

Nathan T. Fried, PhD

Assistant Teaching Professor
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Research Aim: Utilize modern neuroscience techniques to identify the molecular and psychological mechanisms behind sleep's impact on the development of chronic pain in both vertebrates and invertebrates with the hope of identifying therapeutic alternatives to opioids.

Teaching Aim: Develop a research program and curriculum that integrates problem-based learning and authentic research experiences to increase the science identity, retention, and success of all students, especially those from underrepresented backgrounds.

Current Appointments at Rutgers University Camden

Assistant Teaching Professor Integrating teaching into my research program using drosophila to study sleep and pain.	2018-
Assistant Director of Undergraduate Research & Education Mentoring students and developing curricula that facilitate undergraduate research.	2018-
Assistant Director & Program Coordinator of the NIH T34 MARC U-STAR program Developing undergraduate research training program to increase diversity in biomedical science.	2019-

Education and Training

Postdoctoral Fellow , NIH K12 Penn-PORT IRACDA Fellow, University of Pennsylvania Developed new molecular, behavioral, and machine learning platform to assess pain in mice. <u>Mentor:</u> Wenqin Luo, Associate Professor	2015-2018
Ph.D. in Neuroscience , NIH T32 Fellow, Thomas Jefferson University Identified mitochondrial dysfunction & altered adenosine signaling in rat model of migraine. <u>Mentors:</u> Michael Oshinsky (NIH Program Director), Melanie Elliott (Assistant Professor)	2010-2015
B.S. in Biological Sciences (minor in mathematics), Drexel University Honors College Identified HDAC regulation of APP in Alzheimer's Disease cell culture model. <u>Mentor:</u> Aleister Saunders (Professor, Senior Vice Provost)	2003-2008

Specialized Education and Training

R25 NIH BRAIN Initiative in Computational Neuroscience Summer Course for undergraduate research/teaching, "Models and Neurobiology", University of Missouri	2019
Problem-Based Learning for Undergraduate Science Education, University of Delaware	2019
CrawFly neurophys course for invertebrate undergraduate research/teaching, Cornell University	2018
Improving STEM Education through Research (audited 3cr course), Drexel University	2018
Overcoming barriers to utilize drosophila at PUIs, Drosophila Research Conference	2018
College and University Teaching (3cr course), University of Pennsylvania	2017
HHMI-BioInteractive Teaching Workshop, University of Pennsylvania	2016

Research Funding

NIH NIGMS T34 Grant (\$1,324,997) (Role: co-wrote, Assistant Director, Program Coordinator) PI: Kwangwon Lee, PhD “Rutgers Camden MARC U-STAR Undergraduate Research Training Grant”	2019-2024
Experiential Learning Infusion Grant (\$2,000) (Role: PI) “Bite-Sized Authentic Research Experiences in Drosophila Sleep & Pain”	2019
Population Health Faculty Professional Development Grant (\$2,000) (Role: co-PI) Co-PI: Jamie Dunaev, PhD “Exploring the social context of stigma on chronic pain catastrophizing.”	2019-2020
Provost Fund for Research Catalyst Grant (\$4,965) (Role: PI) “Characterizing pain in drosophila to identify novel non-opioid pain therapeutic targets.”	2018-2019
NIH IRACDA K12 PENN-PORT Postdoc Fellowship (K12 GM081259)(\$190,488)(Role:trainee) PI: Janis Burkhardt, PhD “Exploring central/peripheral neural circuit modifications in chronic pain.”	2016-2018
Thomas Jefferson Headache Center Miles for Migraine Grant (\$15,000) (Role: co-PI) Co-PIs: Wenqin Luo, PhD; Melanie Elliott, PhD “Investigating the role of non-peptidergic C-fiber nociceptors in post-traumatic headache.”	2015-2016
NIH Junior Investigators in Alcohol Research (T32 AA007463) (\$105,300) (Role: trainee) PI: Jan Hoek, PhD “Studying mitochondrial dysfunction & adenosine signaling in the hangover headache.”	2012-2015

Teaching Funding

Rutgers Open and Affordable Textbooks Award (\$1,000) (Role: PI) “Increasing access by replacing textbook w/ problem-based learning & online materials in Neuro I”	2019-2020
Digital Teaching Fellowship (\$1,500) (Role: PI) “Integrating technology into the biology classroom.”	2018-2019

Honors and Awards

2019 Edmund Optics Educational Award Finalist (\$500)	2019
R25 NIH BRAIN Initiative Comp. Neuro. Undergrad Teaching/Research Scholarship (\$1500)	2019
Drexel University’s 40 under 40	2019
IRACDA Annual Conference Research Poster Award	2018
Cornell CrawFly Invertebrate Neurophysiology Scholarship (\$1500)	2018
Jefferson JCBS Alumni Thesis Award	2016
North American Pain School Trainee (\$1500)	2016
North American Pain School Pain Research Forum Correspondent	2016
New Headache Investigator Research Tournament Winner	2015
International Headache Academy Young Investigator	2015
NIH Pain Consortium Symposium Travel Grant (\$1000)	2014
CLS Capitol Hill Day Travel Grant (\$1000)	2014
Fredric Rieders Renaissance Foundation Graduate Student Award	2014
TJU Travel Grant (\$1000)	2012, 2014
American Headache Society Travel Grant (\$1500)	2013

Seahorse Bioscience Inc Travel Grant (\$1000)
 Leopold Schepp Foundation Graduate Grant (\$20,000)

2012
 2010-2012

Publications

1. Abdus-Saboor I*, **Fried NT***, Lay M, Burdge J, Swanson K, Fischer R, Jones J, Dong P, Cai W, Guo X, Tao YX, Bethea J, Ma M, Dong X, Ding L, Luo W." Development of a Mouse Pain Scale Using Sub-second Behavioral Mapping and Statistical Modeling." *Cell Reports*, 2019; 28 (6): 1623 DOI: 10.1016/j.celrep.2019.07.017 (***co-first authors**)
2. **Fried NT**, Elliot MB, Oshinsky ML. "The Role of Adenosine Signaling in Headache: a Review." *Brain Sci. The Pathogenesis and Treatment of Headache Disorders special issue* 2017, 7(3), 30.
3. **Fried NT**, Maxwell CR, Elliot MB, Oshinsky ML. "Region-specific disruption of the blood-brain barrier following repeated inflammatory dural stimulation in a rat model of chronic trigeminal allodynia." *Cephalalgia* April 2017.
4. **Fried NT**, Moffat C, Seifert EL, Oshinsky ML. "Functional Mitochondrial Analysis in Acute Brain Sections from Adult Rats Reveals Mitochondrial Dysfunction in a Rat Model of Migraine." *Am J Physiol Cell Physiol* 2014, 307(11):C1017-30.
5. Talati PG, Hoang DT, **Fried NT**, Magee MS, Fineberg JD. "A Perspective on PhD Career Outlook: Training, Mentoring and Utilizing a New Generation of STEM Doctoral Degrees." *Technology Transfer and Entrepreneurship* 2014, 1(2):138-143.
6. Hirata H, **Fried NT**, Oshinsky ML. "Quantitative characterization reveals three types of dry-sensitive corneal afferents: pattern of discharge, receptive field, thermal and chemical sensitivity." *Journal of Neurophysiology* 2012, 108(9):2481-93.

Invention Disclosures

1. **A mouse pain scale: method, software, and device**, co-inventor (filed in June 2018 to the University of Pennsylvania Center for Innovation)

Poster Presentations

1. **Fried NT**, Abdus-Saboor I, Dong P, Burdge J, Lu M, Ding L, Luo W. "A Mouse Pain Scale: Assessment of Pain Sensation in Mice Using Sub-second Behavioral Mapping and Statistical Modeling." July 2018 NIH IRACDA Annual Conference, Atlanta, GA. *Received Poster Award
2. Abdus-Saboor I, **Fried NT**, Dong P, Burdge J, Lu M, Ding L, Luo W. "High resolution mapping of sub-second behavior features of mouse paw withdrawal." November 2017 Society for Neuroscience Annual Meeting, Washington DC.
3. Green A, **Fried NT**, Luo W. "Using optogenetics to investigate the interactions between fibroblasts and c-fibers in the development of chronic pain." November 2017 Annual Biomedical Research Conference for Minority Students (ABRCMS), Phoenix AZ.
4. Perino J, **Fried NT**, Oshinsky ML, Daugherty B, Lederman S, Elliott MB. "The (R)-isomer of isometheptene decreases trigeminal sensitivity in a rat model of primary headache." June 2016 American Headache Society Annual Scientific Meeting, San Diego, CA.
5. Hann S, **Fried NT**, Venkatesan L, Oshinsky ML. "Effectiveness of 'Burst' Occipital Nerve Stimulation in Treating Allodynia in a Rodent Model of Migraine." December 2015 The North American Neuromodulation Society Annual Meeting, Las Vegas, NV.
6. **Fried NT**, Oshinsky ML. "The role of adenosine signaling, mitochondrial dysfunction, and glutamate signaling in delayed-ethanol-induced-headache in two rat models of migraine." June 2015 38th annual Research Society on Alcoholism Scientific Meeting, San Antonio, TX.
7. **Fried NT**, Oshinsky ML. "The (R)-isomer of isometheptene, decreases trigeminal sensitivity in a rat model of primary headache." June 2015 AHS Annual Scientific Meeting, Washington, DC.

8. **Fried NT**, Oshinsky ML. "Mitochondrial Dysfunction in the Development of Trigeminal Sensitivity in a Chronic Migraine and Spontaneous Trigeminal Allodynia Rat Model." May 2015 International Headache Congress, Valencia, Spain.
9. **Fried NT**, Oshinsky ML. "Repeated infusion of prostaglandin E2 onto the dura induces chronic trigeminal sensitivity via TRPA1 channels." June 2014 American Headache Society Scientific Meeting, Los Angeles, CA. | November 2014, Society for Neuroscience Meeting, Washington DC.
10. **Fried NT**, Oshinsky ML. "The Role of Mitochondrial Dysfunction in the Development of Chronic Migraine." May 2014, The 9th Annual NIH Pain Consortium Symposium on Advances in Pain Research, Bethesda, MD. (*INVITED POSTER PRESENTER*)
11. **Fried NT**, Oshinsky ML. "The role of adenosine and mitochondrial dysfunction in delayed-ethanol-induced-headache." June 2014, 37th Research Society on Alcoholism Scientific Meeting, Bellevue, WA.
12. **Fried NT**, Moffat C, Seifert EL, Oshinsky ML. "Reduced Spare Respiratory Capacity in a Rat Model of Migraine." June 2013 International Headache Congress, Boston, MA.
13. Hirata H, **Fried NT**, Oshinsky ML. "Short exposure to intense tear hyperosmolarity leads to functional alterations of the corneal nerves involved in tearing and/or ocular pain." March 2013 The Association for Research in Vision and Ophthalmology Annual Meeting Seattle, WA
14. **Fried NT**, Moffat C, Seifert EL, Oshinsky ML. "Mitochondrial dysfunction in a rat model of chronic migraine." October 2012 Society for Neuroscience Annual Meeting, New Orleans, LA (*Endorsed by Seahorse Bioscience and reprinted for publication and in a press release.*)
15. Khandelwal P, Schuster J, **Fried NT**, D'Cruz T, Lee J, Saunders A. "Identification Of Regulators Of APP Metabolism On Chr 10" July 2008 International Conference on Alzheimer's Disease, Chicago, IL
16. **Fried NT**, Khandelwal P, Saunders A. "Identification of HDACs involved in APP metabolism" March 2008 Drexel's CoAS Research Day, Philadelphia, PA; April 2008 (Drexel Research Day – 1st prize)
17. Reddy M, Wong J, **Fried NT**, Prabhakar U. "Human IL-12/23 mAb inhibits Cutaneous Lymphocyte Antigen, IL-12R, and IL-2Ra expression on activated peripheral blood T lymphocytes and secretion of IFN- γ , IL-17, IL-2, IL-10, and TNF- α cytokines" April 2006, Society for Investigative Dermatology, Philadelphia, PA; July 2006, Centocor Science Poster Day, Radnor, PA

Invited Talks

Dept. of Psychology's Cognition and Neuroscience Seminar Series, Temple University "Enhancing vertebrate & invertebrate models of pain."	2019
NIH IRACDA Annual Teaching & Research Conference, Ann Arbor "Barriers to Research for First-Generation Low-income Commuter Students."	2019
Thomas Jefferson University Headache Clinicians Meeting, TJU "Rats, Mice, and Flies: Vertebrates & Invertebrates in Pain Research."	2019
Center for Computational and Integrative Biology, Rutgers Camden "Creating Bite-Sized Authentic Research Experiences in Pain."	2019
Dept. of Biology's Seminar Series, Drexel University "Refining our Measurement of Pain in Mice."	2019
PYPELINES Research & Education Conference, Fox Chase Cancer Institute "Promoting Experiential Learning and Diversity w/ a Research Program in Pain."	2019
Problem-Based Learning Symposium, Rutgers Camden "Infusing Problem-Based Learning into a Biology Curriculum."	2019
Society for Scholarly Publishing Conference, Wistar Institute "Harnessing the 'ah-ha' moment in teaching and research."	2019
Chancellor's New Faculty Research Symposium, Rutgers "Bringing Pain Research to Undergraduates."	2018
Coriell Institute Seminar Series, Coriell "Increasing the predictive validity of pre-clinical animal pain models."	2018
SACNAS Annual Meeting, San Antonio "Being a First-Generation Low-Income Faculty Member."	2018
NIH IRACDA Annual Teaching & Research Conference, Emory	

"Obstacles for First-Generation Low-Income Students in STEM."	2018
NIH IRACDA Annual Teaching & Research Conference, Emory	
"How do you Know a Mouse is in Pain?"	2018
Thomas Jefferson University Headache Clinicians Meeting, TJU	
"CGRP and high-speed imaging of rodent headaches "	2018
Postdoctoral Research Highlights Seminar, Drexel University	
"High-speed imaging of mouse pain behavior "	2018
Communicating Your Science Conference, Drexel University	
"Sharing your science on social media "	2017
Tonix Pharmaceuticals Key Opinion Leader Meeting	
"Isometheptene isomer effects on rat model of primary headache."	2015
American Headache Society Annual Meeting	
"Isometheptene: It works, but for the wrong reason."	2015
University of Texas at Austin Seminar, UofT	
"Unraveling basic migraine physiology by defining how alcohol affects trigeminal pain."	2015

Research Experience

Assistant Teaching Professor, Dept. of Biology, Rutgers University Camden	2018-
Developing undergraduate-driven research program in drosophila sleep & pain.	
NIH Penn-PORT IRACDA Postdoctoral Fellow, Dept. of Neuroscience, Univ. of Pennsylvania	2015-2018
Utilized mouse genetics, optogenetics, and behavior to study neural circuits of pain.	
PhD Candidate, Dept. of Neuroscience, Thomas Jefferson University	2010-2015
Studied mitochondrial dysfunction and adenosine signaling in rat model of migraine.	
Research Lab Manager, Dept. of Biology, Drexel University	2008-2010
Managed cell imaging, flow cytometry, and RNAi resource centers.	
Student Research Assistant, Dept. of Biology, Drexel University	2005-2008
Performed a chromosome-wide screen for genes affecting Alzheimer's disease.	
Co-op/Assistant Scientist, Centocor	2005-2007
Used cell-based assays to study efficacy of multiple sclerosis therapeutics.	

Teaching Experience

Positions

Assistant Teaching Professor, Dept. of Biology, Rutgers University Camden	2018-
Visiting Professor, Dept. of Biology, Rutgers University Camden	2017-2018
Visiting Professor, Dept. of Biology, Delaware County Community College	2017
Mathematics Instructor & Physics Teaching Assistant, Thomas Jefferson University	2013-2018

Courses Developed & Taught

Neuroscience I (300-level & graduate)	
2019 Spring Teaching Effectiveness Evaluation:	4.8/5.0
The Neuroscience of the Opioid Epidemic (300-level & graduate)	
2018 Fall Teaching Effectiveness Evaluation:	5.0/5.0
2018 Spring Teaching Effectiveness Evaluation:	5.0/5.0
Neurobiology II (300-level & graduate) *teaching Spring 2020	
Communicating Biomedical Science (300-level & graduate) *teaching Fall 2019	

Courses Adopted & Taught

Statistics in Biological Science (200-level)	
2019 Spring Teaching Effectiveness Evaluation:	4.9/5.0
Principles and Practices of Biological Research CURE course (300-level)	
2019 Spring Teaching Effectiveness Evaluation:	4.8/5.0
Pathophysiology (300-level)	
2018 Fall Teaching Effectiveness Evaluation:	4.7/5.0
Exploring Careers in Biology (100-level)	
2018 Fall Teaching Effectiveness Evaluation:	4.8/5.0
Anatomy and Physiology I (200-level)	
2017 Fall Teaching Effectiveness Evaluation:	4.9/5.0

Science Writing Experience

Freelance Science Journalist, International Association for the Study of Pain (IASP)	2016-2018
Freelance Science Copy Editor, Cactus Communications	2016-2017
Freelance Science Writer, American Association for Cancer Research	2014-2015
Columnist, Integrative Academic Solutions	2013-2014
Content Editor, National Institute of Neurological Disorders and Stroke	2011-2012

Service

Activities

Assistant Editor for the Rutgers Camden Journal of Biological Science	2019-
Ad hoc academic reviewer at PLOS ONE, Cephalalgia, Journal of the Neurological Sciences, Cellular Physiology and Biochemistry, and Experimental Brain Research.	2016-
Tutored mathematics, physics, neuroscience, biology, and genetics	2008-2016
Mapped primate populations w/ Bioko Biodiversity Protection Program, Equatorial Guinea	2010
Mapped sea turtle populations w/ Archelon: Sea Turtle Protection Society of Greece, Greece	2008
Mapped lanternfish populations w/ SEA sailing research vessel, Sargasso sea	2008

Public Outreach

Rutgers Camden Biology Club Neuroscience Seminar	2019
Rutgers Neuroscience Table at Philadelphia Science Festival Carnival & La Colombe	2019
Invited curator of the @RealScientists Twitter outreach account w/ 78K followers	2018
Invited speaker at Cafe Scientifique in Woking, United Kingdom at the LightBox art gallery	2018
Invited monologist at "Without Order" performance	2018
Invited speaker at Taste of Science Festival	2018
Invited speaker at University of Pennsylvania's Biological Basis of Behavior Society	2018
Invited speaker at TimeCamp001 science fiction conference hosted by Afrofuturist Affair	2017
Invited speaker at Washington Township High School	2017
Invited speaker at Philadelphia Science Festival's Sensory Overload at Yard's Brewery	2017
Philadelphia Brain Health Fair	2014
Coalition for the Life Sciences Capitol Hill Day	2014
SFN Brain Week activities	2011-2014

Diversity Outreach

Invited speaker at Design Thinking Academy Charter School	2019
Poster judge for Penn's Office of Research & Diversity Training Symposium	2018
Invited speaker at Lincoln University (HBCU)	2016
Poster judge for Penn Honors Diversity Symposium	2016

Leadership Positions in Scientific Organizations

Co-Director/Co-Founder of the Science Building Highschool Internship	2019-
Web developer for the Philadelphia Chapter of SFN	2011-
Standing member on the Publications committee in the Research Society on Alcoholism	2013-2015
Founding member of the Thomas Jefferson University Business and Biotech Group (BizBio)	2012-2014
VP of Career Development, Graduate Student Association	2012-2014
Graduate Student Liaison for TJU Neuroscience Dept	2011-2013

Students Mentored

As a faculty member:

Christina Curran-Alfaro, MS in Biology (thesis committee), Rutgers University Camden	2019-
Shariq Khan, BS in Biology (MARC fellow), Rutgers University Camden	2019-
Jenny Pan, BS in Biology, Rutgers University Camden	2019
Robert Hughes, BS in Health Sciences, Rutgers University Camden	2019
Ubaidah Khan, BS in Biology, Rutgers University Camden	2019
Meghan Wachira, BS in Biology, Rutgers University Camden	2019

As a postdoc:

Azikiwea Green, BS in Neuroscience, Swarthmore College	
Currently lab tech at University of Pennsylvania	2017-2018
Monisha Murarka, BS in Biology, Drexel University	
Currently DVM student at University of Minnesota College of Veterinary Medicine	2016-2018
Dragan Vujovic, BS in Chemistry, Williams College	2016
Purnika Selvan, BS in Biology, University of California, Irvine	2015

References

Michael Oshinsky, PhD

(PhD Co-Advisor)

Program Director, Pain and Migraine

National Institutes of Health, NINDS

michael.oshinsky@nih.gov

Melanie Elliott, PhD

(PhD Co-Advisor)

Director, Physiology Thread at Sidney Kimmel Medical College

Jefferson University, Dept of Neurosurgery

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Wenqin Luo, PhD

(Postdoctoral Research Advisor)

Associate Professor

University of Pennsylvania, Dept of Neuro

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Janis Burkhardt, PhD

(Postdoctoral Teaching Advisor)

Professor

Children's Hospital of Philadelphia Research Institute, Pathology and Laboratory Medicine

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