction reconstruction of refractive-index and fluorescence," in SPIE BiOS Photonics West (2017, San Francisco, USA)
12. **S. Chowdhury** and J. Izatt, "Structured illumination for combined 3D quantitative phase and fluorescence sub-diffraction microscopy," in SPIE BiOS Photonics West (2017, San Francisco, USA)
13. **S. Chowdhury** and J. Izatt, "Simultaneous fluorescence and phase imaging with extensions toward sub-diffraction resolution via structured-illumination," in SPIE BiOS Photonics West (2016, San Francisco, USA), paper 9713-44
14. **S. Chowdhury** and J. Izatt, "Structured illumination microscopy for sub-diffraction quantitative-phase and multiplexed fluorescent imaging," in SPIE BiOS Photonics West (2015, San Francisco, USA), paper 9713-44
15. **S. Chowdhury** and J. Izatt, " Multiplexed structured illumination microscopy for simultaneous, sub-diffraction resolution fluorescent and quantitative-phase imaging," in Gordon Research Conference: Lasers in Medicine and Biology (Holderness School, NH)
16. **S. Chowdhury** and J. Izatt, " Multiplexed structured illumination microscopy for simultaneous, sub-diffraction resolution fluorescent and quantitative-phase imaging," in Biomedical Optics and 3-D Imaging, OSA Technical Digest (Optical Society of America, 2014, Miami, USA), paper BW2A.2
17. **S. Chowdhury** and J. Izatt, "Speckle-free sub-diffraction resolution quantitative phase imaging via structured illumination," in SPIE BiOS Photonics West (2014, San Francisco, USA), paper 8949-52
18. **S. Chowdhury** and J. Izatt, "Structured Illumination Phase Microscopy for Super Resolution Phase Imaging," in Optics in the Life Sciences, OSA Technical Digest (online) (Optical Society of America, 2013, Hawaii, USA), paper NM2B.3.
19. **S. Chowdhury**, A. Dhalla, and J. Izatt, "Structured oblique illumination microscopy for enhanced resolution imaging of non-fluorescent, scattering samples," in SPIE BiOS Photonics West (2013, San Francisco, USA), paper 8589-17
20. **S. Chowdhury**, A. Dhalla, and J. Izatt, "Coherent Super-Resolution Structured Illumination Microscopy of Non-Fluorescent Samples," in Biomedical Optics and 3-D Imaging, OSA Technical Digest (Optical Society of America, 2012, Miami, USA), paper BSu4B.8.
21. **S. Chowdhury**, F. Robles, and A. Wax, "Detecting Hemoglobin Concentration Using the Dual Window Method for Processing Spectroscopic Optical Coherence Tomography Signals," in Biomedical Optics and 3-D Imaging, OSA Technical Digest (CD) (Optical Society of America, 2010, Miami, USA), paper JMA43.
22. A. H. Sinofsky, B. A. Landman, **S. Chowdhury**, A. Gambini, S. Mori, D. S. Zee, J. L. Prince, and S. H. Ying. "Diffusion-weighted MR imaging of the cerebellar peduncles as a surrogate measure of cerebellar degeneration", Organization for Human Brain Mapping, Florence, Italy, June 2006
23. B. A. Landman, **S. Chowdhury**, A. H. Sinofsky, S. Mori, D. S. Zee, J. L. Prince, and S. H. Ying. "s-Image Representation of Diffusion Tensor Contrast and Fiber Geometry: Leukometric Analysis in the Brainstem and Cerebellum", Organization for Human Brain Mapping, Florence, Italy, June 2006

24. B. A. Landman, **S. Chowdhury**, A. H. Sinofsky, A. S. K. Liu, S. Mori, D. S. Zee, J. L. Prince, and S. H. Ying, "Delineation of Cerebellar Fiber Tracts on Anatomically Aligned Planes with ViPAR, a Novel MRI Visualization and Manipulation Tool", Organization for Human Brain Mapping, Florence, Italy, June 2006