

SARAH WALTERS

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EDUCATION

University of Rochester, Rochester, NY

Doctor of Philosophy, Optics anticipated 2019

Dissertation: "Two-photon adaptive optics ophthalmoscopy in the non-human primate: expansion of capabilities and utility"

Master of Science, Technical Entrepreneurship and Management 2015

Bachelor of Science, Optical Engineering 2013

FELLOWSHIPS AND SCHOLARSHIPS

National Science Foundation Graduate Research Fellow 2013-2018

Edmund A. Hajim Engineering Scholarship 2009-2013

HONORS AND AWARDS

Member of Phi Beta Kappa and Tau Beta Pi Honor Societies

ARVO/Retina Research Foundation/Joseph M. & Eula C. Lawrence Travel Grant 2018

OSA Fall Vision Meeting Young Investigator Award, Honorable Mention 2016

Travel Award, XVIIth International Symposium on Retinal Degenerations 2016

University of Rochester Kearney Travel Award 2016

New York State Business Plan Competition, 3rd Place Social Entrepreneurship/Non-Profit 2015

Sigma Xi Grant-in-Aid of Research Award 2015

Charles L. Newton Prize for Excellence in Engineering Research 2013

Newport Outstanding Academic Performance Award 2012

Edmund Optics Excellence in Optics Award 2012

Dean's Award in Undergraduate Research 2012

U. Rochester Phi Beta Kappa Iota Book Award for Outstanding First-Year Students 2010

RESEARCH EXPERIENCE

Graduate Research Assistant, University of Rochester, Rochester, NY 2014-present

Performed retinal imaging of non-human primates in the labs of David R. Williams and Jennifer J. Hunter using adaptive optics light scanning ophthalmoscopy. Research objectives include:

(1) Optical system design and modification for intrinsic two-photon excited fluorescence in the retina with three modes of detection: intensity, fluorescence lifetime, and spectroscopy.

(2) Increasing efficiency of two-photon fluorescence excitation by decreasing pulse width of excitation source and correcting for higher-order dispersion and chromatic aberration.

- (3) Characterization of a non-human primate model of retinal degeneration to be used in vision restoration research, including assessment of photoreceptor structure and function with two-photon excitation fluorescence, non-confocal offset aperture, and confocal reflectance imaging.
- (4) Induction of systemic hypoxia in non-human primates as a model of physiological change and observation of effects on two-photon fluorescence kinetics of photoreceptors.

Undergraduate Research Assistant, Laboratory for Laser Energetics, Rochester, NY 2010-2013

Liquid Crystal Alignment Research (2011-2013): Worked independently under the advising of Dr. Stephen Jacobs on the characterization of liquid crystal alignment using unconventional alignment methods. Fabricated liquid crystal devices and analyzed alignment uniformity. Designed and implemented an optical setup to measure surface anchoring strength. Investigated mechanical and chemical properties of the alignment surface using an atomic force microscope, scanning electron microscope, and x-ray photoelectron spectroscopy.

Diffraction Grating Research (2010): Worked alongside senior scientist Dr. Stephen Jacobs to formulate a novel cleaning process for meter-scale diffraction gratings used in high-energy laser systems in an attempt to increase the laser damage threshold for the gratings.

INDUSTRY EXPERIENCE

Optical Engineering Intern, Ball Aerospace, Boulder, CO 2013

Contributed to testing of a satellite-based hyperspectral imaging spectrometer in development for NASA to investigate dynamics of coastal marine ecosystems. Incorporated as-built optical data from manufacturer reports into Code V model of the system and calculated smile and keystone distortions. Designed and built optical test bed for testing of MTF and aberrations of prototype spectrometer. Designed and built optical test bed for characterizing "out of channel response" that resulted from spectral image overlap as a consequence of multiple slits imaging onto a single focal plane array.

Optical Engineering Intern, BAE Systems, Inc., Nashua, NH 2012

Performed optical surface quality inspections for field-returned aircraft-mounted missile defense units. Performed ray tracing analysis of CAD models using FRED. Ensured product specifications were met by measuring optical power output and numerical aperture and imaging fiber emitters. Assisted in diagnosing a problem induced by misaligned birefringent crystals leading to undesirable polarization and loss of efficiency. Wrote Matlab script to interface with ZEMAX and assist in tolerancing optical systems by calculating ensquared energy in nominal and aberrated conditions.

ENTREPRENUERIAL EXPERIENCE

Cataract Innovations, Rochester, NY 2015

Performed market research and developed a business plan for a start-up seeking to make cataract removal surgery more accessible in developing countries. Entered the 2015 New York State Business Plan Competition and won third place overall in the Social Entrepreneurship/Non-Profit category.

SCHOLARSHIP

RECENT PUBLICATIONS

Walters, S., Schwarz, C., Sharma, R., Fischer, W. S., DiLoreto Jr., D. A., . . . Merigan, W. H. (2019). Cellular-scale evaluation of induced photoreceptor degeneration in the living primate eye. *Biomedical Optics Express*, 10(1), 66-82.

Williams, D. R. & **Walters, S.** (2017). Possibilities in physiological optics. In P. Artal (Ed.), *Handbook of Visual Optics Vol. 1*. Boca Raton, FL: CRC Press.

Rossi, E., Granger, C., Sharma, R., Yang, Q., Saito, K., Schwarz, C., **Walters, S.** . . . Williams, D. R. (2017). Imaging individual neurons in the retinal ganglion cell layer of the living eye. *Proceedings of the National Academy of Sciences*, 114(3), 586-591. doi:10.1073/pnas.1613445114

CONFERENCE COMMUNICATIONS

Schwarz, C., Sharma, R., **Walters, S.**, Williams, D. R., Hunter, J. J. (2018). Watching Photoreceptors at Work: Two-Photon Ophthalmoscopy in the Living Eye. Latin America Optics & Photonics Conference, OSA Technical Digest, paper Th5C.3. [Talk].

Dhakal, K., **Walters, S.**, Schwarz, C., Strazzeri, J., Bateman, B.,...Merigan, W. H. Ultrafast laser induced retinal degeneration model in macaque using adaptive optics. OSA Fall Vision Meeting, Reno, NV, September 2018. [Talk]

McGregor, J. E., **Walters, S.**, Parkins, K., Dhakal, K., Strazzeri, J.,...Merigan, W. H. Optogenetic vision restoration in the living macaque. OSA Fall Vision Meeting, Reno, NV, September 2018. [Talk]

McGregor, J. E., Godat, T., Parkins, K., Dhakal, K., **Walters, S.**, Strazzeri, J.,...Merigan, W. H. Optogenetic vision restoration in the living macaque. XVIIIth International Symposium on Retinal Degenerations, Killarney, Ireland, September 2018. [Talk]

Walters, S., Schwarz, C., Walker, A., DiVincenti, L., Hunter, J. J. (2018). Two-photon autofluorescence kinetics of macaque photoreceptors are slowed during systemic hypoxia. *Investigative Ophthalmology & Visual Science* 59(9), 1155. [Talk]

McGregor, J. E., Phillips, M. J., **Walters, S.**, Zhang, J., Strazzeri, J., DiLoreto, D.,... Merigan W. H. (2017). Non-invasive retinal imaging of fluorescent hESC-derived photoreceptor precursors in the living primate. *Investigative Ophthalmology & Visual Science*, 58(8), 4576. [Poster]

Feeks, J., **Walters, S.**, Schwarz C., Hunter, J. J. (2017). Two-photon fluorescence lifetime ophthalmoscopy of intrinsic fluorophores on a cellular scale in the living macaque. *Investigative Ophthalmology & Visual Science*, 58(8), 3431. [Talk]

Walters, S., Schwarz, C., Sharma, R., Fischer, W. S., DiLoreto Jr., D. A., . . . Merigan, W. H. (2017). *In vivo* imaging of photoreceptor structure and function in a non-human primate model of retinal degeneration. *Journal of Vision*, 17(7), 53. doi: 10.1167/17.7.53 [Poster]

Walters, S., Schwarz, C., Sharma, R., Fischer, W. S., DiLoreto Jr., D. A., . . . Merigan, W. H. Characterization of photoreceptor structure and function in a non-human primate model of retinal degeneration. XVIIth International Symposium on Retinal Degenerations, Kyoto, Japan, September 2016. [Poster]

Walters, S., Schwarz, C., Fischer, W. S., DiLoreto Jr., D. A., Nelidova, D., . . . Merigan, W. H. (2016). Evaluation of damaged photoreceptors in a macaque model of viral vector induced retinal degeneration using an AOSLO. *Investigative Ophthalmology & Visual Science*, 57(12), 2219. [Poster]

Campbell, M., Emptage, L., Schwarz, C., **Walters, S.,** Ksilak, M., Brooks, M. L., Hunter, J. J. (2016). *In vivo* and *ex vivo* multi-modal images in the canine model of Alzheimer's disease. *Investigative Ophthalmology & Visual Science*, 57(12), 2217. [Poster]

TEACHING EXPERIENCE

Guest Lecturer, University of Rochester, Rochester, NY 2017-2018
Gave multiple guest lectures for Vision and the Eye course. Topics included optical modeling of the eye, refractive error, phototransduction, the visual cycle, retinal pigment epithelium functions, light and dark adaptation, and visual thresholds.

Graduate Teaching Assistant, University of Rochester, Rochester, NY 2014-2015
Appointment involved two courses: Introductory Optics, Vision and the Eye. Responsible for teaching workshops (intensive problem solving and concept reinforcing sessions with 10 to 20 students), grading homework and exams, and preparing in-class demonstrations and labs.

Undergraduate Teaching Assistant, University of Rochester, Rochester, NY 2011-2012
Appointment involved two courses: Geometrical Optics, Introductory Optics. Responsible for teaching workshops.