Sarah E. Marzen

CONTACT INFORMATION

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Pitzer and Scripps College
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RESEARCH INTERESTS

Resource-rational decision making, reservoir computing, computational mechanics, sensory prediction, reinforcement learning, the intersection of information theory and biology, mechanistic interpretability

EDUCATION

University of California, Berkeley, Berkeley, CA, USA

Ph.D., Physics, September 2011 - May 2016

- Dissertation Topic: "Bio-inspired problems in rate-distortion theory"
- Advisor: Michael R. DeWeese

Summer Schools

American Physical Society New Faculty Workshop, 2022
Santa Fe Institute Complex Systems School, 2014
Machine Learning Summer School, 2013

California Institute of Technology, Pasadena, CA, USA

B.S., Physics, September 2007 - May 2011

CERTIFICATION

MIT Kauffman Teaching Certificate Program Graduate 2018

FUNDING

PI, **Department of Natural Sciences Faculty Research Committee** Grant
Amount: $\sim \$1,000$
Period of Performance: May 2026

Co-PI, **American Physical Society Division of Biological Sciences** Grant
Project: Biological Physics Education Community Building
Amount: $\sim \$600$
Period of Performance: March 2026

Co-PI, **Army Research Laboratory** MURI
Project: The Best of Both Worlds: Joint Engineering of Living and Artificial Neural Networks for Context-Dependent Learning and Prediction
Amount: $\sim \$7,500,000$
Period of Performance: September 2025 - September 2030

PI, **Carnegie Institute** Mini-WISE Grant
Amount: $\$5,000$
Workshop Date: November 19-21 2025

PI, **Sloan Foundation and Santa Fe Institute**
Workshop: Computational Mechanics, Where It's Been and Where It's Going
Amount: $\sim \$40,000$
Workshop Date: September 4-10, 2025

Co-PI, **DARPA**
Project: Hyperspectral-Hyperdimensional Engines via Ultralow-Power Resonant In-Memory- Com-

pute Systems and Tunable Phononic Combs (HEURISTIC)
Amount: $\sim \$3,800,000$
Period of Performance: December 2023-August 2025

PI, **National Science Foundation** ACCESS
Project: The Effect of S, M, and L Cone Distribution on the Information Captured by the Eye
Period of Performance: December 2025-December 2026
Project: Resource-rational reinforcement learning
Period of Performance: September 2024-September 2025

Co-PI, **W. M. Keck Science Department** DEI Mini-Grant
Amount: $\sim \$1,000$ each time
Seminar Dates: September 2023, February 2025

PI, **National Science Foundation, Santa Fe Institute, and the W. M. Keck Science Department**
Workshop: Sensory Prediction, Engineered and Evolved
Amount: $\sim \$75,000$
Workshop Date: July 10-14, 2023

PI, **OCAC Data Science Development Grant**
Amount: $\$1,500$
Period of Performance: May 2021-August 2021

Co-PI, **Templeton Foundation**
Project: Grokking the Voices of the Deep—Detecting Bioacoustic Signatures of Cetacean Intelligence through Semantic Information Theory
Amount: $\sim \$250,000$
Period of Performance: September 2021- August 2023

PI, **Air Force Office of Scientific Research**, Computational and Cognitive Sciences
Project: Minimal Models of Sensory Prediction
Amount: $\sim \$600,000$
Period of Performance: August 2019- August 2023

Professional Affiliations

Society for Industrial and Applied Mathematics, American Physical Society

Work Experience

Affiliate Professor of Physics, KDIS Services Claremont McKenna College in Claremont, CA — August 2025 - present

Associate Professor of Physics, Department of Natural Sciences Services Pitzer College and Scripps College in Claremont, CA — June 2025 - present

Pioneer Research Program Mentor — Summers 2020 - 2025

Assistant Professor of Physics, W. M. Keck Science Department Services Pitzer College, Scripps College, and Claremont McKenna College in Claremont, CA — August 2019 - June 2025

Postdoctoral Fellow, MIT, Cambridge, MA — August 2016 - August 2019

Seminar XL/LE Facilitator, MIT, Cambridge, MA — 2018

Advisor for Stealth Startup Awecom — 2016 - present

Physics Graduate Student at U.C. Berkeley 2011-2016
Advised by Professor Michael R. DeWeese

Teaching Assistant for Professor James Crutchfield, U. C. Davis Fall 2015

Teaching Assistant for Professor Rob Phillips, Caltech Winter and Spring 2010

Research Assistant for Professor Rob Phillips, Caltech Summers 2009-2010

Research Assistant for Professor Axel Scherer, Caltech Summer 2008

Research Assistant to Dr. James Ellenbogen, MITRE Corporation Summers 2004-2007
Intern in MITRE Nanosystems Student Program

Assistant Swim Coach to Chesterbrook Swim Team, McLean, VA Summer 2003

Service

Associate Editor for AI & Society January 2026 - present

Guest Editor

Journal of the Royal Society Interface Focus Special Issue on "Information, Selection and Evolution" 2025
Entropy Special Issue on "Information-Theoretic Methods in Computational Neuroscience" 2024-2026
Computational Brain and Behavior Special Issue on "Sensory Prediction: Engineered and Evolved" 2023-2025
Open Mind Special Issue on "Information-Theoretic Principles in Cognitive Systems" 2023-2024
Entropy Special Issue on "The Role of Information in Cultural Evolution" 2022-2023

Workshop Co-organizer

Carnegie Institute, Mini-WISE Meeting on Evolutionary Constraints 2025
Santa Fe Institute, "Computational Mechanics: Where It's Been and Where It's Going" 2025
Santa Fe Institute, "Sensory Prediction: Engineered and Evolved" 2023
NeurIPS, "Information-Theoretic Principles in Cognitive Systems" 2022
Aspen Center for Physics, "Learning Dynamical Models from Biophysical Data" 2022

Scripps College Academy Mentor Summer 2023

American Physical Society Division of Biological Sciences

Community Engagement Committee Member 2026
Executive Committee Early Career Member 2022 - 2024
Newsletter Editor 2022 - 2025
Focus Session Co-organizer 2023-2025
APS PULSE Webinar Speaker 2023

Service to National Institute for Theory and Mathematics in Biology 2026-

External Review Committee for NITMB Research Trainee Program

Service to Claremont Colleges 2019 -

Panelist for 7C Structured Debate on GenAI and Education

Panelist for CMC Expert Panel on AI, Social Networks, and Election Misinformation
Teaching, Learning and Campus Life Committee Vice Chair
Sponsored Research Specialists Committee
Claremont Association for Sensory Perception Professional Development Network
Department of Natural Sciences DEI Committee
Department of Natural Sciences Executive Committee
Data Science Curriculum Coherence Committee
Scripps Public Events Advisory Committee
Scripps Post-Bac Interview Committee
Department of Natural Sciences Seminar Series Committee
Scripps Student Funding Opportunities Committee
Scripps and Pitzer Advisor
Department of Natural Science Thesis Award Committee
Professional Development Network Committee on AI Ethics

Reviewer for fQXi, Princeton University Press, MIT Press, Alfred P. Sloan Foundation, Templeton Foundation, Physical Review X, Physical Review Letters, European Journal of Physics Plus, Biophysical Journal, Physical Review B, PLoS Computational Biology, Physical Review Research, Nature Physics, Frontiers in Computational Neuroscience, New Journal of Physics, Science Advances, Journal of Theoretical Biology, Advances in Complex Systems, Entropy, Bulletin of Mathematical Biology, Chaos, Biochemical Society Transactions, Cognitive Science, Computational Brain and Behavior, Biosystems, npj Systems Biology and Applications, npj Digital Medicine, AI & SOCIETY, PRX Life, PRX Intelligence and Physics Letters A 2014 -

Books

Minimal Models in Biophysics. Under contract, Princeton University Press. Expected 2030

Patents

Closed-Loop AI Control for Pharmaceutical Manufacturing Optimization. Provisional October 2025

Honors and Awards

AWM-HERS Leadership Program 2027

CMC Faculty Scholarship Award 2026

Affiliate Member, National Institute for Theory and Mathematics in Biology November 2025 - October 2026

ILIAD Travel Grant September 2025

Entropy Travel Grant March 2025

SIAM-MGB Early Career Fellow Finalist 2025

Sloan Foundation Grant for Aspen Center for Physics Summer 2024

Academic Minute Featured Researcher 2024

Scialog Research Fellow, Molecular Basis of Cognition 2022

Mary W. Johnson Faculty Scholarship Award 2020, 2022, 2024, 2026

Google Summer of Code Mentor with Christopher Hillar to Shiven Tripathi 2021

Entropy Topic Advisory Board 2021 - 2026

Entropy Reviewer Board 2020 - present

MIT Physics of Living Systems Fellowship 2016

Ling-Lie Chau Excellence Award 2015

COSYNE Travel Grant 2014

Organization of Computational Neuroscience Travel Grant 2013

National Science Foundation Graduate Research Fellowship in Biophysics 2011

U.C. Berkeley Chancellor's Fellowship 2011

Haren Lee Fisher Memorial Award 2010
Awarded to one junior at Caltech per year for excellence in physics

Amgen Scholar, Caltech 2009

Caltech Axline Award 2007-2011
Merit scholarship that provides free tuition, room, board, and money for books

Intel Science Talent Search Finalist 2007

U.S. Physics Team finalist 2005, 2007
Chosen as one of 24 students in United States to train for International Physics Olympiad, winning "Best Non-Traveling Theorist" in 2007

Publications

A single asterisk denotes student co-authorship, while a double asterisk denotes equal last-authorship.

S. Marzen. "The collective statistical mechanical personality of a group", arXiv:2607.05597 and submitted (2026).

E. Goldfein* and **S. Marzen**. "Predictions for and lack of maximal information transmission in the neuromuscular junction", arXiv:2606.12712 and submitted (2026).

Z. Cui* and **S. Marzen**. "An Investigation of the Channel Capacity of Bacterial Chemotactic Sensors for Low Chemoattractant Concentrations", arXiv:2601.02446 and submitted (2026).

V. Ferdinand, A. Yu*, and **S. Marzen**. "Humans are resource-rational predictors in a sequence learning task," bioRxiv and submitted (2026).

S. Marzen. "What about prediction of sequences?", invited commentary in press at Brain and Behavioral Sciences (2026).

S. Marzen and J. M. C. Austria. "Closed-Loop Control of Pharmaceutical Manufacturing Processes Can Usually Optimize Better Than Open-Loop Control", submitted to Information (2026). This was an AI experiment– we used prompt engineering only to make a paper and submitted it, knowing that it was as close to AI slop as you could get, just to see if it would get in. One of three reviewers was fooled. All details are available on my website.

C. Wang*, E. Schimke*, T. Kako*, A. Gao*, M. Lamberti*, J. le Feber, and **S. Marzen**. "Analyzing an organism's sensors using Maximum Entropy models with bias, variance, and confusion matrices", PLoS One 21(8): e0342165 (2026).

R. Ampah*, M. Booth*, and **S. Marzen**. "Can Large Language Models replace a professor?", CourseSource 12 (2026).

S. Marzen. "Resource-rational reinforcement learning and sensorimotor causal states, and resource-rational maximiners", Interface Focus 15(5): 20240062 (2025).

P. Mullarkey* and **S. Marzen**. "New analytic formulae for memory and prediction functions in reservoir computers with time delays", Chaos 35, 103127 (2025). Highlighted as a Wolfram Staff Pick.

S. Marzen. "A Simple Open-Loop Control Method for Optimizing a Manufacturing Process Using Artificial Intelligence", Electronics 14(13), 2676 (2025). Selected as an Editor's Choice.

M. Lamberti*, M. van Putten, **S. Marzen** and J. le Feber. "The role of NMDA receptors in memory and prediction", Journal of Neural Engineering 22(1) (2025).

A. Shai, **S. E. Marzen**, L. Teixeira, A. G. Oldenziel, P. M. Riechers. "Transformers represent belief state geometry in their residual stream", Advances in Neural Information Processing Systems 37 (2024).

S. Marzen. "Comment on Deterministic Information Bottleneck", arXiv:2407.01786 (2024).

E. Dong* and **S. Marzen**. "Cognitive biases can move opinion dynamics from consensus to transient chaos", American Journal of Physics (invited) 92, 801-808 (2024).

S. Marzen. "Time Delays Improve Performance of Certain Neural Networks." Physics 17: 111 (2024).

S. E. Marzen, P. M. Riechers, and J. P. Crutchfield, "Complexity-calibrated Benchmarks for Machine Learning Reveal When Next-Generation Reservoir Computer Predictions Succeed and Mislead", Scientific Reports 14 (2024).

G. Seifert*, A. Sealander*, **S. Marzen****, and M. Levin**. "From reinforcement learning to agency: Frameworks for goal-directed agents", Biosystems 235 (2024).

Y. Sawaya*, G. Issa*, and **S. Marzen**. "A framework for solving time-delayed Markov Decision Processes", Physical Review Research 5 (2023)

M. Lamberti*, S. Tripathi*, M. van Putten, **S. Marzen**, and J. le Feber. "Prediction in cultured cortical neural networks", PNAS Nexus 2(6) (2023)

J. Soriano* and **S. Marzen**. "How Well Can We Infer Selection Benefits and Mutation Rates from Allele Frequencies?", Entropy 25(4), 615 (2023).

D. Levenstein, V. Alvarez, A. Amarasingham, H. Azab, Z. S. Chen, R. C. Gerkin, A. Hasenstaub, R. Iyer, R. B. Jolivet, **S. Marzen**, J. Monaco, A. A. Prinz, S. Quraishi, F. Santamaria, S. Shivkumar, M. F. Singh, R. Traub, F. Nadim, H. G. Rotstein, A. D. Redish. "On the Role of Theory and Modeling in Neuroscience", J. Neurosci. 43 (2023).

A. Duran* and **S. Marzen**. "Not so optimal: The evolution of mutual information in potassium voltage-gated channels", PLoS One (2023)

A. Hsu* and **S. Marzen**. "Strange properties of linear reservoirs in the infinitely large limit for continuous-time prediction", J. Stat. Phys. 190 (2023)

S. Marzen and J. P. Crutchfield. "Inference, Prediction, and Entropy-Rate Estimation of Continuous-Time, Discrete-Event Processes", Entropy 24, 1675 (2022).

M. Lamberti*, M. Hess*, I. Dias, M. van Putten, J. le Feber** and **S. Marzen**. "Maximum entropy models provide functional connectivity estimates in neural networks", Scientific Reports 12 (2022).

C. Tyler*, J. Monroy and **S. Marzen**. "Mathematically modelling prey-catching behavior of the tomato frog", Spora 8, 1-6 (2022).

S. Marzen and J. P. Crutchfield. "Probabilistic deterministic finite automata and recurrent networks, revisited", Entropy 24 (1), 90 (2022)

S. Marzen. "Choosing dynamical systems that predict weak input", Physical Review E 102 (2021)

B. Arul*, D. Lee*, and **S. Marzen**. "A proposed probabilistic method for distinguishing between delusions and other environmental judgements, with applications to psychotherapy", Frontiers in Psychology (2021)

A. Hsu* and **S. Marzen**. "Time cells might be optimized for predictive capacity, but not for redundancy reduction or memory capacity", Physical Review E 102 (2020)

W. Zhong, J. M. Gold, **S. Marzen**, J. L. England, and N. Y. Halpern. "Machine learning outperforms thermodynamics in measuring how well a many-body system learns a drive", Scientific Reports 11, 9333 (2021).

A. Uppal*, V. Ferdinand, and **S. Marzen**. "Inferring an observer's strategy in sequence learning experiments", Entropy 22(8), 896 (2020). Chosen as a Featured Article for a Special Issue on Social Processes.

M. Razo-Mejia, **S. Marzen**, G. Chure, R. Taubman*, M. Morrison, and R. Phillips. "First-principles prediction of the information processing capacity of a simple genetic circuit", Physical Review E 102, 022404 (2020). Chosen as an Editor's Suggestion.

S. Marzen and J. P. Crutchfield. "Prediction and Dissipation in Nonequilibrium Molecular Sensors: Conditionally Markovian Channels Driven by Memoryful Environments", Bulletin of Mathematical Biology 82, 25 (2020)

S. Marzen. "Novelty detection improves reinforcement learning in fluctuating, partially observable environments", Journal of Theoretical Biology 477, 44-50 (2019)

S. Marzen. "Intrinsic computation of a Monod-Wyman-Changeux molecule", Entropy 20 (8), 599 (2018)

S. Marzen. "Infinitely large, randomly wired sensors cannot predict their input unless they are close to deterministic", PLoS ONE 13 (8), e0202333 (2018)

S. Marzen and J. P. Crutchfield. "Optimized bacteria are environmental prediction engines", Physical Review E 98, 012408 (2018)

S. Marzen. "Difference between memory and prediction in linear recurrent networks", Physical Review E 96, 032308 (2017)

S. Marzen and J. P. Crutchfield. "Structure and randomness of continuous-time discrete-event

processes", Journal of Statistical Physics 169 (2) 303-315 (2017)

S. Marzen and J. P. Crutchfield. "Nearly maximally predictive features and their dimensions", Physical Review E 95, 051301(R) (2017)

S. Marzen and S. DeDeo. "The evolution of lossy compression", Journal of the Royal Society Interface 14 (2017)

S. Marzen and J. P. Crutchfield. "Informational and causal architecture of continuous-time renewal processes", Journal of Statistical Physics 168 (1) 109-127 (2017)

C. Hillar and **S. Marzen**. "Revisiting perceptual distortion for natural images: mean discrete structural similarity index", Data Compression Conference (2016)

S. Marzen and S. DeDeo. "Weak universality in sensory tradeoffs", Physical Review E 94, 060101(R) (2016)

A. Goudarzi, **S. Marzen**, P. Banda, G. Feldman, M. R. Lakin, C. Teuscher, and D. Stefanovic. "Memory and information processing in recurrent neural networks", arXiv:1604.06929 (2016)

S. Marzen and J. P. Crutchfield. "Predictive rate-distortion for infinite-order Markov processes", Journal of Statistical Physics 163 (6), 1312-1338 (2016)

S. Marzen and J. P. Crutchfield. "Statistical Signatures of Structural Organization: The case of long memory in renewal processes", Physics Letters A 380 (17), 1517-1525 (2016)

S. Marzen, M. R. DeWeese and J. P. Crutchfield. "Time resolution dependence of spike train information measures", Frontiers in Computational Neuroscience 9 (2015)

J. P. Crutchfield and **S. Marzen**. "Signatures of Infinity: Nonergodicity in Prediction, Complexity, and Learning", Physical Review E 91, 050106(R) (2015). Selected as an Editor's Suggestion.

J. P. Crutchfield, R. G. James, **S. Marzen**, and D. P. Varn. "Understanding and Designing Complex Systems: Response to 'A framework for optimal high-level descriptions in science and engineering–preliminary report"', arXiv:1412.8520 [cond-mat.stat-mech] (2015)

S. Marzen and J. P. Crutchfield. "Informational and causal architecture of discrete-time renewal processes", Entropy 17 (7), 4891-4917 (2015)

S. Marzen and J. P. Crutchfield. "Information anatomy of stochastic equilibria", Entropy 16 (9), 4713-4748 (2014)

S. Marzen, H. G. Garcia, and R. P. Phillips. "Statistical Mechanics of the Monod-Wyman-Changeux (MWC) Models," Journal of Molecular Biology 425(9): 1433-1460 (2013)

S. Marzen, D. Wu, M. Imandar, and R. P. Phillips. "Maximum Caliber model of the two-state system is equivalent to the one-dimensional Ising model," arXiv:1008.2726 [physics.bio-ph] (2011)

Book Chapters

C. J. Hillar and **S. E. Marzen**. "Neural network coding of natural images with applications to pure mathematics," Proceedings of the AMS Special Session on Algebraic and Geometric Methods in Discrete Mathematics, edited by: Heather Harrington, Mohamed Omar, and Matthew Wright (2017).

Conferences

Proceedings

R. Tikhonov, **S. Marzen**, and S. Dedeo. "How Predictive Minds Explain and Control Dynamical Systems", in publication by NeurIPS Workshop on Information-Theoretic Principles in Cognitive Systems (2022).

Contributed talks

A single asterisk denotes student co-authorship, while a double asterisk denotes equal last-authorship.

S. Marzen. "Can a Large Language Model replace a professor?", 7Cs AI Symposium 2026.

S. Marzen. "Living organisms versus artificial neural networks", ILIAD ODYSSEY 2025.

S. Marzen. "A dive into reservoir computing: How to view nonautonomous dynamical systems", SOCAMS 2025.

A. Minin*, K. Rabinowitz*, D. Xiong*, N. Harper, and **S. Marzen**. "Tracing a naturalistic artificial neural network's adaptation through memory and prediction", American Physical Society Joint Global Summit, March 2025.

S. Marzen. "Resource-rational reinforcement learning and sensorimotor causal states, and resource-rational maximiners", American Physical Society Joint Global Summit, March 2025.

R. Ampah*, M. Booth*, and **S. Marzen**. "Using ChatGPT to Enhance Research Mentorship", American Physical Society Joint Global Summit, March 2025.

C. Wang*, E. Schimke*, M. Lamberti*, T. Kako*, J. le Feber, and **S. Marzen**. "Analyzing an organism's sensors using Maximum Entropy models with bias, variance, and confusion matrices", American Physical Society Joint Global Summit, March 2025.

V. Ni*, K. Setter** and **S. Marzen****. "Investigation of simple quantum reservoir computers", American Physical Society Joint Global Summit, March 2025.

E. Dong* and **S. Marzen**. "Cognitive biases can move opinion dynamics from consensus to chaos", American Physical Society March Meeting, March 2024.

V. Ferdinand, A. Yu*, and **S. Marzen**. "Humans efficiently predict in a sequence learning task", American Physical Society March Meeting, March 2024.

Y. Sawaya*, G. Issa*, and **S. Marzen**. "A framework for solving time-delayed Markov Decision Processes", American Physical Society March Meeting, March 2023.

J. Soriano* and **S. Marzen**. "The information acquired by evolution", American Physical Society March Meeting, March 2023.

S. Marzen and J. P. Crutchfield. "Predictive feature extraction by conditionally Markovian channels in memoryful, fluctuating environments", Information Engines Workshop, October 2018.

S. Marzen and J. P. Crutchfield. "Optimized bacteria are environmental prediction engines", Society of Industrial and Applied Mathematics, August 2018.

S. Marzen and J. P. Crutchfield. "Optimized bacteria are environmental prediction engines", Telluride Information Engines Workshop, July 2018.

S. Marzen and S. DeDeo. "Evolution of lossy compression", Society of Industrial and Applied Mathematics, July 2016.

S. Marzen and S. DeDeo. "Evolution of lossy compression", American Physical Society, March 2016.

S. Marzen. "New tools for dimensionality reduction in prediction", Conference on Complex Systems Satellite Session, October 2015.

R. Mehta, **S. Marzen**, and C. Hillar. "Exploring discrete approaches to lossy compression of natural image patches", 2015 European Signal Processing Conference.

S. E. Marzen, J. Zylberberg, and M. R. DeWeese. "How efficient coding of binocular disparity statistics in the primary visual cortex influences eye rotation strategy", BMC Neurosci. 2013; 14(Suppl1): O7. (talk) Recipient of travel grant from Organization of Computational Neuroscience.

Plenary talks

S. Marzen. "How do we use information theory in biology?" WISE (2024)

Invited talks

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" Max Planck Institute Physics for Complex Systems Information & Decisions Across Scales: Constraints and Optimality in Neural and Biological Networks (2026)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" University of Tennessee AI Symposium (2026)

S. Marzen. "Agency: A list of questions and a proposal", BITS Physics of Agency (2025).

S. Marzen. "Computational Mechanics: Where It's Been and Where It's Going", Santa Fe Institute Computational Mechanics Working Group (2025).

S. Marzen and K. Setter. "Quantum reservoir computing methods and their applicability" Fermilab ETD Special Seminar (2025)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" Neurotalk (2025)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" SIAM-DS (2025)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" U.C. Irvine Center for Theoretical Behavioral Studies Colloquium (2025)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" Claremont Colleges Applied Math Seminar (2024)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" Sonoma State Physics Colloquium (2024)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" U of Rochester Templeton Workshop on Information Driven States of Matter (2024)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" Pomona Physics Colloquium (2024)

E. Dong and **S. Marzen**. "Cognitive biases can move opinion dynamics from consensus to chaos?" Joint Mathematics Meeting (2024)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" NeurIPS InfoCog Workshop (2023)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" Organization of Computational Neuroscience Workshop on Information Theory (2023)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" Santa Fe Institute Workshop on Sensory Prediction, Engineered and Evolved (2023)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" American Mathematical Society, Sectional Meeting (2023)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" American Physical Society March Meeting (2023)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" CSU Long Beach Physics Seminar Series (2022)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" UCSB Biology Seminar Series (2022)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" UCSD Institute of Neural Computation Seminar Series (2022)

S. Marzen. "How well do neurons, humans, and artificial neural networks predict?" MITRE Tech Talk, McLean campus (2022)

S. Marzen. "Information theory in biology", Redwood Neuroscience Seminar Series 2018.

S. Marzen. "Prediction and dissipation: faster calculations, bounds, and optimized sensors", BIRS (2022)

S. Marzen. "Optimal sensors in random environments", Flatiron Research Institute (2022)

S. Marzen. "Everything's a reservoir: Using the back of the brain to improve machine learning prediction algorithms", FlatIron Research Institute (2021)

S. Marzen. "Everything's a reservoir: Using the back of the brain to improve machine learning prediction algorithms", Emory Physics Colloquium (2021)

S. Marzen. "Using lossy representations to understand the neural code?", Organization of Computational Neuroscience Workshop on Information Theory (2020)

S. Marzen. "New methods for continuous-time, discrete-event prediction", Workshop on Agency at the Interface of Quantum and Complexity Science (2020)

S. Marzen. "How can we predict efficiently?", Okinawa Institute of Science and Technology Seminar Series 2020.

S. Marzen. "How can we predict efficiently?", USC Physics Colloquium 2019.

S. Marzen. "How can we predict efficiently?", Harvey Mudd Physics Colloquium 2019.

S. Marzen. "Bio-inspired problems in rate-distortion theory", USC Information Sciences Institute 2019.

S. Marzen. "Bio-inspired problems in rate-distortion theory", IEEE International Symposium on Information Theory 2019.

S. Marzen and A. Hsu. "Difference between memory and prediction in linear recurrent networks", American Physical Society 2019.

S. Marzen. "Optimal sensors in random environments", Redwood Neuroscience Seminar Series 2018.

S. Marzen. "Extracting lossy predictive features", Info-Metrics Workshop on Causality 2018.

S. Marzen. "Optimal sensors in random environments", U. Michigan 2018.

S. Marzen. "Predicting with limited resources", W. M. Keck Science Department 2017.

S. Marzen. "Thinking in machines, not statistics", American Physical Society 2017 [missed due to sickness] .

S. Marzen. "Avoiding the curse of dimensionality with maximally predictive models", Theoretical Computer Science seminar at Indiana University, Bloomington, December 2014.

S. Marzen and J. P. Crutchfield. "Predictive inference in non equilibrium steady state", Information Engines Minisymposium of SIAM Annual Meeting 2014.

S. Marzen. "Information-theoretic approaches to time series modeling", Machine Learning Seminar Series at the University of Hawaii, Honolulu 2014.

Posters

C. Wang*, E. Schimke*, M. Lamberti*, T. Kako*, J. le Feber, and **S. Marzen**. "Analyzing an organism's sensors using Maximum Entropy models with bias, variance, and confusion matrices", SoCal-Nev Section Meeting (2026).

S. Marzen, V. Ferdinand, J. le Feber, and M. Lamberti. "Efficient prediction in cultured neurons and humans", ECI Workshop (2026).

M. Lamberti, S. Tripathi, **S. Marzen**, and J. le Feber. "Cultured neurons predict their input", Society for Neuroscience (2022).

S. Marzen et al. "Inference of functional connectivity in living neural cultures", Organization for Computational Neuroscience (2020).

S. Marzen and J. P. Crutchfield. "Optimized bacteria are environmental prediction engines", 2018 Theory in Biology Conference.

S. Marzen and S. DeDeo. "Weak universality in sensory tradeoffs", 2017 International Conference on Mathematical Neuroscience.

C. Hillar and **S. Marzen**. "Revisiting perceptual distortion for natural images: mean discrete structural similarity index", 2017 International Conference on Mathematical Neuroscience.

S. Marzen, M. R. DeWeese, and J. P. Crutchfield. "Predictive models of spike trains from integrate-and-fire neurons", 2015 International Conference on Mathematical Neuroscience.

S. Marzen, M. R. DeWeese, and J. P. Crutchfield. "Statistical complexity of neural spike trains", Cosyne 2014.

C. Hillar, **S. Marzen**, U. Koster, and K. Koepsell. "A Hopfield net trained on images matches retinal spike statistics and encodes images efficiently", Cosyne 2014.

S. Marzen, J. Zylberberg, and M. R. DeWeese. "Modified visuomotor optimization theory to explain Listing's Law", J. of Vis. abstract, Vision Science Society 2013.

Personal Accomplishments

Celebrating students for winning awards

Richard Ampah for Best Thesis in Biology
Peyton Mullarkey for Best Thesis in Biophysics
Alejandra Duran (high schooler) for her paper in Pioneer Research Journal (competitive)
Mia Syme for Best Thesis in Physics
Micah Hou (high schooler) for an accepted BioSensors conference paper

Mental health advocate for schizophrenia

NITMB Featured Affiliate	2026
CURESZ Summit Speaker	2026
CURESZ Survivor	2024 - present
Physics Magazine Spotlight	2022

Writing

Claremont Data Science Hub blogger on how to understand data
Periodically-deleted anonymous Medium on schizophrenia, politics, AI, education, and everything
Science blog on my personal website on everything science
Physics Today sometimes writer
APS DBIO Newsletter Editor-in-Chief while on APS DBIO ExComm
Randomly wrote a never-seen half-finished book that isn't very good yet
News and Copy Editor of the California Tech and Caltech Admissions Blogger while in college

SoundCloud artist produced by Kevin Musgrave of Noise to Notes