

JOSH SIEGLE

SCALABLE SYSTEMS NEUROSCIENCE

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My work pushes the limits of large-scale neural recording, produces widely used open datasets and software, and has revealed fundamental links between brain anatomy and spiking dynamics.

POSITIONS

- **Senior Scientist**, Allen Institute for Neural Dynamics (2021-present)
Leader of the Electrophysiology Group
- **Assistant Investigator**, Allen Institute MindScope Program (2020-2021)
Collected and shared massive open datasets of spiking activity from the mouse visual system
- **Scientist I & II**, Allen Institute MindScope Program (2014-2020)
Early adopter of Neuropixels probes for *in vivo* electrophysiology

EDUCATION

- **PhD, Neuroscience**, Massachusetts Institute of Technology (2014)
- **ScB, Neuroscience**, Brown University (2007)

PUBLICATIONS

- Buccino AP, Sridhar A, Feng D, Svoboda K, **Siegle JH** (2026) "Efficient and reproducible pipelines for spike sorting large-scale electrophysiology data" *eLife* **15**, RP110170.
- Lakunina A, Socha KZ, Ladd A, [...] **Siegle JH**, Carandini M (2025) "Neuropixels Opto: Combining high-resolution electrophysiology and optogenetics" *bioRxiv*.
- Newman JP, Zhang J, Cuevas-López A [...] **Siegle JH**, Harnett MT, Wilson MA, Voigts J (2025) "ONIX: a unified open-source platform for multimodal neural recording and perturbation during naturalistic behavior." *Nature Methods* **22**, 187-192.
- Ye Z, Shelton AM, Shaker JR, Boussard J [...] **Siegle JH**, Koch C, Olsen SR, Harris TD, Steinmetz NA (2025) "Ultra-high-density Neuropixels probes improve detection and identification in neuronal recordings." *Neuron* **113**, 3966-3982.e12.
- Arora V, Lachi D, Knight IJ, Azabou M, Richards B, Hurwitz CL, **Siegle JH**, Dyer EL (2025) "Know thyself by knowing others: Learning neuron identity from population context." *arXiv*.
- Bennett C, Gale S, Heller G, Ramirez T, Belski H [...] **Siegle JH** [...] Koch C, Olsen SR (2025) "Map of spiking activity underlying change detection in the mouse visual system." *bioRxiv*.
- Arkhipov A, da Costa N, de Vries S, Bakken T [...] **Siegle JH** [...] Koch C, Zeng H (2025) "Integrating multimodal data to understand cortical circuit architecture." *Nature Neuroscience* **28**, 717-730.
- Roszko DA, Chen FD, Straguzzi J, Wahn H [...] **Siegle JH**, Poon JKS, Sacher WD (2025) "Foundry-fabricated dual-color nanophotonic neural probes for photostimulation and electrophysiological recording." *Neurophotonics* **12**, 025002.
- Akella S, Ledochowitsch P, **Siegle JH** et al. "Deciphering neuronal variability across states reveals dynamic sensory encoding." *Nature Communications* **16**, 1768.

- Bennett C, Ouellette B, Ramirez TK [...] **Siegle JH**, Farrell C, Groblewski PA, Olsen SR (2024) "SHIELD: Skull-shaped hemispheric implants enabling large-scale electrophysiology datasets in the mouse brain." *Neuron* **112**, 2869-2885.e8.
- Buccino AP, Winter O, Bryant D, Feng D, Svoboda K, **Siegle JH** (2023) "Compression strategies for large-scale electrophysiology data." *Journal of Neural Engineering* **20**, 056009.
- De Vries SEJ, **Siegle JH**, Koch C (2023) "Sharing neurophysiology data from the Allen Brain Observatory." *eLife* **12**, e85550.
- Birman D, Yang KJ [...] **Siegle JH**, Steinmetz NA (2023) "Pinpoint: trajectory planning for multi-probe electrophysiology and injections in an interactive web-based 3D environment." *bioRxiv*.
- Rimehaug AE, Stasik AJ, Hagen E, Billeh YN, **Siegle JH** et al. (2023) "Uncovering circuit mechanisms of current sinks and sources with biophysical simulations of primary visual cortex." *eLife* **12**, e87169.
- Wei Y, Nandi A, Jia X, **Siegle JH** et al. (2023) "Associations between *in vitro*, *in vivo*, and *in silico* classes in mouse primary visual cortex." *Nature Communications* **14**, 2344.
- Durand S, Heller GR, Ramirez TK [...] **Siegle JH**, Olsen SR (2023) "Acute head-fixed recordings in awake mice with multiple Neuropixels probes." *Nature Protocols* **18**, 424-457.
- Koch C, Svoboda K, Bernard A, Basso MA [...] **Siegle JH**, Zador A (2022) "Next-generation brain observatories." *Neuron* **110**, 3661-3666.
- Jia X, **Siegle JH**, Durand S, Heller G, Ramirez TK, Koch S, Olsen SR (2022) "Multi-regional module-based signal transmission in mouse visual cortex." *Neuron* **110**, 1585-1598.
- Petersen PC, **Siegle JH**, Steinmetz NA, Mahallati S, Buzsáki G (2021) "CellExplorer: A framework for visualizing and characterizing single neurons." *Neuron* **109**, 3594-3608.
- Lecoq J, Oliver M, **Siegle JH**, Orlova N, Ledochowitsch P, Koch C (2021) "Removing independent noise in systems neuroscience data using DeepInterpolation." *Nature Methods* **18**, 3594-3608.
- **Siegle JH**, Ledochowitsch P, Jia X, Millman DJ et al. (2021) "Reconciling functional differences in populations of neurons recorded with two-photon imaging and electrophysiology." *eLife* **10**, e69068.
- **Siegle JH**, Jia X, Durand S, Gale S, Bennett C, Graddis N, Heller G, Ramirez TK, Choi H et al. (2021) "Survey of spiking in the mouse visual system reveals functional hierarchy." *Nature* **592**, 86-92.
- Buccino AP, Hurtwitz CL, Garcia S, Magland J, **Siegle JH**, Hurwitz R, Hennig Matthias H (2020) "SpikeInterface, a unified framework for spike sorting." *eLife* **9**, e61834.
- Billeh YN, Cai B, Gratiy S, Dai K, Iyer R, Gouwen NW, Abbasi-Asl R, Jia X, **Siegle JH**, Olsen SR, Koch C, Mihalas S, Arkhipov A (2020) "Systematic integration of structural and functional data into multi-scale models of mouse primary visual cortex." *Neuron* **106**, 388-403.e18.
- Putzeys J, Raducanu BC, Carton A, De Ceulaer JD, Karsh B, **Siegle JH** et al. (2019) "Neuropixels data-acquisition system: a scalable platform for parallel recording of 10,000+ electrophysiological signals." *IEEE Transactions on Biomedical Circuits and Systems* **13**, 1635-1644.
- Jia X, **Siegle JH**, Bennett C, Gale S, Denman DJ, Koch C, Olsen S (2019) "High-density extracellular probes reveal dendritic backpropagation and facilitate neuron classification." *Journal of Neurophysiology* **121**, 1831-1847.
- Jun JJ, Steinmetz NA, **Siegle JH**, Denman DJ, Bauza M, Barbarits B, Lee AK, et al. (2017) "Fully integrated silicon probes for high-density recording of neural activity." *Nature* **551**, 232-236.
- **Siegle JH**, Cuevas López A, Patel Y, Abramov K, Ohayon S, Voigts J (2017) "Open Ephys: An open-source, plugin-based platform for multichannel electrophysiology." *Journal of Neural Engineering* **14**, 045003.
- Denman DJ, **Siegle JH**, Koch C, Reid RC, Blanche TJ (2017) "Spatial organization of chromatic pathways in the mouse dorsal lateral geniculate nucleus." *Journal of Neuroscience* **37**, 1102-1116.
- Teeters JL, Godfrey K, Young R, Dang C [...] **Siegle JH** et al. (2015) "Neurodata Without Borders: Creating a common data format for neurophysiology." *Neuron* **88**, P629-634.
- Pak N, **Siegle JH**, Kinney JP, Denman DJ, Blanche TJ, Boyden ES (2015) "Closed-loop, ultraprecise, automated craniotomies." *Journal of Neurophysiology* **113**, 3943-3953.

- **Siegle JH**, Hale GJ, Newman JP, Voigts J (2015) "Neural ensemble communities: Open-source approaches to hardware for large-scale electrophysiology." *Current Opinion in Neurobiology* **32**, 53-59.
- Pritchett DL, **Siegle JH**, Deister CA, Moore CI (2015) "For things needing your attention: the role of neocortical gamma in sensory perception." *Current Opinion in Neurobiology* **31**, 254-263.
- **Siegle JH**, Pritchett DL, Moore CI (2014) "Gamma-range synchronization of fast-spiking interneurons can enhance detection of tactile stimuli." *Nature Neuroscience* **17**, 1371-1379.
- **Siegle JH**, Wilson MA (2014) "Enhancement of encoding and retrieval functions through theta phase-specific manipulation of hippocampus." *eLife* **3**, e03061.
- Voigts J, **Siegle JH**, Pritchett DL, Moore CI (2013) "The flexDrive: an ultra-light implant for optical control and highly parallel chronic recording of neuronal ensembles in freely moving mice." *Frontiers in Systems Neuroscience* **7**.
- Carlen C, Meletis K, **Siegle JH** et al. (2012) "A critical role for NMDA receptors in parvalbumin interneurons for gamma rhythm induction and behavior." *Molecular Psychiatry* **17**, 537-548.
- Halassa MM, **Siegle JH**, Ritt JT, Ting JT, Feng G, Moore CI (2011) "Selective optical drive of thalamic reticular nucleus generates thalamic bursts and cortical spindles." *Nature Neuroscience* **14**, 1118-1120.
- Knoblich U, **Siegle JH**, Pritchett DL, Moore CI (2010) "What do we gain from gamma? Local dynamic gain modulation drives enhanced efficacy and efficiency of signal transmission." *Frontiers in Human Neuroscience* **4**.
- **Siegle JH**, Warren WH (2010) "Distal attribution and distance perception in sensory substitution." *Perception* **39**, 208-223.

AWARDS & FELLOWSHIPS

- NRSA Fellowship (2012-2014)
- National Defense Science and Engineering Graduate Fellowship (2009-2012)
- Angus MacDonald Award for Excellence in Undergraduate Teaching (2011)
- Brown University Neuroscience Prize (2007)
- Sigma Xi (2007)
- Phi Beta Kappa (2006)

TEACHING EXPERIENCE

- Neuropixels and OpenScope Workshop, Organizer (2019-2025)
- MPFI Advanced Neurotechniques Course, Lecturer (2025)
- UCL Neuropixels Workshop, Lecturer (2023-2024)
- Paris Neuro Course, Lecturer (2022-2024)
- Summer Workshop on the Dynamic Brain, Instructor (2023)
- Karolinska Institute Brain Circuits Course, Instructor (2012, 2013, 2015)
- Transylvanian Experimental Neuroscience Summer School, Teaching Assistant (2014, 2016)
- MIT Independent Activities Period "Building Your Own Neuroscience Lab" Course, Organizer (2012)
- MIT Systems Neuroscience Laboratory, Teaching Assistant (2010-2011)
- Woods Hole Neural Systems and Behavior Summer Course, Teaching Assistant (2009)

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