JACOB ALAN WESTERBERG, Ph.D.

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111 21st Avenue South, 301 Wilson Hall, Nashville, TN 37240, USA
Born Sep. 27th, 1993 in Minneapolis, MN, US ◇ US Citizen ◇ Married

POSITIONS

Postdoctoral Scholar *Aug. 2022 - Present*
Bastos Lab, Department of Psychology
Vanderbilt University, Nashville, TN, US

EDUCATION

Vanderbilt University, Nashville, TN, US *Aug. 2016 - Aug. 2022*
Department of Psychology, Vanderbilt Graduate School
Ph.D. Psychology
Advisors: Alexander Maier, Ph.D. and Jeffrey D. Schall, Ph.D.
Committee: André M. Bastos, Ph.D., John H. Reynolds, Ph.D., and Geoffrey F. Woodman, Ph.D.
Dissertation: Cortical microcircuitry supporting attentional selection, and its extracranial consequences

Saint Olaf College, Northfield, MN, US *Aug. 2012 - May 2016*
Neuroscience Program, Center for Integrative Studies
B.A. Cognitive Neuroscience
Advisor: Jeremy L. Loebach, Ph.D.
Thesis: Free-field multisensory decision-making

FELLOWSHIPS

F31 - NEI NRSA Predoctoral Fellow *Sep. 2020 - Aug. 2022*
NIH F31EY031293
Contributions of prefrontal and extrastriate cortex to the ERP index of attention
Sponsors: Geoffrey F. Woodman, Ph.D. and Alexander Maier, Ph.D.
Collaborators: John H. Reynolds, Ph.D., Jorge J. Riera, Ph.D., and Jeffrey D. Schall, Ph.D.

T32 - NEI NRSA Predoctoral Fellow *Sep. 2017 - Apr. 2020*
NIH T32EY007135
Microcircuitry of visual attention in macaque area V4
Preceptors: Alexander Maier, Ph.D. and Jeffrey D. Schall, Ph.D.
Institutional Sponsor: Vanderbilt Vision Research Center (P30EY008126)

GRANTS

OpenScope *Jan. 2022 - Present*
The Allen Institute (via NIH U24NS113646)
Neural circuitry underlying detection of local and global prediction errors
PIs: Jacob A. Westerberg, Alexander Maier, Ph.D., and André M. Bastos, Ph.D.
Press Releases: 1 2

Academic Hardware Grant *Sep. 2018*
Nvidia Corporation
GPU-based data analysis of neural integration within visual cortical circuits
PIs: Jacob A. Westerberg and Alexander Maier, Ph.D.

SELECTED HONORS AND AWARDS

FABBS Doctoral Dissertation Research Excellence Award *May 2020*

Pat Burns Memorial Graduate Student Research Award *May 2020*

Vivien Casagrande Neuroscience Award *Apr. 2018*

Ken Bonde Award *May 2016*

PUBLICATIONS

H-Index: 7 ◇ **i10-Index: 6** ◇ **(Co-)Lead Author: 8** ◇ **Citations: 140**

*Denotes equal contribution

Complete library

[15] *Herrera, B., ***Westerberg, J. A.**, Schall, M. S., Maier, A., Woodman, G. F., Schall, J. D., and Riera, J. J. (2022) Resolving the mesoscopic missing link: Biophysical modeling of EEG from cortical columns in primates. *NeuroImage*, in press.

[14] Maier, A., Cox, M. A., **Westerberg, J. A.**, and Dougherty, K. (2022) Binocular integration in the primate primary visual cortex. *Annual Review of Vision Science*, 8:10.1-10.16. doi | M

[13] Mitchell, B. A., Dougherty, K., **Westerberg, J. A.**, Carlson, B. M., Daumail, L., Maier, A., and Cox, M. A. (2022) Stimulating both eyes with matching stimuli enhances V1 responses. *iScience*, 25(5):104182. doi | M

[12] **Westerberg, J. A.**, Schall, M. S., Maier, A., Woodman, G. F., and Schall, J. D. (2022) Laminar microcircuitry of visual cortex producing attention-associated electric fields. *eLife* 11:e72139. doi | M

[11] **Westerberg, J. A.**, Sigworth, E. A., Schall, J. D., and Maier, A. (2021) Pop-out search instigates beta-gated feature selectivity enhancement across V4 layers. *Proceedings of the National Academy of Sciences* 118(50):e2103702118. doi | M

[10] **Westerberg, J. A.** and Schall, J. D. (2021) Neural mechanism of priming in visual search. *Attention, Perception, and Psychophysics* 83(2):587-602. doi | M

[9] Dougherty, K., Carlson, B. M., Cox, M. A., **Westerberg, J. A.**, Zinke, W., Schmid, M. C., Martin, P. R., and Maier, A. (2021) Binocular suppression in the macaque lateral geniculate nucleus reveals early competitive interactions between the eyes. *eNeuro* 8(2):ENEURO.0364-20.2020. doi | M

[8] *Tovar, D. A., ***Westerberg, J. A.**, Cox, M. A., Dougherty, K., Carlson, T., Wallace, M. T., and Maier, A. (2020) Stimulus feature-specific information flow along the columnar cortical microcircuit revealed by multivariate laminar spiking analysis. *Frontiers in Systems Neuroscience* 14:90. doi | M

[7] **Westerberg, J. A.**, Maier, A., and Schall, J. D. (2020) Priming of attentional selection in macaque visual cortex: feature-based facilitation and location-based inhibition of return. *eNeuro* 7(2): ENEURO.0466-19.2020. doi | M

[6] **Westerberg, J. A.**, Maier, A., Woodman, G. F., and Schall, J. D. (2020) Performance monitoring during visual priming. *Journal of Cognitive Neuroscience* 32(3):515-526. doi | M

[5] Cox, M. A., Dougherty, K., **Westerberg, J. A.**, Schall, M. S., and Maier, A. (2019) Temporal dynamics of binocular integration in primary visual cortex. *Journal of Vision* 19(13):1-21. doi | M

[4] **Westerberg, J. A.**, Cox, M. A., Dougherty, K., and Maier, A. (2019) V1 microcircuit dynamics: altered signal propagation suggests intracortical origins for adaptation in response to visual repetition. *Journal of Neurophysiology* 121(5):1938-1952. doi | M

[3] *Dougherty, K., *Cox, M. A., **Westerberg, J. A.**, and Maier, A. (2019) Binocular modulation of monocular V1 neurons. *Current Biology* 29(3):381-391.

[2] Cox, M. A., Dougherty, K., Adams, G. K., Reavis, E. A., **Westerberg, J. A.**, Moore, B. S., Leopold, D. A., and Maier, A. (2019) Spiking suppression precedes cued attentional enhancement of neural responses in primary visual cortex. *Cerebral Cortex* 29(1):77-90.

[1] Crisp, K. M., Sutter, E. N., and **Westerberg, J. A.** (2015) Pencil and paper neural networks: an undergraduate laboratory exercise in computational neuroscience. *Journal of Undergraduate Neuroscience Education* 14(1):13-22.

SUBMITTED MANUSCRIPTS AND PREPRINTS

**Denotes equal contribution*

[15] Daumail, L., Carlson, B. M., Mitchell, B. A., Cox, M. A., **Westerberg, J. A.**, Johnson, C., Martin, P. R., Tong, F., Maier, A., and Dougherty, K. (2022) Primate LGN neurons adapt across repeated cycles of drifting gratings during active fixation. *Journal of Neurophysiology*, in revision.

[16] **Westerberg, J. A.**, Schall, J. D., Woodman, G. F., and Maier, A. (2022) Feedforward attentional selection in sensory cortex. *Nature Communications*, under review.

[17] Blackman, R. K., Crowe, D. A., DeNicola, A. L., Sakellaridi, S., **Westerberg, J. A.**, MacDonald III, A. W., Sponheim, S., and Chafee, M. V. (2022) State representations for cognitive control processes disrupted in schizophrenia are distributed between prefrontal and parietal neurons. *Journal of Neuroscience*, under review.

[18] *Tovar, D. A., ***Westerberg, J. A.**, Cox, M. A., Dougherty, K., Bastos, A. M., Wallace, M. T., and Maier, A. (2022) Near-field potentials better index cortical computations than population spiking. Rχ

DATASETS PUBLISHED OPEN ACCESS

[4] **Westerberg, J. A.**, Schall, J. D., Woodman, G. F., and Maier, A. (2022) Data from: feedforward attentional selection in sensory cortex. Dryad, Dataset, scheduled to be released upon publication of the associated manuscript.

[3] ***Westerberg, J. A.**, *Herrera, B., Schall, M. S., Maier, A. Woodman, G. F., Schall, J. D., and Riera, J. J. (2022) Data from: Resolving the mesoscopic missing link: biophysical modeling of EEG from cortical columns in primates. Dryad, Dataset, scheduled to be released upon publication of the associated manuscript.

[2] **Westerberg, J. A.**, Schall, M. S., Maier, A., Woodman, G. F., and Schall, J. D. (2022) Data from: laminar microcircuitry of visual cortex producing attention-associated electric fields. Dryad, Dataset, DOI: 10.5061/dryad.djh9w0w15.

[1] **Westerberg, J. A.**, Sigworth, E. A., Schall, J. D., and Maier, A. (2021) Data from: pop-out search instigates beta-gated feature selectivity enhancement across V4 layers. Dryad, Dataset, DOI: 10.5061/dryad.3r2280gh4.

INVITED TALKS

[7] **Westerberg, J. A.** (anticipated 2022) Cortical circuits for attentional capture and predictive processing. For The Allen Institute.

[6] **Westerberg, J. A.** (2022) Identifying traces of attentional selection across visual cortical columns. For the Rockefeller University Laboratory for Neural Systems.

[5] **Westerberg, J. A.** (2022) Grabbing attention, and its substrates in visual cortex. For the Netherlands Institute for Neuroscience Vision and Cognition Research Group.

[4] **Westerberg, J. A.** (2022) Attention and feature-selectivity along cortical columns during pop-out search. For the Neurospin Primate Research Group.

[3] **Westerberg, J. A.** (2021) Cortical columns producing cognitive electric fields: attention and the EEG-N2pc. For the Southern Illinois University Department of Physiology Seminar Series.

[2] **Westerberg, J. A.**, Schall, M. S., Maier, A., Schall, J. D., and Woodman, G. F. (2020) Cortical columns in area V4 produce the N2pc event-related potential index of attention. For the 4th Annual Southeastern Vision Research Conference.

[1] **Westerberg, J. A.**, Maier, A., and Schall, J. D. (2020) Neural mechanism of priming of pop-out in visual cortex. For the 20th Annual Vision Sciences Society Annual Meeting.

SELECTED ABSTRACTS

**Denotes equal contribution*

[40] **Westerberg, J. A.**, Herrera, B., Schall, M. S., Riera, J. J, Maier, A., Woodman, G. F., and Schall, J. D. (anticipated 2022) The neural basis for an EEG index of attention. Human Single Neuron Conference.

[39] **Westerberg, J. A.**, Maier, A., and Schall, J. D. (anticipated 2022) Priming alters cortical columnar attentional processing differently for targets vs. distractors in V4. Society for Neuroscience Annual Meeting.

[38] Bastos, A. M., Mendoza-Halliday, D., Major, A., Lee, N., Lichtenfeld, M., Carlson, B. M., Mitchell, B. A., Meng, P. D., Xiong, Y., **Westerberg, J. A.**, Kaas, J., Maier, A., Desimone, R., and Miller, E. K. (anticipated 2022) A preserved spectro-laminar motif of local field potential power across cortical maps onto histologically-identified layers. Society for Neuroscience Annual Meeting.

[37] Carlson, B. M., Mitchell, B. A., **Westerberg, J. A.**, and Maier, A. (2022) Interocular transfer of adaptation primarily modulates the infragranular layers of V1. Society for Neuroscience Annual Meeting.

[36] **Westerberg, J. A.**, Schall, J. D., and Maier, A. (2022) Evidence for bottom-up computation of pop-out in visual cortex which predicts behavior. Vision Sciences Society Annual Meeting.

[35] Carlson, B. M., Mitchell, B. A., **Westerberg, J. A.**, and Maier, A. (2022) Interocular transfer across ocular dominance columns of primate V1. Vision Sciences Society Annual Meeting.

[34] Mitchell, B. A., Carlson, B. M., Dougherty, K., **Westerberg, J. A.**, Cox, M. A., and Maier, A. (2022) Role of V1 Ocular Dominance for Binocular Integration. Vision Sciences Society Annual Meeting.

[33] **Westerberg, J. A.**, Woodman, G. F., Schall, J. D., and Maier, A. (2022) Attentional priority computed and precisely modified in sensory cortex. CSHL Meeting: From Neuroscience to Artificially Intelligent Systems.

[32] **Westerberg, J. A.**, Sigworth, E. A., Schall, J. D., and Maier, A. (2021) Laminar profile of feature selectivity in V4 and its rhythmic enhancement with exogenous attention. Society for Neuroscience Annual Meeting.

[31] Maier, A., Carlson, B. M., Cox, M. A., Dougherty, K., **Westerberg, J. A.**, and Tsuchiya, N. (2021) Cause-effect structures of cortical columnar activity. Society for Neuroscience Annual Meeting.

[30] Carlson, B. M., Dougherty, K., **Westerberg, J. A.**, Cox, M. A., and Maier, A. (2021) Dichoptic suppression reverses after adaptation in primate visual cortex. Society for Neuroscience Annual Meeting.

[29] Daumail, L., Carlson, B. M., Mitchell, B. A., Cox, M. A., **Westerberg, J. A.**, Johnson, C., Martin, P. R., Tong, F., Maier, A., and Dougherty, K. (2021) Rapid visual adaptation of thalamic relay neurons in the macaque monkey. Society for Neuroscience Annual Meeting.

[28] Mitchell, B. A., Dougherty, K., **Westerberg, J. A.**, Carlson, B. M., Daumail, L., Maier, A., and Cox, M. A. (2021) V1 shows facilitation rather than suppression during onset of binocular rivalry flash suppression. Society for Neuroscience Annual Meeting.

[27] Schall, J. D., Cohen, J., Dougherty, K., Godlove, D. C., Heitz, R., Herrera, B., Ninomiya, T., Sajad, A., Schall, M. S., **Westerberg, J. A.**, Maier, A., Riera, J. J., and Woodman, G. F. (2021) Laminar recordings in agranular and granular areas of macaque: relation to event-related potentials. 20$^{\text{th}}$ World Congress of Psychophysiology.

[26] Carlson, B. M., Dougherty, K., **Westerberg, J. A.**, Maier, A., and Cox, M. A. (2020) Stimulus history affects binocular visual processing in primate visual cortex. Southeastern Vision Research Conference.

[25] Daumail, L., Cox, M. A., **Westerberg, J. A.**, Mitchell, B. A., Carlson, B. M., Johnson, C., Martin, P. R., Tong, F., Maier, A., and Dougherty, K. (2020) Rapid visual adaptation of LGN neurons. Southeastern Vision Research Conference.

[24] Mitchell, B. A., Dougherty, K., **Westerberg, J. A.**, Carlson, B. M., Daumail, L., Maier, A., and Cox, M. A. (2020) V1 laminar spiking responses to binocular stimuli predicted by monocular activity and principles of gain-control. Southeastern Vision Research Conference.

[23] *Schall, M. S., ***Westerberg, J. A.**, Maier, A., Schall, J. D., and Woodman, G. F. (2020) Laminar origins of the N2pc index of visual attention in area V4. Vision Sciences Society Annual Meeting.

[22] Mitchell, B. A., Dougherty, K., **Westerberg, J. A.**, Carlson, B. M., Daumail, L., Maier, A., and Cox, M. A. (2020) V1 laminar spiking responses to binocular stimuli of varying contrast. Vision Sciences Society Annual Meeting.

[21] Daumail, L., Cox, M. A., **Westerberg, J. A.**, Mitchell, B. A., Carlson, B. M., Johnson, C., Martin, P. R., Tong, F., Maier, A., and Dougherty, K. (2020) Sparse adaptation among LGN neurons in the awake behaving macaque. Vision Sciences Society Annual Meeting.

[20] **Westerberg, J. A.**, Maier, A., and Schall, J. D. (2019) Microcircuitry of visual attention: laminar organization of attentional selection in area V4. Society for Neuroscience Annual Meeting.

[19] *Schall, M. S., ***Westerberg, J. A.**, Maier, A., Schall, J. D., and Woodman, G. F. (2019) Contribution of area V4 to the N2pc event-related potential index of attention. Society for Neuroscience Annual Meeting.

[18] *Schall, J. D., ***Westerberg, J. A.**, and Maier, A. (2019) Microcircuitry of visual attention: attentional priming in area V4. Society for Neuroscience Annual Meeting.

[17] Dougherty, K., Carlson, B. M., Cox, M. A., **Westerberg, J. A.**, Schall, M. S., Turchi, J. N., Martin, P. R., and Maier, A. (2019) Neural mechanisms of binocular convergence in the primate primary visual pathway. Society for Neuroscience Annual Meeting.

[16] **Westerberg, J. A.**, Woodman, G. F., Maier, A., and Schall, J. D. (2019) Performance monitoring signals during visual priming. Vision Sciences Society Annual Meeting.

[15] Dougherty, K., Cox, M. A., **Westerberg, J. A.**, and Maier, A. (2019) Binocular modulation of monocular neurons in the primary visual pathway. Vision Sciences Society Annual Meeting.

[14] **Westerberg, J. A.**, Maier, A., and Schall, J. D. (2018) Visual search strategies: priming of pop-out in macaques. Society for Neuroscience Annual Meeting.

[13] *Tovar, D. A., ***Westerberg, J. A.**, Cox, M. A., Dougherty, K., Carlson, T., Wallace, M. T., and Maier, A. (2018) Multivariate analysis of V1 spiking dynamics for ocularity, orientation, and repetition. Society for Neuroscience Annual Meeting.

[12] Dougherty, K., Cox, M. A., **Westerberg, J. A.**, and Maier, A. (2018) Monocular V1 neurons are sensitive to both eyes. Society for Neuroscience Annual Meeting.

[11] **Westerberg, J. A.**, Cox, M. A., Dougherty, K., and Maier, A. (2018) Repetitive stimulation enhances V1 encoding efficiency. Vision Sciences Society Annual Meeting.

[10] Dougherty, K., Cox, M. A., **Westerberg, J. A.**, and Maier, A. (2018) Binocular modulation of monocular V1 neurons. Gordon Research Conference on Thalamocortical Interactions.

[9] **Westerberg, J. A.**, Cox, M. A., Dougherty, K., and Maier, A. (2017) Repetitive visual stimulation suppresses spiking across V1 laminae. Society for Neuroscience Annual Meeting.

[8] **Westerberg, J. A.**, Cox, M. A., Dougherty, K., and Maier, A. (2017) Pre- versus post-stimulus comparison of correlated spiking variability across V1 laminae. Vision Sciences Society Annual Meeting.

[7] Dougherty, K., Cox, M. A., **Westerberg, J. A.**, and Maier, A. (2017) Interocular interactions in the macaque LGN. Vision Sciences Society Annual Meeting.

[6] **Westerberg, J. A.**, Cox, M. A., Dougherty, K., and Maier, A. (2017) Layer-specific differences between spontaneous and visually evoked spiking correlations in V1. Cosyne.

[5] **Westerberg, J. A.**, Middlebrooks, P. M., and Schall, J. D. (2016) Effect of choice difficulty on local field potentials in frontal eye field of nonhuman primates. Cognitive Neuroscience Society Annual Meeting.

[4] Balhorn, A. R., Tyshynsky, R. S., **Westerberg, J. A.**, and Loebach, J. L. (2016) A comparison of free-field and headphone-based sound localization using SoLoArc. Cognitive Neuroscience Society Annual Meeting.

[3] **Westerberg, J. A.**, Balhorn, A. R., Tyshynsky, R. S., and Loebach, J. L. (2015) SoLoArc: A free-field, multisensory localization tool for scientific inquiry in undergraduate education. Society for Neuroscience Annual Meeting.

[2] **Westerberg, J. A.**, Sutter, E. N., and Crisp, K. M. (2015) Pencil-and-paper neural networks: an undergraduate laboratory exercise in computational neuroscience. Society for Neuroscience Annual Meeting.

[1] **Westerberg, J. A.**, Blackman, R. K., Sakellaridi, S., and Chafee, M. V. (2014) Modulation of neural synchrony in prefrontal and parietal cortex of monkeys as a function of executive processing demand in a context processing task. Society for Neuroscience Annual Meeting.

SPECIALIZED COURSES, MEETINGS, AND WORKSHOPS ATTENDED

Human Single Neuron Conference *a. Nov. 2022*
Hosted by the University of California, Los Angeles

CSHL Meeting: From Neuroscience to Artificially Intelligent Systems *Apr. 2022*

Cold Spring Harbor Laboratory

Public Scholarship Workshop *Jun. 2021*
Federation of Associations in Behavioral and Brain Sciences

Neuropixels Workshop *Jan. 2021*
The Allen Institute

6th Workshop on the Computational Properties of Prefrontal Cortex *Oct. 2018*
Hosted by Vanderbilt University

PROFESSIONAL AFFILIATIONS

Faculty for Undergraduate Neuroscience Education *Aug. 2022 - Present*
Vision Sciences Society *Nov. 2016 - Present*
Cognitive Neuroscience Society *May 2015 - Present*
Society for Neuroscience *May 2013 - Present*

SERVICE AND EXPERIENCE

Invited Ad Hoc Reviewer:

Attention, Perception, and Psychophysics
Cerebral Cortex
eLife
Frontiers in Medicine
Frontiers in Psychiatry
Frontiers in Systems Neuroscience
J. E. P.: Learning, Memory, and Cognition
Journal of Neuroscience
Nature Scientific Data
Nature Scientific Reports
Proceedings of the National Academy of Sciences
Psychonomic Bulletin and Review
Psychological Research

Visiting Scientist *Jul. 2019 - Feb. 2020*
Multisensory Laboratory, Department of Anatomy
Southern Illinois University, Carbondale, IL, US

Trainee Representative *Sep. 2015 - Sep. 2017*
Cognitive Neuroscience Society

RESEARCH MENTORSHIP

†*Presented at scholarly meeting*, ‡*Co-authored manuscript*

Ali Hussain, undergraduate student | *Vanderbilt University* *Jul. 2022 - Present*

Kaitlyn Gabhart, research assistant | *Vanderbilt University* *Jun. 2022 - Present*

Cortez Johnson†,‡, undergraduate student | *Vanderbilt University* *Aug. 2019 - May 2020*
now pursuing an M.D. at Kaiser Permanente Bernard J. Tyson School of Medicine

Brock Carlson†,‡, research assistant | *Vanderbilt University* *Jun. 2018 - Aug. 2020*
now pursuing a Ph.D. at Vanderbilt University

Jacob Elsey†, research assistant | *Vanderbilt University* *Jun. 2016 - May 2018*
now pursuing a Ph.D. at Johns Hopkins University

TEACHING EXPERIENCE

Guest Lecturer *Spring 2021*
Perception
Vanderbilt University, Nashville, TN, US

Teaching Assistant *Fall 2015*
Sensation and Perception
Saint Olaf College, Northfield, MN, US

Academic Tutor *Spring 2015*
Neuroscience Program, Academic Support Center
Saint Olaf College, Northfield, MN, US

Teaching Assistant *Spring 2015*
Cellular and Molecular Neuroscience
Saint Olaf College, Northfield, MN, US

RESEARCH ASSISTANTSHIPS

Research Assistant *May 2015 - Sep. 2015*
Schall Lab, Department of Psychology
Vanderbilt University, Nashville, TN, US
Advisor: Jeffrey D. Schall, Ph.D.
Project: Neurophysiology of choosing and stopping

Research Assistant *May 2013 - May 2015*
Chafee Lab, Brain Sciences Center
University of Minnesota, Minneapolis, MN, US
Advisor: Matthew V. Chafee, Ph.D.
Project: Neural synchrony in fronto-parietal networks

Research Assistant *Oct. 2012 - May 2015*
Department of Psychology
Saint Olaf College, Northfield, MN, US
Advisors: Shelly Dickinson, Ph.D. and Gary Muir, Ph.D.
Project: Behavioral neuroscience and spatial navigation

Research Assistant *May 2013 - Sep. 2013*
Law School
University of Minnesota, Minneapolis, MN, US
Advisor: Francis X. Shen, J.D., Ph.D.
Project: Law and neuroscience