# Nicholas A. Steinmetz

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## *Education*

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| 2007 –2014 | Ph.D., Neurosciences, Stanford University, Stanford, CA, USA<br>Supervisors: Prof. Tirin Moore and Prof. Kwabena Boahen |
| 2003 –2007 | Bachelor of Science and Engineering in Bioengineering, *summa cum laude*<br>University of Pennsylvania, Philadelphia, PA, USA |

## *Employment*

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| 2019 – present | Assistant Professor, Department of Biological Structure, University of Washington |
| 2017 – 2018 | Senior Research Associate, University College London, London, UK |
| 2014 – 2017 | Research Associate, University College London, London, UK<br>Supervisors: Prof. Matteo Carandini and Prof. Kenneth D. Harris |

## *Team Science Roles*

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| 2019 – present | Member, International Brain Laboratory |

## *Peer-Reviewed Publications*

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|---|---|---|
| 2019 | **Steinmetz NA**, Zatka-Haas P, Carandini M, Harris KD<br>Distributed Correlates of Visually-Guided Behavior Across the Mouse Brain | *Nature (in press)* |
| | Stringer C*, Pachitariu P*, Steinmetz NA, Carandini M, Harris KD<br>High-Dimensional Geometry of Population Responses in Visual Cortex | *Nature* |
| | Stringer C*, Pachitariu P*, Steinmetz NA, Reddy CB, Carandini M, Harris KD<br>Spontaneous Behaviors Drive Multidimensional, Brain-Wide Population Activity | *Science* |
| | Shimaoka D, Steinmetz NA, Harris KD, Carandini M<br>The Impact of Bilateral Ongoing Activity on Evoked Responses in Mouse Cortex | *eLife* |
| | Okun M, Steinmetz NA, Lak A, Dervinis M, Harris KD<br>Distinct Structure of Cortical Population Activity on Fast and Infraslow Timescales | *Cerebral Cortex* |
| | Pettine WW, Steinmetz NA, Moore T<br>Laminar Segregation of Sensory Coding and Behavioral Readout in Macaque V4 | *PNAS* |
| 2017 | Jun J*, **Steinmetz NA***, Siegle JH*, Denman DJ*, Bauza M*, Barbarits B*, Lee AK*, et al.<br>Fully Integrated Silicon Probes for High-Density Recording of Neural Activity | *Nature* |
| | Burgess CP*, Lak A*, **Steinmetz NA***, Zatka-Haas P*, et al.<br>High-Yield Methods for Accurate Two-Alternative Visual Psychophysics in Head-Fixed Mice | *Cell Reports* |
| | **Steinmetz NA**, Buetfering C, Lecoq J, Lee CR, et al.<br>Aberrant Cortical Activity in Multiple GCaMP6-Expressing Transgenic Mouse Lines | *eNeuro* |
| | Sridharan D, Steinmetz NA, Moore T, Knudsen EI<br>Does the Superior Colliculus Control Perceptual Sensitivity or Choice Bias during Attention? Evidence from a Multialternative Decision Framework | *J. of Neurosci* |
| 2016 | Engel TA*, **Steinmetz NA***, Gieselmann MA, Thiele A, Moore T, Boahen K<br>Selective Modulation of Cortical State During Spatial Attention | *Science* |
| | Stringer C, Pachitariu M, Steinmetz NA, Okun M, Bartho P, Harris K, Sahani M, Lesica N<br>Inhibitory Control of Correlated Intrinsic Variability in Cortical Networks | *eLife* |

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| | Pachitariu M, Steinmetz NA, Kadir S, Carandini M, Harris KD<br>Fast and Accurate Spike Sorting of High-Channel Count Probes with Kilosort | *NeurIPS* |
| 2015 | Okun M, Steinmetz NA, … Carandini M, Harris KD<br>Diverse Coupling of Neurons to Populations in Sensory Cortex | *Nature* |
| 2014 | **Steinmetz NA**, Moore T<br>Eye Movement Preparation Modulates Neuronal Responses in Area V4 When Dissociated from Attentional Demands | *Neuron* |
| | Zirnsak M, Steinmetz NA, Noudoost B, Xu K, Moore T<br>Visual Space is Compressed in Prefrontal Cortex Before Eye Movements | *Nature* |
| | Sridharan D, Steinmetz NA, Moore T, Knudsen EI<br>Distinguishing Bias from Sensitivity Effects in Multialternative Detection Tasks | *J. of Vision* |
| | **Steinmetz NA**<br>Circuits Underlying Visual Attention in Primate Neocortex | *Ph.D. Thesis* |
| 2010 | **Steinmetz NA**, Moore T<br>Changes in the Response Rate and Response Variability of Area V4 Neurons During the Preparation of Saccadic Eye Movements | *J. of Neurophys* |
| 2009 | Aton SJ, Seibt J, Dumoulin M, Jha SK, Steinmetz N, Coleman T, Naidoo N, Frank MG<br>Mechanisms of Sleep-Dependent Consolidation of Cortical Plasticity | *Neuron* |
| 2008 | Liu X, Steinmetz NA, Farley AB, Smith CD, Joseph JE<br>Mid-fusiform Activation During Object Discrimination Reflects the Process of Differentiating Structural Descriptions | *J. of Cog Neurosci* |
| 2006 | Joseph JE, Cerullo MA, Farley AB, Steinmetz NA, Mier CR<br>fMRI Correlates of Cortical Specialization and Generalization for Letter Processing | *Neuroimage* |
| | Joseph JE, Powell DK, Andersen AH, …, Steinmetz NA, Zhang Z<br>fMRI in Alert, Behaving Monkeys: An Adaptation of the Human Infant Familiarization Novelty Preference Procedure | *J. of Neurosci Methods* |
| 2005 | Jha SK, Jones BE, Coleman T, Steinmetz N, …, Frank MG<br>Sleep-Dependent Plasticity Requires Cortical Activity | *J. of Neurosci* |

## *Preprints*

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|---|---|---|
| 2019 | Peters A, Steinmetz NA, Harris KD, Carandini M<br>Striatal Activity Reflects Cortical Activity Patterns | *bioRxiv* |
| | Schröder S, Steinmetz NA, Krumin M, Pachitariu M, Rizzi M, Lagnado L, Harris KD, Carandini M<br>Retinal Outputs Depend on Behavioural State | *bioRxiv* |
| 2018 | Zatka-Haas P*, **Steinmetz NA***, Carandini M, Harris KD<br>Distinct Contributions of Mouse Cortical Areas to Visual Discrimination | *bioRxiv* |
| | Jacobs EAK, Steinmetz NA, Carandini M, Harris KD<br>Cortical State Fluctuations During Sensory Decision Making | *bioRxiv* |
| | Shamash P, Harris KD, Carandini M, **Steinmetz NA**<br>A Tool for Analyzing Electrode Tracks From Slice Histology | *bioRxiv* |

## *Reviews and Commentary*

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| 2018 | **Steinmetz NA**, Koch C, Harris KD, Carandini M<br>Challenges and opportunities for large-scale electrophysiology with Neuropixels probes | *Curr Op in Neurobiology* |
| 2012 | Squire RF*, **Steinmetz NA***, Moore T<br>Frontal Eye Fields | *Scholarpedia* |

**Steinmetz NA**, Moore T *Neuron*
Lumping and splitting the neural circuitry of visual attention

2010 Noudoost B, Chang MH, Steinmetz NA, Moore T *Curr Op in Neurobiology*
Top-down control of visual attention

## *Fellowships and Awards*

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| 2019 – pres. | Whitehall Foundation |
| 2015 – 2018 | Postdoctoral Fellowship from the Human Frontier Sciences Program |
| 2016 – 2018 | Postdoctoral Fellowship from the Marie Curie Action of the EU |
| 2015 | Newton Postdoctoral Fellowship from the Royal Society (awarded) |
| 2011 – 2014 | Graduate Research Fellowship from National Science Foundation (NSF GRFP) |
| 2009 – 2011 | Graduate Research Fellowship from the Stanford Center for Mind, Brain, and Computation, National Science Foundation, Integrative Graduate Education Research Traineeship (NSF IGERT) |
| 2006 – 2007 | Blair Fellowship for Undergraduate Research in Bioengineering/Biomedical Sciences from the University of Pennsylvania |
| 2005 – 2007 | University Scholars Fellowship for Undergraduate Research from the University of Pennsylvania |

## *Invited Talks*

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| 2019 July | Champalimaud Centre for the Unknown, Lisbon, Portugal |
| 2019 July | Neural Data Science course, Cold Spring Harbor Labs, New York, NY, USA |
| 2019 May | Statistical Analysis of Neural Data, Keynote speaker, Pittsburgh, PA, USA |
| 2019 Apr | University of Washington, Seattle, WA, USA |
| 2019 Mar | University of Oregon, Eugene, OR, USA |
| 2019 Jan | Neural Computation and Engineering Connection, University of Washington, Seattle, WA, USA |
| 2018 Nov | Society for Neuroscience, Nanosymposium, San Diego, CA, USA |
| 2018 Oct | 'Neureka' Symposium, Kings College London, London, UK |
| 2018 Sept | Cardiff University, Cardiff, Wales, UK |
| 2018 May | International Brain Laboratory, First Science Meeting, Paris, France |
| 2018 May | International Conference for Advanced Neurotechnology, Ann Arbor, MI, USA |
| 2018 Mar | Cosyne Workshop on "Brain-wide neuronal dynamics", Breckenridge, CO, USA |
| 2018 Feb | Neuralink, San Francisco, CA, USA |
| 2017 Nov | SfN Neuropixels Satellite Session, Washington, DC, USA |
| 2017 Oct | Kavli Futures Symposium: Neurotechnology, Santa Monica, CA, USA |
| 2017 Sept | NIH Neurotechnology Seminar, Bethesda, MD, USA |
| 2017 July | Computational Neuroscience Society, Antwerp, Belgium |
| 2017 July | Champalimaud Centre for the Unknown, Lisbon, Portugal |
| 2017 June | International Conference for Advanced Neurotechnology, Freiburg, Germany |
| 2016 Nov | Institute of Opthalmology, University College London, London, UK |
| 2015 Nov | Neuroseeker Data Workshop, Nijmegen, Netherlands |

## *Other Training*

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| 2012 | FENS-IBRO-Hertie Winter School on "Neural Coding in Sensory Systems", Obergurgl, Austria |
| 2009 | "Methods in Computational Neuroscience", Woods Hole, MA, USA |

## *Teaching Activities*

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|---|---|
| 2019 | Course organizer and lecturer for Neuropixels Workshop, Allen Institute for Brain Science |
| 2019 | Course organizer and lecturer for Neuropixels Training Course 2019, University College London |
| 2018 | Course organizer and instructor for International Brain Laboratory "Neuropixels mini-course" |
| 2018 | Course instructor for Cajal Course "Linking Neural Circuits and Behavior", Bordeaux, France |
| 2018 | Course instructor for Paris Neuro, Paris, France |
| 2018 | Course organizer and lecturer for Neuropixels Training Course 2018, University College London |
| 2017 | Teaching Assistant for Cajal Course "Interacting with Neural Circuits", Champalimaud Centre, Lisbon, Portugal |
| 2017 | Course organizer and lecturer for Neuropixels Training Course 2017, University College London |
| 2012 | Teaching Assistant, *Large-scale neural models*, with Dr. Kwabena Boahen, Stanford University |
| 2011 | Teaching Assistant, *Computational Neuroscience*, with Dr. John Huguenard, Stanford University |
| 2009 | Teaching Assistant, *Information and Signaling in Neurons and Networks*, with Dr. Richard Tsien and Dr. Stephen Baccus, Stanford University |
| 2008 | Teaching Assistant, "Stanford Intensive Neuroscience" graduate program boot camp |

## *Selected Conference Presentations*

Chen S, Neto J, Pachitariu M, Kampff A, **Steinmetz NA.** On the shape and extent of extracellular action potential waveforms across the rodent brain. Poster at Society for Neuroscience 2018, San Diego, CA, USA

**Steinmetz NA,** Zatka-Haas P, Carandini M, Harris KD. Local and global neural correlates of a perceptual decision. Poster at Federation of European Neuroscience Societies (FENS) 2018, Berlin, Germany

**Steinmetz NA,** Zatka-Haas P, Carandini M, Harris KD. Local and global neural correlates of a perceptual decision. Poster at AREADNE 2018, Santorini, Greece

**Steinmetz NA,** Zatka-Haas P, Carandini M, Harris KD. Distributed neuronal populations underlying vision, action, and reward across the mouse brain. Poster at Computational and Systems Neuroscience (Cosyne) 2018, Denver, CO, USA

**Steinmetz NA,** Zatka-Haas P, Carandini M, Harris KD. Neuronal populations supporting vision, action, and reward across the mouse brain. Poster at Society for Neuroscience 2017, Washington, DC, USA

**Steinmetz NA,** Carandini M, Harris KD. Distributed neuronal populations supporting vision, action, and reward across the mouse brain. Poster at International Conference for Advanced Neurotechnology 2017, Freiburg, Germany.

**Steinmetz NA,** Pachitariu M, Burgess CP, Rossant C, Harris T, Carandini M, Harris KD. Recording large, distributed neuronal populations with next-generation electrode arrays in behaving mice. Poster at Society for Neuroscience 2016, San Diego, CA, USA

**Steinmetz NA**, Pachitariu M, Rossant C, Hunter MLD, Neto JP, Kampff A, Carandini M, Harris KD. Neuropixels and Kilosort: 384-channel recordings in awake mice and improved spike-sorting software. Poster at International Conference for Advanced Neurotechnology 2016, Ann Arbor, MI, USA

**Steinmetz NA,** Burgess CP, Kadir SN, Rossant C, Goodman DFM, Hunter MLD, Carandini M, Harris KD. Neural correlates of visually-guided behavior in mouse cingulate cortex. Poster at Society for Neuroscience 2015, Chicago, IL, USA

**Steinmetz NA**, Kadir SN, Rossant C, Goodman DFM, Hunter MLD, Carandini M, Harris KD. Next-generation microelectrode arrays for probing the neocortical circuits underlying visually-guided behavior. Poster at Brain Informatics and Health 2015, London, UK *** Awarded Best Poster**

**Steinmetz NA**, Moore T. Circuits underlying covert attention and saccade preparation within the primate frontal eye field. Poster at FENS Brain Conference on Controlling Neurons, Circuits, and Behavior 2014, Copenhagen, Denmark

**Steinmetz NA**, Moore T. Circuits underlying covert attention and saccade preparation within the primate frontal eye field. Poster at Society for Neuroscience 2014, Washington, D.C., USA

Engel T, **Steinmetz NA**, Moore T, Boahen K. Effects of attention on spatio-temporal correlations across layers of a single column in area V4. Poster at Computational and Systems Neuroscience (Cosyne) Conference 2013, Salt Lake City, UT, USA

**Steinmetz NA**, Benjamin BV, Boahen K. NMDA-mediated feedback accounts for effects of visual spatial attention in Neurogrid simulations. Poster at Computational and Systems Neuroscience (Cosyne) Conference 2013, Salt Lake City, UT, USA

**Steinmetz NA**, Moore T. Simultaneous measurement of visual response modulation across cortical layers in area V4 during covert attention and saccade preparation. Poster at Society for Neuroscience 2012, New Orleans, LA, USA

**Steinmetz NA**, Moore T. Pattern of attentional and presaccadic modulation of visual responses in macaque V4 measured simultaneously across cortical layers. Poster at Computational and Systems Neuroscience (Cosyne) Conference 2012, Salt Lake City, UT, USA

**Steinmetz NA**, Moore T. Pattern of attentional and presaccadic modulation of visual responses in macaque V4 measured simultaneously across cortical layers. Poster at FENS-IBRO Winter School: Neural Coding in Sensory Systems 2012, Obergurgl, Austria

**Steinmetz NA**, Moore T. Pattern of presaccadic modulation of visual responses in macaque V4 measured simultaneously across cortical layers. Poster at Society for Neuroscience 2011, Washington, D.C., USA

Benjamin B, McQuinn E, Gao P, Choudhary S, **Steinmetz NA**, Moore T, Boahen K. Simulating a Two-Cortical Area Model of Top-Down Attention on Neurogrid. Poster at NIH Pioneer Conference 2011, Washington, D.C., USA

Merolla P, Arthur J, Benjamin B, Neil D, Elassaad S, **Steinmetz NA**, Moore T, Boahen K. Simulating Cortical Neuron Populations in Real-Time on the Neurogrid Desktop Supercomputer. Poster at NIH Pioneer Conference 2010, Washington, D.C., USA

**Steinmetz NA**, Moore T. (2010) Changes in the Response Rate and Response Variability of Area V4 Neurons During the Preparation of Saccadic Eye Movements. Poster at Computational and Systems Neuroscience (Cosyne) Conference 2010, Salt Lake City, UT, USA

**Steinmetz NA**, Moore T. (2008) A Signature of Eye Movement Preparation in the Response Variability of Area V4 Neurons. Poster at Dynamical Neuroscience XVI, Washington D.C., USA