

CURRICULUM VITAE

Andrew M. Leifer

Associate Professor of Physics and Neuroscience

CONTACT INFORMATION

Joseph Henry Laboratories
Princeton University
Princeton, NJ 08544

Phone: (609) 258-8779
leifer@princeton.edu
<http://leiferlab.princeton.edu>

PROFESSIONAL EXPERIENCE

Princeton University, Princeton, NJ 2024–present
Associate Professor, Department of Physics and Princeton Neuroscience Institute
Associated Faculty, Lewis-Sigler Institute for Integrative Genomics
Associated Faculty, Omenn-Darling Bioengineering Institute

Princeton University, Princeton, NJ 2016–2024
Assistant Professor, Department of Physics and Princeton Neuroscience Institute

Princeton University, Princeton, NJ 2012–2016
Lewis-Sigler Fellow, Lewis-Sigler Institute for Integrative Genomics

Harvard University, Cambridge, MA 2007–2012
NSF Graduate Research Fellow, Program in Biophysics and Department of Physics.

JILA (NIST-University of Colorado), Boulder, CO Summers 2005–2006
NSF Summer Undergraduate Research Fellow.

American Association for the Advancement of Science, Washington, DC Spring 2006
Leonard Rieser Fellow, Center for Science Technology and Security Policy.

Natl. Telecommunications and Information Administration, Boulder, CO . Summer 2004
Researcher, Institute for Telecommunication Sciences, Theory Division.

National Institute of Standards and Technology, Boulder, CO Summer 2003
Researcher, Statistics Division.

EDUCATION

Ph.D. in Biophysics, Harvard University, Cambridge, MA May 2012
Thesis Topic: “Optogenetics and computer vision for *C. elegans* neuroscience and other biophysical applications” Advisor: Professor Aravinthan D.T. Samuel

B.S. in Physics, Stanford University, Stanford, CA June 2007

B.A. in Political Science, Stanford University, Stanford, CA June 2007

Honors in International Security Studies, CISAC, Stanford University, Stanford, CA .. June 2007

Thesis Topic: “International scientific engagement for mitigating emerging nuclear security threats” Advisor: Professor Michael May

HONORS AND AWARDS

National Institutes of Health Director’s New Innovator Award 2019
 National Science Foundation CAREER Award 2019
 Emerging Leaders in Biosecurity Initiative Fellow, Johns Hopkins, Center for Health Security 2015
 Simons Investigator, Simons Collaboration on the Global Brain, Simons Foundation 2014
 American Physical Society, Biological Physics Thesis Award: Certificate of Merit 2013
 Lewis-Sigler Fellowship, Princeton University 2012–2016
 Derek C. Bok Certificate of Distinction in Teaching, Harvard University. 2008
 National Science Foundation Graduate Research Fellowship 2007–2011
 Leonard Rieser Fellowship in Science Tech & Global Security, Bulletin of the Atomic Scientist 2006
 SPIE International Society for Optical Engineering Scholarship..... 2006
 American Institute of Physics, Society of Physics Students, Leadership Award..... 2006
 National Science Foundation, Summer Undergraduate Research Fellowship 2005–2006
 AAAS, Center for Science Technology and Security Policy, Intern of the Year Award..... 2006
 Harry Press Journalism Award, Stanford University. 2006
 Boothe Prize for Excellence in Writing, Stanford University 2004
 Robert C. Byrd Academic Merit Scholarship 2003
 Dofflemeyer Eagle Scout Scholarship 2003
 Awards for the author’s independent research, “Fractals, Power-Laws and the Weibull Distribution: Mathematically Modeling Crumpled Paper” 2003
 American Mathematical Society, Karl Menger Award.
 Office of Naval Research, Naval Science Award.
 Third Place Team Project, Intel International Science and Engineering Fair 2003.
 First Place Team Project, Colorado Science and Engineering Fair.
 Scientific American, Outstanding Achievement in Education.
 Golden State Governor’s Scholarship, State of California..... 2000

DEPARTMENTAL OR UNIT-LEVEL SERVICE (AY 2023-2024)

Department of Physics:

Chair of Equity, Diversity, and Inclusion (EDI) Advisory Board

Princeton Neuroscience Institute:

Website Committee Chair; Neuroscience Grad Admissions Committee

Center for Physics of Biological Function:

Chair of Seminar Series Committee; CPBF Fellow Search Committee

Biophysics Graduate Program:

Chair Grad Admissions Committee

DEPARTMENTAL SERVICE (PREVIOUS)

Chair of the Dicke Fellows Committee (PHY); Senior Committee (PHY); Junior Committee (PHY); Rising Stars in Physics Program Committee; Retreat Co-Organizer (NEU); Faculty Search Committee (Ommen-Darling Bioengineering Institute)

UNIVERSITY SERVICE

Institutional Biosafety Committee, Princeton University 2021–Present
 Freshman & Sophomore Undergrad Advisor, Mathey College, Princeton University ... 2020–2023
 Member, Council of the Princeton University Community 2013–2014
 Senior Staff Committee Member, Lowell House, Harvard College, 2010–2012
 Resident Tutor, Lowell House, Harvard College 2009–2012

PROFESSIONAL SERVICE

Program Committee member, CoSyNe 2019–2022
 Scientific Program Committee member, International *C. elegans* Conference 2019
 Organizer, Simons Foundation, Workshop on Unbiased Quantification of Behavior 2016
 Grant reviewer for funding agencies and foundations including:

Agence Nationale de la Recherche (France), European Research Commission (EU), Israel Science Foundation (Israel), Medical Research Council (UK), NASA (USA), National Institutes of Health (USA), National Science Foundation (USA), NWO (Netherlands), Sir Henry Dale Wellcome Trust (UK), SNSF (Switzerland), W. M. Keck Foundation (USA)

Scientific content reviewer for peer-reviewed journals including:

Current Biology, eLife, Nature Methods, Neuron, Philosophical Transactions of the Royal Society B, Physical Review Letters, Physical Review X, PLOS Biology, PLOS Computational Biology, PNAS

Ad-hoc Reviewing Editor: eLife

TEACHING

Princeton University, *Faculty*:

PHY 108 Physics for Life Scientists Spring 2024
 NEU 457 (557) Measurement and Analysis of Neural Dynamics Spring 2017, 2021, 2023
 PHY 101 Introductory Physics I Fall 2018, 2020–22
 PHY 103 General Physics I Fall 2016, 2019
 NEU 422 Neural Dynamics of Cognition Fall 2017
 ISC 233-234 An Integrated, Quantitative Intro to the Natural Sciences II, 2013–2016
 ISC 231-232 An Integrated, Quantitative Intro to the Natural Sciences I, 2012–2015
 Neurotechnologies and Analysis of Neural Datasets, Summers 2015–2019
 CPBF Physics of Life Summers 2018–19, 2022–23

Princeton University, *Guest Lecturer*:

NEU 501,502 Neuroscience: from molecules to systems and behavior 2017–2022
 Warrior Scholar Project, Physics 2023

SPIA 548, Weapons of Mass Destruction and International Security2017–2019, 2020
 SPIA 353, Science and Global Security,2015, 2017
 NEU 301 Cellular Neurobiology 2016
 QCB 551 Intro to Genomics & Computational Molecular Biology, 2014

Elsewhere:

Stanford University, CS 379C, Computational Models of the Neocortex, *Guest Lecturer*.....2016
 Marine Biological Laboratory, Woods Hole, Neural Systems & Behavior, *Faculty* ... Summer 2014
 Harvard University, BIOPHYS 242R, Brain & Behavior, *Guest Lecturer*.....2013
 Harvard University, MCB 199, Statistical Thermodynamics for Quantitative Biology, *T.A.* .. 2008

ADVISING

PhD Students (current):

Pearl Thijssen (PHY), Wayan Gauthey (NEU, joint w/ Murthy), Emily Osborne (PHY),
 Kevin Chen (NEU, joint w/ Pillow), Sophie Dvali, (PHY), Sandeep Kumar (NEU).

PhD Students (past):

Xinwei Yu (PHY), Ashley Linder (Neuroscience, joint w/ Shaevitz), Mochi Liu (QCB, joint
 w/ Shaevitz)

Undergraduate Students (current):

Abdul-Bassit Fijabi (NEU, Senior Thesis), Anna Borodianski (NEU, Junior Project), Laura
 Sandoval (NEU, Junior Project)

Undergraduate Students (past):

Andrew Tan (NEU, Senior Thesis), Tori Edington (PHY, Senior Thesis), Milena Chakraverti-
 Wuerthwein (PHY, JP and Senior Thesis), John Li (NEU, Senior Thesis), Alicia Castillo
 (NEU, Senior Thesis), Xiaoting Sun; David Mazumder (MOL); Kevin Mizes (PHY, Senior
 Thesis; Treiman Fellow; Sanda & Jeremiah Lambert '55 Undergraduate Neuroscience Re-
 search Award Recipient), Peter Johnson (PHY, Junior Project); Jose Rico Chinchilla; Lukas
 Novak.

INVITED LECTURES

Harvard University, Department of Physics Colloquium2024
 Albert Einstein School of Medicine, Department of Neuroscience 2023
 University of Washington, Department of Physiology and Biophysics 2023
 Allen Institute for Neural Dynamics2023
 Memorial Sloan Kettering Cancer Center, Developmental Biology Seminar2023
 APS March Meeting (delivered by Sophie Dvali)2023
 University of Chicago, Neuroscience Seminar 2023
 New York Area Worm Meeting, Plenary speaker2023
 Yale University, Quantitative Biology Seminar2022
 Google Research 2022
 Syracuse University, Department of Physics 2022
 UCSF2022
 CalTech, Neuroscience Seminar2022
 Stanford University, Wu Tsai Neurosciences Institute2022

Johns Hopkins University, Biology Seminar	2022
Kavli Institute for Theoretical Physics, Neurophysics of Locomotion Workshop	2022
Neuro 2022, Japan Neuroscience Society, Okinawa, Japan	2022
CoSyNe Workshop, Lisbon, Portugal.....	2022
Simons Foundation, Simons Collaboration on the Global Brain Annual Meeting	2022
NSF Workshop: Functional Logic of Neural Circuits, San Juan, PR	2022
Washington University of St. Louis, Department of Physics Colloquium	2021
Society for Neuroscience Short Course, Quantifying Behavior	2019
Workshop on the Aging Brain, Simons Foundation	2019
Rockefeller University	2019
National Institutes of Health BRAIN Initiative Investigators Meeting	2019
Vanderbilt University, Department of Physics and Astronomy Colloquium	2019
Columbia University, Center for Theoretical Neuroscience	2018
SAND8, Statistical Analysis of Neuronal Data, Keynote Lecturer	2017
Rowen University School of Osteopathic Medicine, Department of Cell Biology	2017
APS March Meeting, Patterns & Control in Animal Behavior	2017
CUNY, The Graduate Center, Initiative for the Theoretical Sciences.....	2016
Cornell University, NBB, Perry Gilbert Lecture, Invited by Grad Students	2016
ICFO, Institute of Photonic Sciences, Light for Health Seminar	2016
Simons Foundation, Simons Collaboration on the Global Brain Annual Meeting	2016
Frontiers in Applied & Computational Mathematics.....	2016
Mid-Atlantic Society for Developmental Biology Regional Meeting	2016
Yale University School of Medicine, Department of Neuroscience Seminar	2016
Princeton University, Princeton Neuroscience Institute Seminar	2016
Yale University, Dept. of Molecular Cellular & Developmental Biology Seminar	2016
Google, Inc.	2016
Stanford University School of Medicine, Department of Neurobiology Seminar	2016
Ludwig Maximilians Universitat, Munchen, Center for Nanoscience Colloquium	2015
Northeastern University, Center for Complex Network Research	2015
Princeton University, Woodrow Wilson School, Science and Global Security Seminar	2015
Simons Foundation, Simons Collaboration on the Global Brain Annual Meeting	2015
Rockefeller University, Center for Studies in Physics and Biology Seminar	2015
Stanford University, Stanford Neurosciences Institute & Department of Bioengineering	2015
New York University, Center for Soft Matter Research	2015
Delaware Center for Neuroscience Research	2014
Brandeis University, Computational & Systems Neuroscience Journal Club	2014
Columbia University, Grossman Center, Quantifying Structure in Large Neural Datasets ...	2014
<i>C. elegans</i> topic meeting: Neuronal Development, Synaptic Function & Behavior	2014
Rutgers University, Multi Group Worm Meeting	2013
INSERM, University of Paris Descartes, Optics and Photonics Seminar	2012
Princeton University, Lewis-Sigler Institute for Integrative Genomics	2011
Rutgers University, Molecular Biology and Biochemistry	2010
Harvard University, Rowland Institute	2010

MANUSCRIPTS UNDERGOING PEER REVIEW

1. Sandeep Kumar, Anuj K Sharma, Andrew M Leifer, "An inhibitory acetylcholine receptor gates context dependent mechanosensory processing in *C. elegans*," bioRxiv 2024.03.21.586204, 27 March (2024).
2. Kevin S. Chen, Anuj K. Sharma, Jonathan W. Pillow, Andrew M. Leifer, "Olfactory learning alters navigation strategies and behavioral variability in *C. elegans*" arXiv:2311.07117 [q-bio.NC]; 13 Nov (2023).

PEER-REVIEWED PUBLICATIONS

1. Anuj Kumar Sharma, Francesco Randi, Sandeep Kumar, Sophie Dvali, Andrew M. Leifer, "TWISP: A Transgenic Worm for Interrogating Signal Propagation in *C. elegans*." *Genetics* in press (2024).
2. Wayan Gauthey, Francesco Randi*, Anuj K. Sharma,* Sandeep Kumar, Andrew M. Leifer, "Light evokes stereotyped global brain dynamics in *C. elegans*." *Current Biology*, Vol 34, Issue 1, Pages R14-R15, 8 January (2024).
3. Francesco Randi, Anuj K. Sharma, Sophie Dvali, Andrew M. Leifer, "Neural signal propagation atlas of *C. elegans*." *Nature*, 623, 406–414 (2023).
4. Sandeep Kumar, Anuj K. Sharma, Andrew Tran, Mochi Liu, Andrew M. Leifer, "Inhibitory motor signals gate mechanosensory processing in *C. elegans*" *PLOS Biology*, (9): e3002280 (2023).
5. Kevin S. Chen*, Rui Wu*, Marc H. Gershow, and Andrew M. Leifer. "Continuous odor profile monitoring to study olfactory navigation in small animals." *eLife*, 12:e85910 , 25 July (2023).
6. Matthew S. Creamer, Kevin S. Chen, Andrew M. Leifer, Jonathan W. Pillow, "Correcting motion induced fluorescence artifacts in two-channel neural imaging." *PLOS Computational Biology*, 18(9): e1010421 Sept 28 (2022)
7. Princeton Open Ventilation Monitor Collaboration, Philippe Bourriane, Stanley Chidzik, Daniel J Cohen, Peter Elmer, Thomas Hallowell, Todd J Kilbaugh, David Lange, Andrew M. Leifer, Daniel R. Marlow, Peter D. Meyers, Edna Normand, Janine Nunes, Myungchul Oh, Lyman Page, Talmo Pereira, Jim Pivarski, Henry Schreiner, Howard A Stone, David W Tank, Stephan Thiberge, Christopher Tully. Inexpensive multi-patient respiratory monitoring system for helmet ventilation during COVID-19 pandemic. *ASME Journal of Medical Devices*. Mar 16(1): 011003 (2022).
8. Mochi Liu, Sandeep Kumar, Anuj K Sharma, Andrew M. Leifer. "A high-throughput method to deliver targeted optogenetic stimulation to moving *C. elegans* populations." *PLOS Biology* 20(1): e3001524. (2022)
9. Anne E. Urai, Brent Doiron, Andrew M. Leifer, Anne K. Churchland. "Large-scale neural recordings call for new insights to link brain and behavior." *Nature Neuroscience*, 3 January (2022). [Invited Review]
10. Kelsey M. Hallinen*, Ross Dempsey*, Monika Scholz*, Xinwei Yu, Ashley N Linder, Francesco Randi, Anuj K Sharma, Joshua W. Shaevitz and Andrew M Leifer, "Decoding locomotion from population neural activity in moving *C. elegans*." *eLife*, 10:e66135, 29 July (2021).

11. Xinwei Yu, Matthew S. Creamer, Francesco Randi, Anuj K. Sharma, Scott W. Linderman, Andrew M. Leifer, “Fast deep neural correspondence for tracking and identifying neurons in *C. elegans* using semi-synthetic training.” *eLife*, 10:e66410, 14 July (2021).
12. Francesco Randi and Andrew M. Leifer, “Nonequilibrium Green’s functions for functional connectivity in the brain.” *Phys Rev Lett*, **126**, 118102 (2021).
13. Francesco Randi and Andrew M. Leifer. “Measuring and modeling whole-brain neural dynamics in *Caenorhabditis elegans*.” *Current Opinion in Neurobiology*. Vol 65, Pages 157-167 (2020). [Invited Review]
14. Robert Datta, David Anderson, Kristen Branson, Pietro Perona, and Andrew Leifer, “Computational neuroethology: a call to action.” *Neuron*, 104:1, (2019). [Review]
15. Xiaowen Chen, Francesco Randi, Andrew M Leifer and William Bialek, “Searching for collective behavior in a small brain.” *Phys Rev E* **99**, 052418 (2019).
16. Mochi Liu, Anuj K. Sharma, Joshua W. Shaevitz, Andrew M. Leifer, “Temporal processing and context dependency in *C. elegans* mechanosensation.” *eLife*, 7:e36419 (2018).
17. Jeffrey Nguyen, Ashley N. Linder, George Plummer, Joshua W. Shaevitz, Andrew M. Leifer, “Automatically tracking neurons in a moving and deforming brain” *Plos Computational Biology*, 13(5): e1005517 (2017).
18. Jeffrey Nguyen*, Frederick B. Shipley*, Ashley N. Linder, George Plummer, Mochi Liu, Sagar U. Setru, Joshua W. Shaevitz, Andrew M. Leifer, “Whole-brain calcium imaging with cellular resolution in freely behaving *Caenorhabditis elegans*.” *Proceedings of the National Academy of Sciences*, vol. 113 no. 8, E1074-E1081 (2016).
19. Frederick B. Shipley, Christopher M. Clark, Mark J. Alkema, Andrew M. Leifer, “Simultaneous optogenetic stimulation and calcium imaging in freely moving *C. elegans*.” *Frontiers in Neural Circuits* 8:28 (2014).
20. Steven J. Husson, Alexander Gottschalk, Andrew M. Leifer, “Optogenetic manipulation of neural activity in *C. elegans*: from synapse to circuits and behavior” *Journal of Biology of the Cell*, 105, 1–16 (2013). [Invited Review]
21. Jamie L. Donnelly, Christopher M. Clark, Andrew M. Leifer, Marian Haburacak, Jennifer K. Pirri, Michael M. Francis, Aravinthan D. T. Samuel, and Mark J. Alkema. “Monoaminergic orchestration of motorprograms in a complex behavior in *C. elegans*.” *PLoS Biology* 11(4): e1001529 (2013).
22. Quan Wen, Michelle Po, Elizabeth Hulme, Sway Chen, Xinyu Liu, Sen Wai Kwok, Marc Gershow, Andrew M. Leifer, Victoria Butler, Christopher Fang-Yen, Taizo Kawano, William R. Schafer, George Whitesides, Matthieu Wyart, Dmitri Chklovskii, Mei Zhen, Aravinthan D T Samuel, “Proprioceptive coupling within motor neurons drives *C. elegans* forward locomotion.” *Neuron*, 76, 750–761 (2012).
23. Chenxiang Lin, Ralf Jungmann, Andrew M. Leifer, Chao Li, Daniel Levner, Geroge M. Church, William M. Shih, Peng Yin. “Sub-micrometer geometrically encoded fluorescent barcodes self-assembled from DNA.” *Nature Chemistry*, 4, 832–839 (2012).

24. Andrew M. Leifer*, Christopher Fang-Yen*, Marc Gershow, Mark Alkema, Aravinthan D.T. Samuel, “Optogenetic manipulation of neural activity in freely moving *Caenorhabditis elegans*,” *Nature Methods*, 8(2), p.147–152 (2011) .
25. Kevin J. Coakley, David S. Simons, Andrew M. Leifer. “Secondary Ion Mass Spectrometry Measurements of Isotopic Ratios: Correction for Time Varying Count Rate.” *International Journal of Mass Spectrometry*, 204, 107–120 (2005).

BOOKS UNDER CONTRACT

1. Ross Dempsey and Andrew M. Leifer. *Undergraduate Physics in a Hurry*. Princeton University Press. Expected 2026.

ACTIVE OR AWARDED GRANTS

7/2024–7/2026, Simons Foundation, Simons Collaboration on the Global Brain, SCGB #3196-03 (PI Leifer; spokesperson PI is Zimmer)

“Neuromodulatory interactions the control of long-time scale behaviors”

Total Direct & Indirect Costs: \$436,400

6/2024–6/2025, Princeton Neuroscience Institute Innovation Award, Princeton University (PIs: Leifer & Shaevitz)

“Spatiotemporal dynamics of neuropeptide signaling in the brain”

Total Direct & Indirect Costs: \$200,000

5/2024–4/2026, Eric & Wendy Schmidt Technology Fund, Princeton University (PIs: Leifer & Murthy)

“New Technology for Brain-Wide Functional Connectivity Measurements at Cellular Resolution”

Total Direct & Indirect Costs: \$1,100,000

5/2024–4/2026, Ommen-Darling Bioengineering Institute, Princeton University (PIs: Leifer & Murthy)

“Technology for measuring neural signal propagation at brain-scale”

Total Direct & Indirect Costs: \$140,000

9/18/2019–8/31/2024 National Institute of Health, 1DP2NS116768, (PI: Leifer)

“Probing brain-wide functional connectivity during behavior.”

Total Direct & Indirect Costs: \$2,430,000

6/2019–5/2024 National Science Foundation, 1845137, (PI: Leifer)

“CAREER: Neural mechanisms of flexible sensorimotor processing in *C. elegans*”

Total Direct & Indirect Costs: \$800,000

7/2017–7/2024, Simons Foundation, Simons Collaboration on the Global Brain, SCGB #543003 (PI Leifer; spoksepserson PI is Zimmer)

“Neural Dynamics of a Multi-timescale Social Behavior”

Total Direct & Indirect Costs: \$1,080,000

10/1/2017–9/30/2017 National Science Foundation, PHY-1734030 (PI: Bialek, co-PI: Shaevitz, named investigator: Leifer)

“Physics Frontier Center: Center for the Physics of Biological Function”

Total Direct & Indirect Costs: \$14,700,000

COMPLETED GRANTS

5/15/2020–4/30/2021 National Science Foundation, PHY-2031509, (co-PI: Leifer; PI: Elmer)

RAPID: Open Research Infrastructure for COVID-19 Ventilator Data

Total Direct & Indirect Costs: \$200,000

7/2014–7/2017, Simons Foundation, Simons Collaboration on the Global Brain, SCGB (PI: Leifer)

“Whole brain calcium imaging in freely behaving nematodes”

Total Direct & Indirect Costs: \$320,000

9/2017–8/2019 National Institute of Health, 1R21NS101629, (PI: Murray, U Penn)

“Multicolor labeling for cell identification in the *C. elegans* nervous system”

Total Direct & Indirect Costs: \$500,000 (\$250,000 to Leifer)

9/2014–8/2016, Princeton University, Inaugural Dean’s Innovation Fund for New Ideas in the Natural Sciences (co-PI with Shaevitz)

“All-neuron I/O in freely behaving animals”

Total Direct Costs: \$200,000 (\$100,000 to Leifer)