Benjamin Snow Sipes, Ph.D.

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Research Interests

I research the relationship between the brain's structural connectivity (SC) and its function. In particular, I use the graph Laplacian of SC and its graph harmonics to study how network structure constrains the propagation and organization of brain signals. I argue that these harmonics offer a framework to describe how the brain shapes its function everywhere, all at once.

Education

2022 – 2026 **Ph.D. Bioengineering–Computational Neuroscience, University of California, San Francisco & University of California, Berkeley.**
Thesis title: *Understanding Brain Structure as a Scaffold for Brain Function.*

2018 – 2019 **M.Sc. Biomedical Imaging, University of California, San Francisco.**
Thesis title: *EEG Microstates in Neurofeedback Attention Training.*

2013 – 2017 **B.Sc. Animal Biology, University of California, Davis.**
Minors: Sociology & Professional Writing.
Thesis title: *Affiliative Behavior in Titi Monkeys dosed with Intranasal Oxytocin.*

Employment History

2019 – 2022 **Assistant Specialist.** Drs. Ashish Raj, Olga Tymofiyeva, & Tony Yang, *UCSF*
Implemented image processing pipelines for brain network analysis. Used MRI and MEG data to study brain structure-function relationships in clinical populations. Coordinated NIH R61 clinical trial with healthy adolescents and parents. Collected psychometric data.

2014 – 2018 **Research Assistant.** Drs. Karen Bales & Brenda McCowan, *UC Davis*
Studied rhesus macaque social networks and human conflict in Shimla, India. Collected live behvavioral data from over 100 rhesus macaques. Studied the role of oxytocin in titi monkeys. Collected biological specimens. Filmed and scored behavior.

Research Publications

Journal Articles

1. F. Arab†, **B. S. Sipes**†, S. S. Nagarajan, and A. Raj, "Global signal removal (gsr) as graph spatial filtering," *bioRxiv*, pp. 2026–04, 2026, † Equal contribution.
2. **B. S. Sipes**, F. Arab, S. S. Nagarajan, and A. Raj, "Honed-in on brain activity: Deconvolving passive diffusion on the structural network from functional brain signals," *bioRxiv*, pp. 2026–01, 2026.
3. Y. Xia, F. Arab, U. Saha, **B. S. Sipes**, G. Gooden, M. Chen, and A. Raj, "Mambaxbrain: A multi-task neural framework linking brain functional dynamics to individual fingerprints, cognitive and disease states," *bioRxiv*, pp. 2026–02, 2026.
4. C. Anand, F. Abdelnour, **B. S. Sipes**, D. Ma, P. D. Maia, J. Torok, and A. Raj, "Selective vulnerability and resilience to alzheimer's disease tauopathy as a function of genes and the connectome," *Brain*, vol. 148, no. 10, pp. 3679–3693, 2025.
5. H. Jin, F. Abdelnour, P. Verma, **B. S. Sipes**, S. S. Nagarajan, and A. Raj, "Bayesian inference of frequency-specific functional connectivity in meg imaging using a spectral graph model," *Imaging Neuroscience*, vol. 2, imag–2, 2024.

6. A. Raj, **B. S. Sipes**, P. Verma, D. H. Mathalon, B. Biswal, and S. Nagarajan, "Spectral graph model for fmri: A biophysical, connectivity-based generative model for the analysis of frequency-resolved resting-state fmri," *Imaging Neuroscience*, vol. 2, imag–2, 2024.

7. **B. S. Sipes**, S. S. Nagarajan, and A. Raj, "Integrative, segregative, and degenerate harmonics of the structural connectome," *Communications biology*, vol. 7, no. 1, p. 986, 2024.

8. O. Tymofiyeva†, **B. S. Sipes**†, T. Luks, E. J. Hamlat, T. E. Samson, T. J. Hoffmann, D. V. Glidden, A. Jakary, Y. Li, T. Ngan, et al., "Interoceptive brain network mechanisms of mindfulness-based training in healthy adolescents," *Frontiers in psychology*, vol. 15, p. 1 410 319, 2024, † Equal contribution.

9. J. A. Cummings, **B. S. Sipes**, D. H. Mathalon, and A. Raj, "Predicting functional connectivity from observed and latent structural connectivity via eigenvalue mapping," *Frontiers in neuroscience*, vol. 16, p. 810 111, 2022.

10. **B. S. Sipes**, A. Jakary, Y. Li, J. E. Max, T. T. Yang, and O. Tymofiyeva, "Resting state brain subnetwork relates to prosociality and compassion in adolescents," *Frontiers in psychology*, vol. 13, p. 1 012 745, 2022.

11. **B. S. Sipes**, T. T. Yang, K. C. Parks, N. Jariwala, and O. Tymofiyeva, "A domain-general developmental "do-good" network model of prosocial cognition in adolescence: A systematic review," *Frontiers in Behavioral Neuroscience*, vol. 16, p. 815 811, 2022.

12. O. Tymofiyeva, M. Y. Hu, **B. S. Sipes**, A. Jakary, D. V. Glidden, N. Jariwala, S. Bhandari, K. C. Parks, C. Nguyen, E. Henje, et al., "A feasibility study of a remotely-delivered mindfulness-based training for adolescents during the covid-19 pandemic," *Frontiers in psychiatry*, vol. 13, p. 838 694, 2022.

13. O. Tymofiyeva, E. Henje, J. P. Yuan, C.-Y. Huang, C. G. Connolly, T. C. Ho, S. Bhandari, K. C. Parks, **B. S. Sipes**, T. T. Yang, et al., "Reduced anxiety and changes in amygdala network properties in adolescents with training for awareness, resilience, and action (tara)," *NeuroImage: Clinical*, vol. 29, p. 102 521, 2021.

Skills

Mathematics	Graph Theory, Graph Signal Processing, Dynamical Systems, Network Control, Network Modeling, Optimization, Statistical Learning
Coding	MATLAB, Python, LaTeX, Git, Bash, High-Performance Computing (SLURM)
Neuroimaging	Structural Connectomics, Functional Connectivity, Task & Resting-State fMRI, Diffusion MRI, Tractography, Surface-Based Analysis
Pipelines & Software	fMRIPrep, QSIPrep, XCP-D, Micapipe, FSL, ANTs, MRtrix3, DiPy, EEGLAB
Clinical Research	Double-blind Randomized Controlled Trials, IRB Compliance

Miscellaneous Experience

Awards and Achievements

2026 **Trainee Travel Award**, International Society for Magnetic Resonance in Medicine (ISMRM).

2025 **Best Grant Pitch**, CIFAR Neuroscience of Consciousness Winter School.

Best Neuroimaging Poster Award, UCSF Radiology Research Conference.

Society Memberships

The Society for Neuroscience | The Organization of Human Brain Mapping | The Organization for Computational Neuroscience | International Society for Magnetic Resonance in Medicine

Peer Review

Network Neuroscience | *Imaging Neuroscience* | *Mind, Brain and Education*