

Education

- 2012–2019 **Ph.D. in Condensed Matter Physics**, *Peking University*, China.
Thesis: Theoretical study on odor coding in peripheral olfactory systems.
Advisors: Chao Tang and Yuhai Tu.
- 2008–2012 **B.S. in Physics**, *Central China Normal University*, China.
Advisor: Jinping Liu.

Professional Appointments

- 2024–Present **Associate Research Scientist**, *Center for Computational Neuroscience*, Flatiron Institute, New York, NY.
Faculty mentor: Dmitry “Mitya” Chklovskii.
 - Developing normative frameworks to understand neural computation.
 - Predictive information for understanding single neuron physiology.
- 2019–2023 **Postdoctoral Fellow**, *School of Engineering and Applied Sciences*, Harvard University, Cambridge, MA.
Faculty mentor: Cengiz Pehlevan.
 - Designed novel biologically plausible learning algorithms.
 - Unraveled causes and dynamics of drifting neural representations.
 - Characterized ensemble-level odor coding properties in *C. elegans*, olfactory information processing in fly larvae (in collaboration with Aravinthan Samuel lab).
- 2012–2019 **Research Assistant**, *Center for Quantitative Biology*, Peking University, Beijing, China.
Faculty mentor: Chao Tang and Yuhai Tu.
 - Established a theoretical framework for nonlinear compressed sensing problems and applied it to the peripheral olfactory systems.
 - Early warning signals in nonlinear complex systems.
 - Elucidated the nonlinear dynamics of the intrinsic apoptosis signaling pathway.
- 2016 **Graduate Visiting Scholar**, *Hernan Garcia Lab*, Department of Molecular and Cell Biology, The University of California, Berkeley, CA.
Designed and performed experimental study on the temperature-dependent speed of embryogenesis in *Drosophila Melanogaster*.
- 2009–2011 **Undergraduate Research Assistant**, *Jinping Liu Lab*, School of Physics, Central China Normal University, China.
Successfully prepared the hematite nanorods array, and studied its electrochemical properties as an anode material and reversible lithium storage.

Publications

See also [Google Scholar](#) or [ORCID](#). * Equal contribution; † Corresponding author.

Selected Publications

1. **S. Qin**, S. Farashahi, D. Lipshutz, A. M. Sengupta, D. B. Chklovskii, and C. Pehlevan. “Coordinated drift of receptive fields in Hebbian/anti-Hebbian network models during noisy representation learning”. *Nature Neuroscience* 26 (2), 339–349 (2023).

2. P. Masset*, **S. Qin***, J. Zavatone-Veth*. "Drifting Neuronal Representations: Bug or Feature?", *Biological Cybernetics*, 116, 253–266 (2022).
3. Y. Liu, Q. Li, C. Tang, **S. Qin**[†], and Y. Tu[†]. "Short-Term Plasticity Regulates Both Divisive Normalization and Adaptive Responses in Drosophila Olfactory System". *Frontiers in Computational Neuroscience* 15, 730431 (2021).
4. **S. Qin**, N. Mudur, C. Pehlevan, "Contrastive Similarity Matching for Supervised Learning", *Neural Computation* 33(5), 1300 (2021).
5. **S. Qin***, Q. Li*, C. Tang and Y. Tu, "Optimal compressed sensing strategies for an array of nonlinear olfactory receptor neurons with and without spontaneous activity", *Proc. Natl. Acad. Sci. U.S.A.*, 116, 20286 (2019).
6. **S. Qin** and C. Tang, "Early-warning signals of critical transition: Effect of extrinsic noise", *Physical Review E*, 97, 032406 (2018).

Additional Published Research

7. Y. Cai[†], J. Kanyo*, R. Wilson*, S. Bathla*, P. L. Cardozo*, L. Tong*, **S. Qin***, L. A. Fuentes*, I. Pinheiro-de-Sousa*, T. Huynh*, L. Sun*, M. S. Mansuri, Z. Tian, H. Gan, A. Braker, H. K. Trinh, A. Huttner, T. T. Lam, E. Petsalaki, K. J. Brennand, Angus C. Nairn, J. Grutzendler[†]. Subcellular proteomics and iPSC modeling uncover reversible mechanisms of axonal pathology in Alzheimer's disease. (2024) *Nature Aging, in press*. *bioRxiv* doi: <https://doi.org/10.1101/2022.09.30.510408>.
8. B. Liu, **S. Qin**, V. Murthy, and Y. Tu, "One nose but two nostrils: Learning to align with sparse connections between two olfactory cortices". *PRX Life* 2(4), 043016 (2024).
9. A. Lin, **S. Qin**, H. Casademunt, M. Wu, W. Hung, G. Cain, N. Z. Tan, R. Valenzuela, L. Lesanpezeshki, C. Pehlevan, V. Venkatachalam, M. Zhen, A. D. T. Samuel, "Functional imaging and quantification of multi-neuronal olfactory responses in *C. elegans*". *Science Advances* 9(9), eade1249 (2023).
10. Y. Yuan, H. Ren, Y. Li, **S. Qin**, X. Yang, and C. Tang. "Cell-to-cell variability in inducible Caspase9-mediated cell death". *Cell Death & Disease* 13(1) (2022)
11. K. Vogt, D. Zimmerman, M. Schlichting, L. A. H. Nunez, **S. Qin**, K. Malacon, M. Rosbash, C. Pehlevan, A. Cardona, A. D. T. Samuel, "Internal state configures olfactory behavior and early sensory processing in *Drosophila* larva", *Science advances* 7(1), eabd6900 (2021).
12. Z. Gao, H. Sun, **S. Qin**, X. Yang and C. Tang, "A systematic study of the determinants of protein abundance memory in cell lineage", *Science Bulletin*, 63, 1051 (2018).
13. Z. Gao, S. Chen, **S. Qin** and C. Tang, "Network Motifs Capable of Decoding Transcription Factor Dynamics", *Scientific Reports*, 8, 3594 (2018).
14. L. Cao, D. Yang, W. Wu, X. Zeng, B. Jing, M. Li, **S. Qin**, C. Tang, Y. Tu, D. Luo, "Odor-evoked inhibition of olfactory sensory neurons drives olfactory perception in *Drosophila*", *Nature Communications*, 8, 1357 (2017).
15. Y. Song, **S. Qin**, Y. Zhang, W. Gao, and J. Liu, "Large-Scale Porous Hematite Nanorod Arrays: Direct Growth on Titanium Foil and Reversible Lithium Storage", *the Journal of Physical Chemistry C*, 114, 21158 (2010).

Preprint and manuscript under review

16. L. Cao, W. Wu, C. Xia, **S. Qin**, C. Chang, D. Yang, B. Jing, K. Leng, C. Tang, Y. Tu, G. Si, D. Luo, "Bidirectional coding enables temperature compensation in olfactory sensation", 2024

17. S. Zhao, H. Shen, **S. Qin**, S. Jiang, X. Tang, M. Lee, X. Zhang, J. Lee, J. Chen and J. Liu, "Realigning representational drift in mouse visual cortex by flexible brain-machine interfaces ", 2024

Talks and Seminars

- 2024 June Flatiron Institute Center for Computational Neuroscience Retreat Seminar. *Temporal filters of neurons as low-rank forecasters*, Mohonk, NY.
- 2024 June Xiaojing Wang lab meeting at NYU. *A Normative approach to neural computation - from biologically plausible learning to representational drift*, New York, NY. (**invited**)
- 2023 July 2023 International Workshop on "Soft Matter and Biophysics Theories". *Brain in motion: causes and dynamics of drifting neural representations*, Xi'an, China (virtual, **invited**).
- 2023 June Chinese Computational and Cognitive Neuroscience Conference. *Brain in motion: causes and dynamics of drifting neural representations*, Beijing, China (virtual, **invited**).
- 2023 Apr Brown University. *Brain in motion: causes and dynamics of drifting neural representations*, Providence, RI (**invited**).
- 2023 Mar Neurolunch Seminar, Center for Brain Science, Harvard University. *Brain in motion: causes and dynamics of drifting neural representations*, Cambridge, MA.
- 2023 Mar The Scripps Research Institute, *Brain in motion: causes and dynamics of drifting neural representations*, La Jolla, CA (**invited**).
- 2023 Mar The University of Texas Southwestern Medical Center, *Brain in motion: causes and dynamics of drifting neural representations* (virtual,**invited**).
- 2023 Feb Institute of Neuroscience, Chinese Academy of Sciences, *Brain in motion: causes and dynamics of drifting neural representations* (virtual,**invited**).
- 2023 Jan VIB-KU Leuven Center for Brain Sciences and Disease, *Dynamics and structure of drifting neural representations* (virtual,**invited**).
- 2023 Jan Washington University School of Medicine in St. Louis, *Neural representation: from optimal olfactory code to representational drift during learning*, St. Louis, MO (**invited**).
- 2022 Dec Cold Spring Harbor Laboratory faculty candidate seminar, *Neural representation: from optimal olfactory code to representational drift during learning* (virtual, **invited**).
- 2022 Oct Guangdong-Hong Kong-Macao Young Scientists' Forum on Interdisciplinary Studies. *Uncovering the dynamics and structure of drifting neural representations* (virtual, **invited**).
- 2022 Mar Harvard Applied Mathematics Food For Thought Hour, *Unveiling the dynamics and structure of drifting neural representations*, Cambridge, MA.
- 2022 Mar APS March Meeting, *Unveiling the dynamics and structure of drifting neural representations*, Chicago, IL.
- 2021 Oct Gordon Research Conference on stochastic physics in biology, *Dynamics of drifting receptive fields during noisy representation Learning*, Ventura, CA.
- 2021 Oct Rutgers Center for Quantitative Biology Seminar, *Unveiling the dynamics and structure of drifting neural representations* (virtual, **invited**).
- 2021 June MIT/Harvard Computational and Theoretical Neuroscience Journal Club, *Representational drift: experiments, models, and implications* (virtual, **invited**).
- 2020 Oct The online Neuromatch Conference 2.0, *Dynamics of drifting receptive fields during noisy representation learning* (virtual).
- 2020 Mar The online Neuromatch Conference 1.0, *Biologically plausible supervised learning* (virtual).

- 2019 Dec Sensing Chemical Spaces, Princeton, Princeton University, *Optimal compressed sensing strategies for an array of nonlinear olfactory receptor neurons*, Princeton, NJ.
- 2019 Mar American Physical Society March Meeting, *Statistical properties of the optimal sensitivity matrix for compressed sensing with nonlinear sensors*, Boston, MA.
- 2018 Nov Postdoctoral fellow interview symposium of the Center for the Physics of Biological Functions, *Statistical properties of the optimal sensitivity matrix for compressed sensing with nonlinear sensors*. Princeton, NJ. **(invited)**.
- 2018 July Quantitative Biology: Neuroscience and Artificial Intelligence – Where Do We Meet, *An information-theoretic model for odor coding*, Beijing, China.

Poster presentations

- 2024 Sept From Neuroscience to Artificial Intelligent Systems. *The neuron as a low rank forecaster*, Cold Spring Harbor, NY.
- 2024 Aug Computational and Cognitive Neuroscience conference. *Representational sparsity determines representational stability in sensory cortices*, Boston, MA.
- 2024 Feb Computational and System Neuroscience conference. *Representational sparsity determines representational stability in sensory cortices*, Lisbon, Portugal.
- 2023 Sept Harvard SEAS postdoc appreciation week poster session. *Coordinated drift of receptive fields during noisy representation learning*, Allston, MA.
- 2023 Sept Harvard Program in Neuroscience orientation poster session. *Coordinated drift of receptive fields during noisy representation learning*, Boston, MA.
- 2023 Apr Harvard Mind Brain Behavior poster showcase. *Coordinated drift of receptive fields during noisy representation learning*, Cambridge, MA.
- 2023 Apr HHMI Janelia Conference on Causes and Implications of Representational Drift. *Coordinated drift of receptive fields during noisy representation learning*, Ashburn, VA.
- 2022 Sept Harvard Program in Neuroscience orientation poster session. *Coordinated drift of receptive fields during noisy representation learning*, Cambridge, MA.
- 2022 July 14th Harvard-LMU young scientists' forum. *Coordinated drift of receptive fields during noisy representation learning*, Cambridge, MA.
- 2021 Sept Bernstein Conference, *Coordinated drift of receptive fields during noisy representation learning* (virtual).
- 2021 Feb Computational and Systems Neuroscience (Cosyne), *Dynamics of drifting receptive fields during noisy representation learning* (virtual).
- 2020 Nov From Neuroscience to Artificially Intelligent Systems (NAISys) , *Contrastive Similarity Matching for Supervised Learning* (virtual).
- 2020 Sept Bernstein conference, *Stable representational similarity despite drifting neural activity in noisy representation learning*, (virtual).
- 2020 Feb Computational and Systems Neuroscience (Cosyne), *Supervised Deep Similarity Matching*, Denver, CO.
- 2019 June Dynamic signaling in cells and embryos, *Nonlinear Compressed Sensing in Olfactory Systems*, Yantai, China. (Best poster award)
- 2019 Jan Annual symposium of Center for Quantitative Biology, *An Information-theoretic model for odor coding*, Beijing, China. (Best poster award)
- 2018 Aug *An Information-theoretic model for odor coding*, Beijing, China.

- 2017 Jan Center for Quantitative Biology annual symposium, *Impact of extrinsic noise on the signals of critical transitions*, Beijing, China.
- 2016 Jan Center for Quantitative Biology annual symposium, *Anticipating critical transition- effect of extrinsic noise*, Beijing, China.
- 2014 Sept Workshop on Systems Biology, BICMR. *Correlation of gene expression noise during cell fate transition*, Beijing, China.
- 2013 Sept Fall Meeting of Chinese Physical Society, *Modeling metaphase to anaphase transition of budding yeast cell cycle*, Xiamen, China. (Best poster award)

Teaching and Advising Experience

Teaching Assistant

Responsibilities included developing new class materials, leading class discussions, supervising labs, grading all assignments, and meeting with students individually.

- 2023 Introduction to applied mathematics (AM50), Harvard University.
32 undergraduates.
- 2022 Introduction to applied mathematics (AM50), Harvard University.
33 undergraduates.
- 2020 Neural Computation (AM226), Harvard University.
30 graduate students.
- 2014 Critical reading of systems biology, Peking University.
10 undergraduates and 20 graduates.

Advisor

- 2024 Advised two summer intern student at the Center for Computational Neuroscience, Flatiron Institute.
- 2023 Advised an undergraduate summer intern of Harvard University.
- 2021 Advised 4 students from the online Neuromatch Academy.
- 2019 Advised a rotation PhD student in the Harvard physics program.
- 2019 Honors thesis advisor of an undergraduate student of Peking University.
- 2013-2019 Advised 3 undergraduates of Peking University.
- 2013-2017 Advised 6 rotational graduates at Peking University.
- 2015 Honors thesis advisor of an undergraduate student of Tsinghua University.

Selected Awards and Honors

- 2020 *Distinguished teaching assistant*, Harvard University.
- 2020 Harvard MBB young investigator awards.
- 2019 Quantitative Biology research scholarship, Peking University.
- 2017 Huirong Li scholarship, Peking University.
- 2014 Quantitative Biology research scholarship, Peking University.
- 2012 Pacemaker to merit student, Central China Normal University.
- 2011 Second-class prize of *Challenge Cup* national college students extracurricular academic work competition.
- 2011 National scholarship, Central China Normal University.

2010 National Encouragement scholarship, Central China Normal University.

Reviewer

Ad hoc reviewer for Nature Communications, Physical Review X, Physical Review X Life, Physical Review E, PLoS Computational Biology, eLife, PNAS. Review editor for the *Frontiers in Computational Neuroscience*.

University/Departmental Service

- 2022 Aug Co-organizer of "Workshop on Reinforcement Learning at Harvard".
- 2019 - 2022 Co-organizer of "Harvard Neuro Theory journal club".
- 2018 Jan Co-organizer of "Brain Storm" at Center for Quantitative Biology together with Prof. Ping Wei.
- 2015 May Co-organizer, The first Young Scholars Frontier Symposium on Quantitative Biology Development.
- 2014 July Co-organizer, 2014 Center for Quantitative Biology Annual Symposium.

Professional membership

- 2022-present The Society of Neuroscience
- 2014-present The American Physical Society