

Qingguang Zhang, Ph.D.

Assistant Professor

Department of Physiology
College of Human Medicine
Michigan State University
East Lansing, MI 48824

email: gzhang24@msu.edu

lab website:
zhanglabmsu.github.io

Education

2011-2015	Ph.D.	Biomedical Engineering University of Kentucky, Lexington, KY
2008-2011	M.S.	Biomedical Engineering Shandong University, China
2004-2008	B.E.	Biomedical Engineering Shandong University, China

Positions

2024-present	Assistant Professor , Department of Physiology, Michigan State University
2020-2023	Assistant Research Professor , Engineering Science and Mechanics, Penn State
2015-2020	Postdoctoral Fellow , Engineering Science and Mechanics, Penn State
2011-2015	Graduate Research Assistant , Biomedical Engineering, University of Kentucky
2009-2011	Software Development Engineer , Jinan HYRG Technology Co. Ltd., China
2008-2011	Graduate Research Assistant , Biomedical Engineering, Shandong University, China

Research Support

Current Support

Research Startup Funds, Michigan State University 01/2024-01/2029
Personnel: Zhang Q (PI)

Career Development Award #935961, American Heart Association 04/2022-03/2025
Personnel: Zhang Q (PI)
Project Title: Cellular Architecture and Functional Imaging: Integrated Approach for Understanding Cerebrovascular Aging in Awake Mice

Fellowships and Awards

2022-2025	Career Development Award, American Heart Association
2014-2015	International Student Scholarship, University of Kentucky
2013	Max Steckler Fellowship, University of Kentucky
2011	Third Place Award, LabVIEW Student Design Competition, National Instruments
2011	First Place Presentation Award at Qilu Graduate Student Academic Forum
2009-2011	Outstanding Graduate Student Scholarship, Shandong University
2005-2008	Outstanding Undergraduate Student Scholarship, Shandong University

Peer-Reviewed Publications [Google Scholar](#), [ORCID](#)

- Bennett HC*, **Zhang Q***, Wu YT*, Manjila SB*, Chon U, Shin D, Vanselow, J, Pi H, Drew PJ and Kim Y. Aging drives cerebrovascular network remodeling and functional changes in the mouse brain. **Nature Communications**. 2024. doi: 10.1038/s41467-024-50559-8. ([Link](#)) *Co-first author.
- Gheres KW, Aoensal HS, Han X, **Zhang Q**, Turner KL, Zhang N, and Drew PJ. Arousal state transitions occlude sensory-evoked neurovascular coupling in neonatal mice. **Communications Biology**. 2023, doi: 10.1038/s42003-023-05121-5. ([Link](#))
- Zhang Q**, Haselden WD, Charpak S and Drew PJ. Could respiration-driven blood oxygen changes modulate neural activity? **Pflügers Archiv-European Journal of Physiology**. 2022, doi: 10.1007/s00424-022-02721-8. ([Link](#))
- Wu YT, Bennett HC, Chon U, Vanselow DJ, **Zhang Q**, Muñoz-Castañeda R, Cheng KC, Osten P, Drew PJ, Kim Y. Quantitative relationship between cerebrovascular network and neuronal cell types in mice. **Cell Reports**. 2022, 39(12), doi: 10.1016/j.celrep.2022.110978. ([Link](#))

"Brain regions vulnerable to disease may lack adequate energy from blood supply" - [Penn State News](#)

15. **Zhang Q**[#], Turner KL, Gheres KW, Md SH and Drew PJ[#]. Behavioral and physiological monitoring for awake neurovascular coupling experiments: A how-to guide. *Neurophotonics*. 2022, 9(2), 021905. doi: 10.1117/1.NPh.9.2.021905. ([Link](#)) [#]**Co-corresponding author**.
“Researchers publish how-to guide for monitoring and analyzing brain activity” - [Penn State News](#)
14. **Zhang Q**[#], Gheres KW, and Drew PJ[#]. Origins of 1/f-like cerebral tissue oxygenation fluctuations in the murine cortex. *PLoS Biology*. 2021, doi: 10.1371/journal.pbio.3001298. ([Link](#)) [#]**Co-corresponding author**.
“Red blood cell ‘traffic’ contributes to changes in brain oxygenation” - [Science Daily](#), [Penn State News](#)
13. **Zhang Q**, Roche M, Gheres KW, Chaigneau E, Kedarasetti RT, Haselden WD, Charpak S and Drew PJ. Cerebral oxygenation during locomotion is modulated by respiration. *Nature Communications*. 2019, doi:10.1038/s41467-019-13523-5. ([Link](#))
“Want to increase brain oxygenation? Locomotion may be key” - [Psychology Today](#), [Neuroscience News](#)
12. Norwood JN, **Zhang Q**, Card D, Craine A, Ryan TM and Drew PJ. Anatomical basis and physiological role of cerebrospinal fluid transport through the murine cribriform plate. *eLife*, 2019, 8. ([Link](#))
“Sense of smell, pollution and neurological disease connection explored” - [Medical Express](#)
11. Drew PJ, Winder AT and **Zhang Q**. Twitches, blinks, and fidgets: important generators of ongoing neural activity. *Neuroscientist*. 2019, 25(4): 298-313. ([Link](#))
“The fidgeting brain” - [Discover Magazine](#)
10. Winder AT, Echagarruga C, **Zhang Q** and Drew PJ. Weak correlations between hemodynamic signals and ongoing neural activity during the resting state. *Nature Neuroscience*, 2017, 20: 1761-1769. ([Link](#))
9. Gao Y, Ma Y, **Zhang Q**, Winder AT, Liang Z, Antinori L, Drew PJ and Zhang N. Time to wake up: studying neurovascular coupling and brain-wide circuit function in the un-anesthetized animal. *Neuroimage*, 2017, 153: 382-398. ([Link](#))
8. **Zhang Q**, Evans JM, Stenger MB, Moore FB and Knapp CF. Autonomic cardiovascular responses to orthostatic stress after a short artificial gravity exposure. *Aerospace Medicine and Human Performance*. 2017, 88: 827-833. ([Link](#))
7. Evans JM, Wang S, Greb C, Kostas VI, Knapp CF, **Zhang Q**, Roemmele ES, Stenger MB and Randall DC. Body size predicts cardiac and vascular resistance effects on men's and women's blood pressure. *Frontiers in Physiology*, 2017, 8: 561. ([Link](#))
6. Evans JM, Knapp CF, Ribiero CL, Moore FB, Wang S, **Zhang Q**, Kostas VI, Ferguson CR, Falvo MJ, Stenger MB, Goswami N, Smith JD and Serrador JM. Hypovolemic men and women regulate blood pressure differently following exposure to artificial gravity. *European Journal of Applied Physiology*, 2015, 115: 2631-2640. ([Link](#))
5. **Zhang Q**, Patwardhan AR, Knapp CF and Evans JM. Cardiovascular and cardiorespiratory phase synchronization in normovolemic and hypovolemic humans. *European Journal of Applied Physiology*, 2015, 115: 417-427. ([Link](#))
4. Evans JM, Jenkins RA, Ilgner RH, Knapp CF, **Zhang Q** and Patwardhan AR. Acute cardiovascular autonomic responses to inhaled particulates. *European Journal of Applied Physiology*, 2015, 115: 257-268. ([Link](#))
3. **Zhang Q**, Knapp CF, Stenger MB, Patwardhan AR, Elayi SC, Wang S, Kostas VI and Evans JM. Simulations of gravitational stress on normovolemic and hypovolemic men and women. *Aviation, Space and Environmental Medicine*, 2014, 85 (4): 407-413. ([Link](#))
2. Li L, Yang J, Liu C, Liu C, **Zhang Q** and Li K. The effect of resampling on spectral analysis of pulse interval series. *Journal of Shandong University (Engineering & Science)*, 2011, 41(2): 102-106. (In Chinese with English Abstract)
1. Liu C, Liu C, **Zhang Q** and Li Q. Construction method for normalized histogram of RR sequence and its application for evaluation heart failure. *ACTA BIOPHYSICA SINICA*, 2009, 25(4): 299-304. (In Chinese with English Abstract)

Patents

1. Yang J, Li L, Liu C, Liu C, and **Zhang Q**. A noninvasive cardiovascular function evaluation device based on multi-modal physiological time series variability analysis. Patent Number: CN 201010267520. File Date: 08/31/2010. Issue Date: 12/29/2010. China. (In Chinese)
2. Liu C, Liu C, **Zhang Q**, Cao Y, Li B, Li L, and Yang J. A device for detecting heart failure based on normalized histogram of RR interval time series. Patent Number: CN 200810238523. File Date: 12/18/2008. Issue Date: 05/27/2009. China. (In Chinese)

Conference Proceedings

1. **Zhang Q** and Liu C. Pulse rate variability analysis based on sample entropy. The Qilu Graduate Student Academic Forum, Jinan, China, Oct. 2010. (In Chinese)
2. **Zhang Q**, Yang J, Li L, Li B and Liu C. Study of pulse rate variability using bispectrum analysis. The 4th International Conference on Bioinformatics and Biomedical Engineering (iCBBE), Chengdu, China, June 2010.
3. Li L, Liu C, Liu C, **Zhang Q** and Li B. Physiological signal variability analysis based on largest Lyapunov exponent. The 2nd International Congress on Image and Signal Processing (CISP) and the 2nd International Conference on BioMedical Engineering and Informatics (BMEI), Tianjin, China, Oct. 2009.
4. Liu C, Liu C, Li L, **Zhang Q** and Li B. Systolic and diastolic time interval variability analysis and their relations with heart rate variability. The 3rd International Conference on Bioinformatics and Biomedical Engineering (iCBBE), Beijing, China, June 2009.
5. **Zhang Q**, Liu C, Li L, Sun C and Liu C. Study of pulse rate variability based on approximate entropy. The Annual Conference of Biomedical Engineering, Chongqing, China, Oct. 2009. (In Chinese with English Abstract)

Selected Presentations

1. **Zhang Q**, Gheres KW and Drew PJ. Opposing effects of neuromodulation and local neural activity on cortical hemodynamic responses during behavior. Annual Meeting of the Society of Neuroscience. Washington, DC, Nov. 2023.
2. Hossain M, Turner KL, **Zhang Q** and Drew PJ. Understanding the influence of cholinergic and noradrenergic modulation on hemodynamics during sleep. Annual Meeting of the Society of Neuroscience. Washington, DC, Nov. 2023.
3. Turner KL, Unsal HS, Brockway DF, Hossain M, Greenawalt DI, **Zhang Q**, Zhang Q, Gheres KW, Crowley NA, Zhang N and Drew PJ. Long-range projecting cortical nNOS neurons modulate bilateral synchronization and neurovascular coupling. Annual Meeting of the Society of Neuroscience. Washington, DC, Nov. 2023.
4. Salehi Shahrababaki F, Turner KL, Hossain M, Greenawalt DI, **Zhang Q** and Drew PJ. The dynamics of Tac1-expressing neuron activity during sleep and wake states. Annual Meeting of the Society of Neuroscience. Washington, DC, Nov. 2023.
5. Garborg S, **Zhang Q**, Turner KL, Ricotta JM, Frank N, Mostafa M, Costanzo F and Drew PJ. Investigating the drivers and mechanics of brain motion in behaving mice. Annual Meeting of the Society of Neuroscience. Washington, DC, Nov. 2023.
6. **Zhang Q**, Bennett HC, Wu YT, Chon U, Pi H, Drew PJ and Kim Y. Aging drives cerebrovascular network remodeling and functional changes in the mouse brain. American Heart Association Scientific Session, Philadelphia, PA, Nov. 2023.
7. **Zhang Q**, Bennett HC, Kim Y and Drew PJ. Neurovascular coupling is preserved in healthy, aged mice. The 9th Annual BRAIN Initiative Meeting, North Bethesda, MD, June. 2023.
8. **Zhang Q**, Bennett HC, Kim Y and Drew PJ. Neurovascular coupling is preserved in healthy, aged mice. Annual Meeting of the Society of Neuroscience. San Diego, CA, Nov. 2022.
9. Turner KL, Hossain M, Greenawalt DI, **Zhang Q**, Gheres KW and Drew PJ. A cellular substrate for ultra-slow bilateral hemodynamic correlations. Annual Meeting of the Society of Neuroscience. San Diego, CA, Nov. 2022.
10. Bennett HC, Wu YT, Chon U, **Zhang Q**, Vanselow DJ, Cheng KC, Drew PJ and Kim Y. Structural and

- morphological remodeling of the mural and vascular network in the aged mouse brain. Annual Meeting of the Society of Neuroscience. San Diego, CA, Nov. 2022.
11. Garborg S, **Zhang Q**, Turner KL and Drew PJ. Understanding the nature and drivers of brain motion in behaving mice. Annual Meeting of the Society of Neuroscience. San Diego, CA, Nov. 2022.
 12. **Zhang Q**, Bennett HC, Kim Y, Drew PJ. Neurovascular coupling is preserved in healthy, aged mice. The 10th International Society for Neurovascular Disease Annual Meeting, New York, NY, Jul. 2022.
 13. **Zhang Q**, Roche M, Gheres KW, Chaigneau E, Haselden WD, Charpak S and Drew PJ. Cerebral oxygenation dynamics in awake behaving mice. Optics and the Brain, Fort Lauderdale, FL, Apr. 2022.
 14. **Zhang Q**, Roche M, Gheres KW, Chaigneau E, Haselden WD, Charpak S and Drew PJ. Cerebral oxygenation during locomotion is modulated by respiration. BMES Annual Meeting, Philadelphia, PA, Oct. 2019.
 15. **Zhang Q**, Gheres KW and Drew PJ. Noradrenergic modulation of neurovascular coupling in awake behaving mice. The 47th Annual Meeting of the Society of Neuroscience. Washington, DC, Nov. 2017.
 16. Echagarruga C, **Zhang Q** and Patrick J. Drew. Dissecting neuronal cell-type specific control of neurovascular coupling using DREADDs. The 47th Annual Meeting of the Society of Neuroscience. Washington, DC, Nov. 2017.
 17. Gheres KW, **Zhang Q** and Drew PJ. Neuronal and non-neuronal factors mediate behavioral-state dependent development of functional hyperemia in the somatosensory cortex of juvenile mice. The 47th Annual Meeting of the Society of Neuroscience. Washington, DC, Nov. 2017.
 18. Norwood JN, Card D, Craine A, Ryan T, **Zhang Q** and Drew PJ. Anatomical basis of cerebrospinal fluid transport through the cribriform plate in mice. The 47th Annual Meeting of the Society of Neuroscience. Washington, DC, Nov. 2017.
 19. **Zhang Q**, Anderson DA, Gheres KW, Winder AT and Drew PJ. Serotonergic and noradrenergic modulation of neurovascular coupling in awake behaving mice. The 46th Annual Meeting of the Society of Neuroscience. San Diego, CA, Nov. 2016.
 20. Joyce M. Evans, Connor R. Ferguson, **Qingguang Zhang**, Siqi Wang, Fritz B. Moore, Jeffery D. Smith, Christine L. Ribeiro, Michael B. Stenger and Charles F. Knapp. Improvement of hypovolemic men's and women's orthostatic tolerance by a short exposure to artificial gravity. UK Center for Clinical and Translational Science 10th Annual Spring Conference, Lexington, KY, Mar. 2015.
 21. **Qingguang Zhang**, Joyce M. Evans, Michael B. Stenger, Fritz B. Moore and Charles F. Knapp. Autonomic cardiovascular responses to orthostatic stress following short duration artificial gravity exposure in hypovolemic men and women. 17th Gill Heart Cardiovascular Research Day, Lexington, KY, Oct. 2014.
 22. Joyce M. Evans, Michael B. Stenger, Connor R. Ferguson, Christine L. Ribeiro, Siqi Wang, **Qingguang Zhang**, Jorge M. Serrador, Vladimir I. Kostas, Michael J. Falvo, Fritz B. Moore, Nandu Goswami, Jeffery D. Smith and Charles F. Knapp. Gender differences in blood pressure regulation following artificial gravity exposure. The 40th COSPAR Scientific Assembly, Moscow, Russia, Aug. 2014.
 23. **Zhang Q**, Knapp CF, Smith JD and Evans JM. Cardiovascular responses to orthostatic stress after 90 minutes head-down bed rest versus artificial gravity exposure in hypovolemic men and women. Experimental Biology, San Diego, CA, Apr. 2014.
 24. Joyce M. Evans, Connor R. Ferguson, **Qingguang Zhang**, Fritz B. Moore, Jeffery D. Smith, Michael B. Stenger, Christine L. Ribeiro and Charles F. Knapp. Mechanisms of orthostatic tolerance improvement following artificial gravity exposure differ between men and women. The NASA Human Research Program Investigators' Workshop, Galveston, TX, Feb. 2014.
 25. **Qingguang Zhang**, Charles F. Knapp, Michael B. Stenger, Timothy P. Matz, Abhijit R. Patwardhan and Joyce M. Evans. Cardiac function during orthostatic stress in normovolemic and hypovolemic men and women. 16th Gill Heart Cardiovascular Research Day, Lexington, KY, Oct. 2013.
 26. **Zhang Q**, Stenger MB, Matz TP, Knapp CF, Patwardhan AR and Evans JM. Left ventricular diastolic function during head up tilt and hypovolemia. BMES Annual Meeting, Seattle, WA, Sep. 2013.

27. **Zhang Q**, Evans JM, Knapp CF, Falvo MJ, Moore FB, Patwardhan AR and Serrador JM. Cardio- and cerebro-vascular control in men and women with furosemide-induced hypovolemia during artificial gravity exposure by short radius centrifuge. *Experimental Biology*, Boston, MA, Apr. 2013.
28. Joyce M. Evans, Siqi Wang, Christine L. Ribeiro, Michael J. Falvo, Connor R. Ferguson, Vladimir I. Kostas, Rachel K. Moore, **Qingguang Zhang**, Jorge M. Serrador, Fritz B. Moore, Jeffery D. Smith and Charles F. Knapp. Improvement of hypovolemic men's and women's orthostatic tolerance by a short exposure to artificial gravity. *Experimental Biology*, Boston, MA, Apr. 2013.
29. Joyce M. Evans, Siqi Wang, Michael B. Stenger, Jorge M. Serrador, Michael J. Falvo, Connor R. Ferguson, Jon Rask, Vladimir I. Kostas, **Qingguang Zhang**, Fritz B. Moore, Jeffery D. Smith and Charles F. Knapp. A short exposure to artificial gravity improves hypovolemic men's and women's orthostatic tolerance. The NASA Human Research Program Investigators' Workshop, Galveston, TX, Jan. 2013.
30. **Zhang Q**, Kostas VI, Wang S, Stenger MB, Knapp CF and Evans JM. Cardiovascular responses of men and women to orthostasis in simulated Lunar and Martian gravities. *BMES Annual Meeting*, Atlanta, GA, Oct. 2012.
31. **Qingguang Zhang**, Charles F. Knapp, Abhijit R. Patwardhan and Joyce M. Evans. Comparison of cardiovascular responses between head-up tilt and upright lower body positive pressure. 15th Gill Heart Cardiovascular Research Day, Lexington, KY, Oct. 2012.
32. Joyce M. Evans, Abhijit R. Patwardhan, Siqi Wang, Rachel K. Moore, Vladimir I. Kostas, **Qingguang Zhang**, Daniel Irwin, Connor R. Ferguson, David C. Randall, Charles F. Knapp, Michael B. Stenger, Jeffery D. Smith, Fritz B. Moore. Efficacy of countermeasures to cardiovascular deconditioning in men and women during simulated Moon and Mars explorations. 17th Annual KY EPSCoR Conference, Lexington, KY, May. 2012.
33. Joyce M. Evans, Siqi Wang, Vladimir I. Kostas, **Qingguang Zhang**, Samy C. Elayi, Michael B. Stenger and Charles F. Knapp. Orthostatic fluid shifts in Earth and simulated Moon and Mars environments. The 32nd Annual International Gravitational Physiology Meeting, San Jose, CA, Nov. 2011.
34. Liping Li, Chengyu Liu, **Qingguang Zhang**, Bin Li and Changchun Liu. The significance of short-time quantitative analysis of the histogram in patients with congestive heart failure. The World Congress of Cardiology Scientific Sessions 2010, Beijing, China, June 2010.

Invited talks and presentations

- 05/2024 "Every move you make, every breath you take: neurovascular coupling in the behaving brain"
Cross Campus Research Day, Grand Rapids, MI

Professional Service and Memberships

Predocctoral Advisory Committee

- 2024-present Alexis Boron, PhD student, Molecular, Cellular, and Integrative Physiology Program

Departmental, College and University Service

- 2024-present Undergraduate Programs & Curriculum Committee member, Department of Physiology, Michigan State University
02/2024 Interviewer for BioMolecular Science graduate admission

Professional Memberships

- 2024-present Member, American Physiology Society
2022-2023 Member, International Society for Neurovascular Disease
2016-present Member, Society for Neuroscience
2016-present Member, American Heart Association
2012-2020 Member, Biomedical Engineering Society

Journal Editorial Board

- 2024-present Review Editor, Brain Imaging Methods (specialty section of *Frontiers in Neuroscience*, *Frontiers in Neurology* and *Frontiers in Neuroimaging*)

Review Groups/Study Sections

2024 AHA's Second Century Early Faculty Independence Award, *ad hoc* reviewer

Journal Reviewer

Nature Communications; Cell Reports; Fluids and Barriers of the CNS; Biomedical Optics Express; Frontiers in Neuroscience; Scientific Reports; PLoS ONE; Journal of Neuroscience Methods; Philosophical Transactions of The Royal Society B; Gravitational and Space Research; Innovation and Research in Biomedical Engineering; Signal Processing; Medical & Biological Engineering & Computing

Other Services

11/2024 Moderator, "Is the brain at the heart of the matter", American Heart Association Scientific Session, Chicago, IL

Mentorship (Michigan State University)

Graduate Students

03/2025-present Olivia Morris Michigan State, Molecular Cellular & Integrative Physiology

Graduate Students (rotation)

08/2024-10/2024 Olivia Morris Michigan State, BioMolecular Sciences Gateway

Undergraduate Students

08/2024-present Joslyn Claypool Michigan State, Neuroscience and Psychology

08/2024-present Jacquelyn Bialy Michigan State, Human Biology

08/2024-present Demarco Valentino Michigan State, Physiology