Aarav Sinha

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Overview

Aarav Sinha is a researcher working at the intersection of computational neuroscience and machine learning. He is a computational neuroscience researcher at Eon Systems PBC, where he leads projects on embodied *Drosophila* brain emulation and task-aligned connectome-constrained machine learning, and a founding member of the Dynamical Intelligence Group at Johns Hopkins University, where he investigates predictive grid coding in the medial entorhinal cortex. He previously conducted summer research at Harvard's Kempner Institute on recurrent neural network models of odor-plume navigation. His research has been presented at NeurIPS and ICML, with additional manuscripts under review at NeurIPS 2026 and TMLR, and a first-author manuscript in preparation for Science Advances. He also qualified for the Gold division of the USA Computing Olympiad as a sophomore (top ~10% of all competitors). His work in embodied brain emulation has reached a public audience of more than one hundred million views across platforms.

Education

2024–2028 Obra D. Tompkins High School, Katy, TX (Class of 2028). GPA: 4.0/4.0; class rank: 5 of 809 students. Advanced coursework includes AP Calculus BC, AP Statistics, AP Psychology, and AP Seminar.

Selected Coursework and Certifications

Apr. 2026 Mathematics for Machine Learning and Data Science, Coursera.

Oct. 2024 Fundamentals of Neuroscience, HarvardX.

Jul. 2024 Machine Learning Specialization, Coursera.

Experience

2026–Present **Member of Technical Staff**, Humanis. Build verification and evaluation infrastructure for an AI scientist that constructs probabilistic world models of complex physical systems with neurosymbolic AI, helping ensure that generated models are scientifically grounded, internally consistent, and useful for real-world decision-making.

2026–Present **Visiting Researcher**, Astera Institute. Develop biologically grounded *C. elegans* models that integrate internal states and environmental signals to produce adaptive navigation, foraging, and threat-avoidance behavior. Study how compact neural systems can generate interpretable, goal-directed behavior.

2025–Present **Computational Neuroscientist**, Eon Systems PBC. Lead experiments in embodied brain emulation and task-aligned connectome-constrained machine learning. Co-developed an emulated whole-brain *Drosophila* model operating in closed loop with a physically simulated body (the first embodied whole-brain emulation); the project generated more than 100 million impressions across social media. Lead experiments demonstrating that alignment between a brain region's biological function and the target task is critical for extracting generalizable principles for AI. Helped raise Eon's funding through technical research, demonstrations, and investor materials.

2025–Present **Founding Lab Member**, Dynamical Intelligence Group, Johns Hopkins University (PI: Prof. William Redman). Study predictive grid coding in the medial entorhinal cortex through neural data analysis and recurrent neural networks trained for path integration. Investigate whether

grid cells represent future position and how predictive spatial codes support navigation. Lead a first-author manuscript in preparation for *Science Advances*.

Summer 2025 **Research Intern**, Harvard University (with Satpreet Singh). Trained agents for odor-plume tracking in walking and flying insects, integrating sensory history, motor dynamics, and closed-loop environmental feedback. Analyzed how learned internal dynamics reproduce biological navigation strategies; work accepted to the *NeurIPS 2025 Workshop on AI for Science*.

Publications and Manuscripts

Accepted Conference and Workshop Papers

1. A. Sinha, "MapShift: Controlled Post-Intervention Evaluation for Embodied World Models," *ICML 2026 RLxF Workshop: Reinforcement Learning from World Feedback* (2026).
2. A. Sinha, "Can AI Scientists Discover Neural Mechanisms? Evaluating Agentic Biological Discovery in a Digital Fly," *ICML 2026 GenBio Workshop: Generative and Agentic AI for Biology* (2026).
3. A. Sinha and S. H. Singh, "Using Deep Reinforcement Learning to Understand Odor Plume Tracking in Walking and Flying Agents," *NeurIPS 2025 Workshop on AI for Science* (2025).

Preprints

4. A. Sinha, "Credit Bandwidth Lower Bounds for Diffusive Cortical Learning," *Research Square* (2026).

Under Review

5. A. Sinha, "Auditing Closed-Loop Learning in Recurrent Neural Networks: Reproduction, Robustness, and Generalization," under review at *Transactions on Machine Learning Research* (2026).

Conference Posters

6. S. Harris, A. Sinha, S. Yaeger-Weiss, V. Louvel, and P. Shiu, "Towards Embodied Brain Emulations: A *Drosophila* Connectome-Constrained Brain Model Accurately Predicts Neural Activity and Controls Behavior in a Virtual Environment," poster presented at the *Society for Neuroscience Annual Meeting* (2025).

Academic Service

2026 Reviewer, ICML Workshop on AI for Math (AI4Math).

2026 Reviewer, ICML Workshop on Generative and Agentic AI for Biology (GenBio).

Leadership and Activities

2025–Present **Founder**, Sinha-Yalegeri Research Group (SYRG). Founded and lead a 10-member student research organization developing collaborative projects in artificial intelligence and computational neuroscience.

2024–Present **President**, AI Club, Obra D. Tompkins High School. Lead biweekly meetings for more than 40 members, organizing workshops and projects that introduce students to machine learning and artificial intelligence.

2023–Present **Officer and Competitor**, OTHS Science Olympiad. Earned more than 20 medals, including four top-three finishes at the state tournament; contributed to a fifth-place team finish statewide.

2024–Present **Violinist**, Tompkins Symphony Orchestra.

Honors and Awards

2026	Platinum Division, USA Computing Olympiad (USACO); qualified as a sophomore.
2025–2026	Commended Scholar, MIT THINK Scholars Program (top 10% of applicants).

Technical Skills

Programming	Python, C++, Java, JavaScript, TypeScript.
Frameworks	PyTorch, TensorFlow.js, React, NumPy, SciPy.
AI/ML	Reinforcement learning, recurrent neural networks, deep learning, representation learning, benchmark design, model evaluation, and statistical data analysis.
Neuroscience	Computational neuroscience, spiking neural networks, connectomics, neural dynamics, embodied brain models, spatial coding, and biologically constrained modeling.
Mathematics	Linear algebra, probability, Bayesian statistics, calculus, dynamical systems, and optimization.
Infrastructure	Git, Linux, Amazon Web Services, cloud computing, and LaTeX.