Sara Stokes Patterson
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EDUCATION

09.2015 - 05.2020 **PhD Candidate in Neuroscience**, University of Washington
Lab of Dr. Jay Neitz

08.2010 - 05.2014 **Bachelor of Science**, Dickinson College
Honors in Neuroscience, Minor in Psychology

RESEARCH EXPERIENCE

09.2016 - 05.2020 *Graduate Student*, University of Washington
Supervisor: Dr. Jay Neitz, Department of Ophthalmology
Structure and function of S-cone circuits in the primate retina
Single electrophysiology and serial electron microscopy

08.2015 - 08.2015 *Post-baccalaureate IRTA*, National Institutes of Health
Supervisor: Dr. Ralph Nelson, Neural Circuits Unit, NINDS
Zebrafish retinal development using ERG and confocal microscopy
Received NINDS Annual Symposium Poster Award, $1500 travel grant

11.2010 - 05.2014 *Research Assistant*, Dickinson College
Supervisor: Dr. Jonathan Page, Department of Psychology
Role of V1 in mental imagery & imagination with visual evoked potentials and EEG
Cognitive-behavioral training for PA State Police Academy

06.2013 - 08.2013 *Summer Intern*, National Institutes of Health, NINDS
Supervisor: Dr. Ralph Nelson, Neural Circuits Unit
Characterized photoreceptor function in transgenic zebrafish lines
Received NINDS Exceptional Summer Intern Award

TEACHING EXPERIENCE

Summer 2018, 2019 *Mentor*, University of Washington
Supervised four high school students in serial EM research projects.

Fall 2017 *Teaching Assistant*, University of Washington
NBIO 302: Introduction to Systems Neurobiology

Summer 2015 *Mentor*, National Institutes of Health
Supervised intern in project that received NINDS Exceptional Summer Intern Award

08.2013 - 05.2014 *Head Lab Assistant*, Dickinson College
Trained and supervised three new lab members in EEG and EMG

SERVICE

- *Ophthalmology Summer Scholars Internship Program Mentor*, University of Washington
- *Neuroscience Seminar Committee*, University of Washington
- *Neuroscience Outreach Group*, University of Washington
- *Expand Your Horizons*, American Association of University Women
- *Neuroscience Student Representative*, Danish Institute for Study Abroad
- *Student Wellness Committee*, Dickinson College

OTHER TRAINING

- 06.2019 - Cold Spring Harbor Vision Course
- 08.2018 - Allen Institute Dynamic Brain Summer Course in Computational Neuroscience

FUNDING

- 06.2020-06.2021 - Vision Training Grant (University of Rochester)
- 06.2018-06.2019 - Vision Training Grant (University of Washington, T32-EY007031)
- 06.2016-06.2017 - Neuroscience Training Grant (University of Washington, T32-NS099578)

AWARDS

- 07.2019 - Patmalnieks Award for Best Student Talk - International Color Vision Society Conference
- 05.2019 - Association for Research in Vision and Ophthalmology Travel Grant
- 09.2018 - Best Collaboration Award - Allen Institute Dynamic Brain Summer Course
- 05.2015 - NINDS Annual Symposium Post-bac Poster Award ($1500 travel grant)
- 08.2014 - McAndrews Award for Outstanding Female Athlete
- 08.2013 - NINDS Exceptional Summer Intern Award
- 05.2013 - Psi Chi National Honor Society
- 05.2012 - Outstanding Research Poster Award, Dickinson Science Research Symposium
- 2011-14 - 4x USATF All-Academic, 2x NCAA All-American Honors
- 01.2011 - Alpha Lambda Delta Freshman Honor Society

OPEN SOURCE SOFTWARE

- SBFSEM-tools: Data analysis and 3D visualization for connectomics and serial electron microscopy
  - RRID: SCR_017350

PATENTS

- Application: “Systems, Methods, and Devices for Stimulating Circadian Rhythms” (filed May 20, 2019)

INVITED TALKS

5.7.2020	*Association for Research in Vision and Ophthalmology Annual Meeting*, Baltimore, MD Direction selectivity in the primate retina.
7.6.2019	*International Color Vision Society Meeting*, Riga, Latvia The neural basis for encoding black, white and hue sensations
4.28.2019	*Association for Research in Vision and Ophthalmology Annual Meeting*, Vancouver, BC An S-cone amacrine sets the circadian clock at sunrise and sunset
4.10.2019	*Janelia Farm Color Vision: Circuits and Behavior*, Ashburn, VA A color vision circuit for circadian photoentrainment in the primate retina.
5.7.2018	*Association for Research in Vision and Ophthalmology Annual Meeting*, Honolulu, HI S-cone inputs to midget retinal ganglion cells and their implications for color vision.
10.14.2017	*OSA Fall Vision Meeting*, Washington, DC Differences between the S-OFF and L/M-OFF contacts inform the role of OFF midget bipolar cells in the perception of yellow

PUBLICATIONS

Peer-Reviewed Journal Articles

- Manookin, M.B., **Patterson, S.S.** & Linehan, C. (2018) Neural mechanisms mediating motion sensitivity in parasol ganglion cells of the primate retina. *Neuron*, 97, 1327–1340
  - Murphy-Baum, B.L. & Awatramani, G.B. (2018) An Old Neuron Learns New Tricks: Redefining Motion Processing in the Primate Retina. *Neuron*, 97, 1205-1207
- Bordt, A.S., Perez, D., Tseng, L., Liu, W.S., Neitz, J., **Patterson, S.S.**, Famiglietti, E.V., Marshak, D.W. (2019) Synaptic inputs and connectivity of a sparsely branched ganglion cell in rabbit retina. *Visual Neuroscience*, 36, E004
- Neitz, M., **Patterson, S.S.**, Neitz, J. (2019) Photopigment genes, cones and color: Disrupting the splicing code causes a diverse array of vision disorders. *Current Opinion in Behavioral Science*, 30, 60-66
- Nelson, R.F., Balraj, A., Suresh, T., Torvund, M., **Patterson, S.S.** (2019) Strain variations in opsin peaks *in situ* during zebrafish development. *Visual Neuroscience*, 36, E010
- **Patterson, S.S.**, Kuchenbecker, J.A., Anderson, J.R., Bordt, A.S., Marshak, D.W., Neitz, M., Neitz, J. (2019) An S-cone circuit for edge detection in the primate retina. *Scientific Reports*, 9, 11913
- **Patterson, S.S.**, Neitz, M., Neitz, J. (2019) Reconciling color vision models with midget ganglion cell receptive fields. *Frontiers in Neuroscience*, 13, 865
- **Patterson, S.S.***, Bordt, A.S.*, Girresch, R.J., Linehan, C.M., Bauss, J., Yeo, E., Perez, D., Tseng, L., Navuluri, S., Harris, N.B., Matthews, C., Anderson, J.R., Kuchenbecker, J.A., Manookin, M.B., Ogilvie, J.M., Neitz, J. and Marshak, D.W. (2019) Wide-field amacrine cell inputs to ON parasol ganglion cells in macaque retina. *Journal of Comparative Neurology*, 1-11. **** co-first author***
- **Patterson, S.S.**, Kuchenbecker, J. A., Anderson, J. R., Neitz, M., Neitz, J. (2020) A color vision circuit for non-image-forming vision in the primate retina. *Current Biology*, 30, 1-6
- Neitz, A., Jiang, X., Kuchenbecker, J.A., Domdei, N., Harmening, W., Yan, H., Yeonan-Kim, J., **Patterson, S.S.**, Neitz, M., Neitz, J., Coates, D., Sabesan, R. (in press) The effect of cone spectral tomography on chromatic detection sensitivity.

Book Chapters

- Neitz, M., **Patterson, S.S.**, Neitz, J. (accepted) The genetics of cone opsin based vision disorders. In: *The Senses: A Comprehensive Reference*, 2nd edition

Preprints

- **Patterson, S.S.**, Neitz, M., Neitz, J. (2019) The Spectral Sensitivity of the Neurons Mediating Black and White. *bioRxiv*, 829051

Conference Abstracts

- **Patterson, S.S.**, Neitz, M., Neitz, J. "Direction selectivity in the primate retina.", Association for Research in Vision and Ophthalmology Annual Meeting, May 2020
- Neitz, J., **Patterson, S.S.**, Chang, J., Giebel, B.Q., Rieke-Wey, I., Neitz, M. "Another blue-ON ganglion cell in the primate retina.", Association for Research in Vision and Ophthalmology, May 2020
- **Patterson, S.S.**, Kuchenbecker, J.A., Anderson, J.R., Neitz, M., Neitz, J. "An S-cone amacrine cell in the primate retina sets the circadian clock at sunrise and sunset.", Association for Research in Vision and Ophthalmology Annual Meeting, May 2019
- Girresh, B.J., **Patterson, S.S.**, Bordt, A.S., Anderson, J.R., Kuchenbecker, J.A., Ogilvie, J., Neitz, J., Manookin, M.B., Marshak, D.W. "Parasol and smooth monostratified retinal ganglion cells of the primate retina", Association for Research in Vision and Ophthalmology Annual Meeting, May 2019
- Kuchenbecker, J.A., **Patterson, S.S.**, Neitz, M., Neitz, J. "The role of video display viewing in myopia.", Association for Research in Vision and Ophthalmology Annual Meeting, May 2019
- **Patterson, S.S.**, Kuchenbecker, J.A., Doebley, A., Neitz, M., Neitz, J. "The normal human visual system extracts about 1% of the hues possible from the L, M and S cones compared to a perfect hue encoder", OSA Fall Vision Meeting, September 2018
- Kuchenbecker, J.A., **Patterson, S.S.**, Neitz, M., Neitz, J., Manookin, M.B. "Spectral density curves of the human lens inaccurate due to increased Rayleigh scatter in post mortem eyes." OSA Fall Vision Meeting, September 2018
- Neitz, A., Jiang, X., Kuchenbecker, J.A., **Patterson, S.S.**, Doebley, A., Neitz, M., Neitz, J., Sabesan, R. "High acuity vision corrected for chromatic and achromatic aberrations is associated with color discrimination without red-green or blue-yellow sensations." OSA Fall Vision Meeting, September 2018
- **Patterson, S.S.**, Kuchenbecker, J.A., Anderson, J.R., Linehan, C.L., Neitz, J. "S-cone inputs to midget retinal ganglion cells and their implications for color vision." Association for Research in Vision and Ophthalmology Annual Meeting, May 2018
- Nelson, R., Balraj, A., Suresh, T., Torvund, M., **Patterson, S.S.** "A computational method for determining opsin peak absorbance wavelengths from zebrafish PIII ERG responses" Association for Research in Vision and Ophthalmology Annual Meeting, May 2018
- Kuchenbecker, J.A., **Patterson, S.S.**, Neitz, M., Neitz, J. "Studying S-cone inputs to hue perception using a DLP based projector integrated with a spectrally tunable light source" Association for Research in Vision and Ophthalmology Annual Meeting, May 2018
- Neitz, A., Jiang, X., **Patterson, S.S.**, Doebley, A., Neitz, M., Neitz, J., Sabesan, R. "Color detection without hue perception", Association for Research in Vision and Ophthalmology, May 2018

- **Patterson, S.S.**, Kuchenbecker, J.A., Anderson, J.R., Neitz, M., Neitz, J., Manookin, M.B. "Differences between S-OFF and L/M-OFF contacts inform the role of OFF midget bipolar cells in the perception of yellow." OSA Fall Vision Meeting, October 2017
- Kuchenbecker, J.A., **Patterson, S.S.**, Neitz, M., Neitz, J. "Best of both worlds? A Maxwellian view visual stimulator incorporating a DLP spatiotemporal light driver with a programmable tunable spectrum source for studying human color vision" OSA Fall Vision Meeting, October 2017
- **Patterson, S.S.**, Yoshimatsu, T., Suresh, T., Nelson, R.F. "The role of thyroid hormone receptor β2 (trβ2) in development of photoreceptor opsin and bipolar cell connectivity" Association for Research in Vision and Ophthalmology Annual Meeting, May 2016
- Kuchenbecker, J., **Patterson, S.S.**, Manookin, M., Buhr, E., Neitz, M., Neitz, J. "An ex vivo electroretinogram to study spectral mechanisms and cone pathways in the retina" Association for Research in Vision and Ophthalmology Annual Meeting, May 2016
- **Patterson, S.S.**, Suresh, T., Yoshimatsu, T., Nelson, R.F. "Development of cone opsin expression in a transgenic line with crx-driven trβ2 expression" Society for Neuroscience Annual Meeting, November 2015
- **Patterson, S.S.**, Nelson, R.F. "Spectral properties of a zebrafish transgenic with L-opsin expression in all cone types" Association for Research in Vision and Ophthalmology Annual Meeting, May 2015
- Nelson, R.F., Abraham, R.R., **Patterson, S.S.**, Syrykowski, J.L., Li, L., Burgess, H.A., Connaughton, V.P. "Zebrafish Transgenic Reports Musashi1 (Msi1) in Retinal Neurons, Association for Research in Vision and Ophthalmology Annual Meeting, May 2014
- Vitrano, D., Emery, A.C., **Patterson, S.S.**, Page, J.W. "Imagine that! Comparing Brain Responses to Imagining and Perceiving Novel Stimuli" Cognitive Neuroscience Society, April 2013

CONFERENCE PRESENTATIONS

- **Patterson, S.S.**, Neitz, M., Neitz, J. "The neural substrates encoding black, white and hue sensations.", International Color Vision Society, July 2019
  - Received Latvijas Universitātes Patmalnieks Award
- Sabesan, R., Neitz, A., Jiang, X., Kuchenbecker, J., **Patterson, S.S.**, Neitz, M., Neitz, J., Coates, D. "Effect of cone spectral tomography on achromatic and chromatic detection sensitivity", International Color Vision Society Meeting, July 2019
- **Patterson, S.S.**, Kuchenbecker, J.A., Doebley, A., Neitz, M., Neitz, J. "The human visual system extracts about 1% of the hues possible compared to a perfect hue encoder", Gained In Translation Meeting, September 2018
- Estrada, M., **Patterson, S.S.**, Linehan, C.M., Neitz, M., Neitz, J. "Amacrine cell inputs to the S-cone pathway", Gained In Translation Meeting, September 2018
- **Patterson, S.S.**, Kuchenbecker, J.A., Manookin, M.B., Neitz, M., Neitz, J. (2018) "Spatial, spectral and directional information in the small bistratified ganglion cell", FASEB Retinal Physiology and Visual Neurobiology, July 2018
- **Patterson, S.S**, Neitz, M., Neitz, J., Manookin, M.B. "Midget ganglion cell circuits for achromatic and hue sensations.", Gained in Translation Meeting, September 2016
- **Patterson, S.S.**, Kuchenbecker, J., Neitz, M., Neitz, J., Manookin, M. "Subtypes of midget retinal ganglion cell in primate retina and their roles in color vision", FASEB Retinal Physiology and Visual Neurobiology, July 2016

- **Patterson, S.S.**, Nelson, R.F. “Spectral properties of a zebrafish transgenic with L-opsin expression in all cone types” NINDS Annual Research Symposium, May 2015
  - Received NINDS Post-baccalaureate Poster Award
- **Patterson, S.S.**, Cohen, P.M., Strykowski, J.L., Burgess, H.A., Nelson, R.F. “Effects of Musashi1 in Zebrafish Retinal Development: Disruption of UV Cone Mosaic and ERG Sensitivity” National Institutes of Health Summer Poster Day, August 2013
  - Received NINDS Outstanding Summer Intern Award
- **Patterson, S.S.** “Blue color vision as a measure of dopamine levels among ADHD subtypes”, Dickinson College 29th Annual Science Research Symposium, May 2014
  - Received Departmental Honors in Neuroscience
- Gregory, K.A., Ludman, T., Liu, K.X., **Patterson, S.S**, Page, J.W. “Context and rapid discrimination” Dickinson College 29th Annual Science Research Symposium, May 2014
- **Patterson, S.S.** “Using synesthesia to study the role of color opponent process pathways in mental imagery” Dickinson College Independent Psychology Research Symposium, December 2013
- Kylus, J., Norato, G., **Patterson, S.S.** “Developing algorithms to detect pain with EEG.” Dickinson College 27th Annual Science Research Symposium, December 2012
  - Received Outstanding Research Poster Award