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# Brandon J. Nelson, PhD

## Present Academic Rank and Position

Jan 2023 - Present **Staff Fellow**, Division of Imaging, Diagnostics, and Software Reliability, Food and Drug Administration, White Oak, MD
- Investigating disparities in pediatric performance of deep-learning CT image reconstruction devices
- Regulatory consultant for device submissions with image reconstruction or AI/ML functionality

July 2022 - Jan 2023 **ORISE Fellow**, Division of Imaging, Diagnostics, and Software Reliability, Food and Drug Administration, White Oak, MD
*Mentor*: Rongping Zeng, PhD

## Education

2022 **PhD in Biomedical Engineering**, *Mayo Clinic Graduate School of Biomedical Sciences*, Rochester, MN, *GPA – 3.85*
*Dissertation:* Complementarity of Multiple X-Ray Contrasts in Characterization of Pulmonary Fibrosis with Grating Interferometer Micro-CT
*Advisor*: Cynthia McCollough, PhD

2016 **BA in Physics, *cum laude***, *Carleton College*, Northfield, MN, *GPA – 3.82*

## Awards

Mar. 2024 **FDA Critical Path Grant**, *FDA Office of Science and Engineering Labs*, Silver Spring, MD
Grant funded to develop phantoms and evaluation methodologies to assess pediatric performance of intracranial hemorrhage computer aided triage devices.

Sep. 2023 **FDA individual incentive award**, *FDA Office of Science and Engineering Labs*, Silver Spring, MD
FDA individual incentive award for "For Outstanding External Communication Efforts"

Feb. 2023 **Medical Physics Blue Ribbon Poster**, *SPIE Medical Imaging Conference 2023*, San Diego, CA
Poster on Pediatric-Specific Evaluations of Deep Learning CT Image Denoising Techniques

Feb. 2019 **Medical Physics Poster Award**, *SPIE Medical Imaging Conference 2019*, San Diego, CA
Poster on Visibility Guided Phase Contrast Denoising

Sept. 2018 **Travel Award**, *Three Minute Thesis Competition*, Mayo Clinic, Rochester, MN
Oration competition to convey a research topic to a public audience in three minutes.

Summer 2015 **TUSA Ambassador Summer Scholar**, *Nation Cheng Kung University*, Tainan City, Taiwan
Student tuition and travel award sponsored by Taiwan-US Sister Relations Alliance to study Mandarin Chinese at National Cheng Kung University in Tainan and teach English.

Fall 2012 **Minneapolis Rotary Club College Scholarship**, *Rotary Club #9*, Minneapolis, MN

## Research Experience

2017 - 2022 **Doctoral Research**, *CT Clinical Innovation Center*, Mayo Clinic, Rochester, MN
- Improved reading efficiency of emergency room head CT images by combining skull and brain CTs into a single series optimal for both using a CNN. Worked with a team to meet clinical needs reducing CT reading volume by two-thirds without loss in diagnostic performance resulting in two manuscripts currently undergoing peer-review
- Designed, built, and programmed an x-ray grating interferometer micro-CT system to investigate the synergistic use of x-ray attenuation and dark-field to improve the quantification of pulmonary fibrosis in a mouse model of disease resulting in one published manuscript and three conference presentations

2014 - 2016 **Research Assistant**, *Department of Physics, Carleton College*, Northfield, MN
- Designed and built 3D printed tunable laser mount reducing cost of laser-optics experiments for undergraduate research labs
- Presented findings at 47th Annual Meeting of American Physical Society's Division of Atomic, Molecular, and Optical Physics

Summer 2014 **NIH Summer Internship Program**, *NIH, NHLBI, Laboratory of Molecular Biophysics*, Bethesda, MD
- Characterized broad-band laser performance at improving fluorophore photostability for confocal microscopy using computer vision-based particle tracking analysis
- Presented findings at NIH Summer Research Symposium

Summer 2013 **Summer Research Internship**, *McLaughlin Research Institute*, Great Falls, MT
- Characterized membrane protein interactions on mitochondria morphology with confocal microscopy and image-based morphologic analysis
- Presented findings at the McLaughlin Summer Internship Program Research Symposium

## Professional and Community Memberships, Societies and Services

### Memberships

2017-Present SPIE The International Organization for Optics and Photonics

2017-Present AAPM: The American Association of Physicists in Medicine

### Committees

2022-Present American College of Radiology: Pediatric AI Working Group - Member

2022-Present AAPM: Pediatric Imaging Subcommittee - Guest Member

2021-Present AAPM: Working Group for Non-Clinical Professionals - Guest Member

## Journal Responsibilities

### Peer Review

2023-Present *Medical Physics*, Associate Editor

2019-Present *Radiology*, Scientific Reviewer

2019-Present *IEEE Transactions in Medical Imaging*, Scientific Reviewer

2017-Present *Medical Physics*, Scientific Reviewer

2017-Present *Journal of Medical Imaging*, Scientific Reviewer

2023-Present *Nature Scientific Reports*, Scientific Reviewer

# Educational Activities

## Teaching Experience

2017-2020 **Teaching Assistant**, *Mayo Clinic Graduate School of Biomedical Sciences*, Rochester, MN
Delivering select lectures, organizing class periods, interactive labs, tutoring, and grading of assignments for "Introduction to Medical Imaging" course.

July 1-14, 2019 **Invited Lecturer**, *"Practical English for the Engineering Physicist"*, Tsinghua University, Beijing, China
Organized and delivered two week course to second year Engineering Physics undergraduates including work shopping to improve scientific presentation skills.

Sept. 1-14, 2018 **Invited Lecturer**, *"Practical English for the Engineering Physicist"*, Tsinghua University, Beijing, China
Organized and delivered two week course to second year Engineering Physics undergraduates including work shopping to improve scientific presentation skills.

2016 **Teaching Assistant**, *Carleton College Physics Department*, Northfield, MN
Lab assistant, tutor, and grader for modern physics and introductory courses.

## Mentoring

2023-Present **Venkatesh, Kesavan**, *Undergraduate ORISE Fellow*, FDA CDRH Office of Science and Engineering Labs, Division of Imaging, Diagnostics and Software Reliability, Currently an undergraduate at Johns Hopkins University

2018 **Almira, Munira**, *High School Summer Intern*, Mayo Clinic, CT Clinical Innovation Center, Currently an undergraduate at Stanford University

# Bibliography

## Peer-review Articles


2023 **Nelson, B**; Kc, Prabhat; Badal-Soler, A; Jiang, L; Masters, S; Zeng, R. "Pediatric-Specific Evaluations for Deep Learning CT Denoising" *Medical Physics*. Accepted Dec. 4, 2023, https://doi.org/10.1002/mp.16901

2023 **Nelson, B**, Gomez-Cardona, D; Missert, D; McCollough, C; "Multiple Kernel Synthesis of Head CT Using a Task-Based Loss Function" *Journal of Digital Imaging*. Accepted Nov. 2, 2023, In Press.

2023 **Nelson, B**; Zeng, R; Sammer, M; Frush, D; Delfino, J; "An FDA Guide on Indications for Use and Device Reporting of Artificial Intelligence-Enabled Devices: Significance for Pediatric Use" *Journal of the American College of Radiology*. Published online July 1, 2023. https://doi.org/10.1016/j.jacr.2023.06.004

2020 **Nelson, B**; Leng, S; Shanblatt, E; McCollough, C; Koenig, T; "Empirical beam hardening correction for grating interferometry (EBHC-GI)" *Medical Physics*. https://doi.org/10.1002/mp.14672

2020 Sung, Y; **Nelson, B**; Shanblatt, E; Gupta, R; McCollough, C.; Graves, W. "Wave-optics simulation of grating-based X-ray phase-contrast imaging using 4D Mouse Whole Body (MOBY) phantom." *Medical Physics*, 47: 5761-5771. https://doi.org/10.1002/mp.14479

2019 Shanblatt, E; Sung, Y; Gupta, R; **Nelson, B**; Leng, S; Graves, W; McCollough, C. (2019 in press) "Forward model for propagation-based x-ray phase contrast imaging in parallel- and cone-beam geometry." *Optics Express*, vol 27(4), 7 February, 2019 https://doi.org/10.1364/OE.27.004504

2017 Sung, Y; Gupta, R; **Nelson, B**; Leng, S; McCollough, C; Graves, W. (2017) "Phase-contrast imaging with a compact x-ray light source: System design." *Journal of Medical Imaging* 4(4), 043503 (23 November 2017) https://doi.org/10.1117/1.JMI.4.4.043503

## Conference Proceedings

2023 Zeng, R; Kc, Prabhat; **Nelson, B**; "Bench testing performance of deep learning-based CT image denoising methods: influence of object background on image sharpness and noise texture." *Proc. SPIE* 12463, Medical Imaging 2023: Physics of Medical Imaging, 1246310 (7 April 2023); https://doi.org/10.1117/12.2653635

2022 **Nelson, B**; Leng, S; Koenig, T; McCollough, C; "Complementary use of x-ray dark-field and attenuation computed tomography in quantifying pulmonary fibrosis in a mouse model." *Proc. SPIE* 12036, Medical Imaging 2022: Biomedical Applications in Molecular, Structural, and Functional Imaging, 120360W (4 April 2022); https://doi.org/10.1117/12.2612877

2022 **Nelson, B**; Leng, S; Koenig, T; McCollough, C; "Complementary use of x-ray dark-field and attenuation computed tomography in quantifying pulmonary fibrosis in a mouse model." *Proc. SPIE* 12036, Medical Imaging 2022: Biomedical Applications in Molecular, Structural, and Functional Imaging, 120360W (4 April 2022); https://doi.org/10.1117/12.2612877

2019 **Nelson, B**; Koenig, T; Shanblatt, S; Leng, S; "Visibility Guided Phase Denoising." *Proc. SPIE*, Vol 10948, id 109484V 0. https://doi.org/10.1117/12.2511212

2019 Shanblatt, E; **Nelson, B**; Tao, S; Leng, S; McCollough, C. "Demonstration of phase-assisted material decomposition with a Talbot-Lau interferometer using a single x-ray tube potential." *Proceedings of SPIE Medical Imaging*, vol 10948, id 109482W. https://doi.org/10.1117/12.2511806

## Select Presentations

April 4, 2022 **Blue Ribbon Poster**, *"Pediatric-Specific Evaluations of Deep Learning CT Image Denoising Techniques."*, AAPM Annual Meeting 2023, Houstun, TX

April 4, 2022 **Oral Presentation**, *"Complementary use of x-ray dark-field and attenuation computed tomography in quantifying pulmonary fibrosis in a mouse model."*, SPIE Medical Imaging Conference 2022, San Diego, CA

July 25, 2021 **Oral Presentation**, *"Task-Based Loss Function for Convolutional Neural Network Image Denoising"*, AAPM 2021 Virtual

July 12, 2020 **Poster Presentation**, *"CNR Dependence on Spatial Resolution and Subject Contrast in Phase Contrast CT "*, Joint AAPM/COMP Meeting, Vancouver, BC (virtual)

Feb. 16, 2019 **Poster Presentation**, *"Visibility Guided Phase Contrast Denoising*, SPIE Medical Imaging Conference 2019, San Diego, CA

Oct. 17, 2018 **Poster Presentation**, *"Methods for Generating and Viewing CT Images Containing Multiple Kernels, Slice Thicknesses, and Display Settings"*, Biomedical Engineering Society, Atlanta, GA

May 20, 2018 **Poster Presentation**, *"Simulation of a Propagation-Based Phase-Contrast Imaging system with a compact x-ray light source"*, International Conference on Image Formation in X-ray Computed Tomography, Salt Lake City, Utah

## Technical Skills

Programming languages: Python, Julia, C/C++, MATLAB

Spoken languages: Mandarin Chinese: reading, writing, and speaking with conversational fluency and 8+ years experience.