


Tuo Liu, Ph.D. candidate

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Education

- 2021 – Present  **P.h.D., University of Arizona**
major in **Environmental Health Science**; minor in **Biostatistics**
advisor(s): Melissa Furlong, Jefferey Burgess
Thesis title: *Differential Metabolite Expressions in Firefighters Induced by Fireground Exposure: A Comparative Metabolomics Analysis.*
- 2018 – 2020  **M.S., University of Michigan**
major in **Environmental Health Science.**
advisor(s): Tim Dvornch
Thesis title: *Real-time personal exposure to PM_{2.5} and CO among female fish smokers in Ghana: a pilot study.*
- 2012 – 2016  **B.S., China University of Petroleum**
major in **Environmental Science.**
Thesis title: *Climate Change Implications of the Ratio of O¹⁸/O¹⁶ in the rainwater.*

Employment History

- 2022 – Present  **Research Associate.** Department of Community, Policy, and Environment, University of Arizona, USA.
- 2021 – 2022  **Research Assistant.** Department of Community, Policy, and Environment, University of Arizona, USA.
- 2021  **Research Assistant.** SCIES, China.
- 2019  **Research Assistant Intern.** CDC NIEH, China.


Awards

- 2023  **One Health Fellowship: \$50,000 (MEZCOPH),** University of Arizona.
- 2021  **Dean Named Scholarship, \$10,000,** University of Arizona.

Publications




Journal Articles

- 1 M. A. Furlong, **T. Liu**, A. Jung, S. Beitel, J. Hughes, R. Krause, R. Mathis, J. Graber, M. Calkins, H. Matthew, G. John, J. Goodrich, and J. L. Burgess, “Per- and polyfluoroalkyl substances (pfas) and microrna: An epigenome-wide association study,” *Environmental Research, review in progress*, 2024.
- 2 **T. Liu**, M. A. Furlong, J. M. Snider, D. I. Walker, and J. L. Burgess, “Evaluating differential metabolic profile by wildland-urban-interface fire exposure: A comparison with structure fire,” *Environmental Research, submitted*, 2024.
- 3 **T. Liu**, M. A. Furlong, J. M. Snider, M. M. Tfaily, C. Itson, S. Beitel, K. Parsawar, K. Keck, J. Galligan, D. I. Walker, J. J. Gulotta, and J. L. Burgess, “Differential metabolic profiles by hispanic ethnicity among male tucson firefighters,” *Metabolomics, accepted*, 2024.

- 4 **T. Liu**, D. Stea, M. A. Furlong, and J. L. Burgess, "Proteomic profiling to investigate biomarkers and biological functions associated with long covid in frontline workers," *manuscript under CDC clearance*, 2024.
- 5 Y. Liu, E. Lu, K. D. Ellingson, J. Hollister, **T. Liu**, W. Hamzazai, S. Beitei, A. Britton, and J. L. Burgess, "Unveiling post-vaccination proteomic signatures in infection-naïve individuals associated with omicron breakthrough infections," *manuscript under CDC clearance*, 2024.
- 6 M. A. Furlong, **T. Liu**, J. M. Snider, M. M. Tfaily, C. Itson, S. Beitel, K. Parsawar, K. Keck, J. Galligan, D. I. Walker, J. J. Gulotta, and J. L. Burgess, "Evaluating changes in firefighter urinary metabolomes after structural fires: An untargeted, high resolution approach," *Scientific Reports*, vol. 13, no. 1, p. 20 872, 2023, ISSN: 2045-2322.  DOI: 10.1038/s41598-023-47799-x.


Research Experience

Firefighter Cancer Cohort Study (FFCCS)


- 2025  **Women Firefighters, Municipal Structure Fire** Evaluating Differential Metabolic Profiles by Structure Fire Exposure in Women Firefighters: A Comparison with Men Firefighters
- Conducted differential expression analysis on 204 urine samples from women firefighters who underwent live-fire training
 - Developed and validated statistical models to compare metabolic profiles across firefighter groups
 - manuscript under development
- 2024  **Men Firefighters, Wildland-Urban-Interface Fire** Evaluating Differential Metabolic Profiles by Wildland-Urban-Interface (WUI) Fire Exposure: A Comparison with Structure Fires
- Analyzed 85 firefighter samples for WUI-specific metabolic changes
 - Integrated metabolomics datasets for comparative analysis
 - Presented findings at the 2024 FFCCS Brown Bag meeting
 - Lead author for a manuscript (submitted to *Environmental Research*)
- 2021-2023  **Men Firefighters, Municipal Structure Fire** Structure Fires Exposure-Male firefighters: Differential Metabolic Profiles by Hispanic Ethnicity Among Male Tucson Firefighters
- Developed an analytical pipeline for metabolomics studies
 - Analyzed 100 firefighter samples for ethnicity-specific metabolic profiles
 - Identified biomarkers for differential exposure by Hispanic ethnicity
 - Presented findings at the 2022 Arizona Cancer Center Retreat
 - Lead authored a manuscript accepted by *Metabolomics*
 - Co-authored a manuscript published on *Scientific Report*

Research Experience (continued)

Arizona Healthcare, Emergency Response, and Other Essential workers Surveillance Study


2023-2024  **Long COVID** Proteomic Profiling to Investigate Biomarkers and Biological Functions Associated with Long COVID in Frontline Workers in the United States (US)

- Led analytical team for proteomics analysis
- Processed and analyzed proteomics data from 130+ frontline and essential workers with long COVID
- Applied bioinformatics techniques to map 20+ significant biological pathways
- Lead author for a manuscript currently under CDC clearance

 **COVID Breakthrough** Serum Proteomics in Omicron SARS-CoV-2 breakthrough: a nested case-control study within a prospective cohort of frontline workers from eight locations in the United States (US)


- Assisted in proteomics analysis for 100+ breakthrough cases to identify risk factors for Omicron breakthrough
- Contributed to a manuscript currently under CDC clearance

Prostate Cancer risk factors among Prostate Cancer (PCa) Patients

2024  **PCa risk** Evaluating Differential Metabolic Profile by Prostate Cancer Risk among Prostate Cancer Patients

- Collaborated with Chemical Analytics team and collected metabolic data from 22 prostate cancer patients
- Identified metabolites and metabolic functions significantly associated with high-risk prostate cancer
- Lead author for the manuscript under development


Particulate Matter (PM) Exposure among Female Fish Smokers in Ghana

2020  **PM** Evaluating real-time exposure to PM and carbon monoxide of female fish smokers; assess exposure-reducing efficiency of newly developed stove as compared to the traditional stove; evaluate the validity of using CO as a exposure proxy for PM

- Led fieldwork for real-time monitoring of PM and CO in 120+ households in Ghana.
- Evaluated the effectiveness of newly developed stoves regarding reduction of PM exposure
- Demonstrated the validity of using CO as a proxy for PM in over 100 exposure assessments
- Community-based research & report back to study participants

Presentations & Media

Presentations

2025  Changes in Metabolic Profile by Wildland Urban Interface Fire (WUI) Exposure in Firefighters & Mice, One Helah 2025 Winter Symposium, University of Arizona.

2024  Differential Metabolic Profiles by WUI Fires: A Comparison With Structure Fires, FFCCS Data Brown Bag Meeting, University of Arizona.

Presentations & Media (continued)

- Differential Metabolic Profiles by Hispanic Ethnicity in Male Structure Firefighters, ISEE 2024 - 36rd Annual Conference of the International Society for Environmental Epidemiology, accepted.
- 2022 ■ Differential Metabolites by Structure Fire Exposure in Male Firefighters, Arizona Cancer Center Scientific Retreat, University of Arizona.

Media

- 2024 ■ **Graduate student using data analysis to protect firefighters from cancer**, Health Sciences, University of Arizona.

Statistics & Data Science Projects

Statistical Techniques




- 2022 ■ **Applied Biostatistics**
 - longitudinal analysis
 - survey analysis
 - matching analysis
 - Survival analysis
 - categorical data analysis
 - high-dimensional data analysis

Data Science Projects



- 2024 ■ **COVID-19 Vaccine Efficacy Visualization, 2020-2024**
 - URL: <https://tuoliu.shinyapps.io/COVID-Vaccine-Efficacy-US/>
 - Built a Shiny application with R to explore covid-related mortality in the United States of America, 2020-2024.
- **US COVID progression, 2019-2023**
 - URL: <https://tuoliu.shinyapps.io/covid-progression-in-the-us/>
 - Built a Shiny application with R to explore the progression of COVID in the United States of America at county level, 2019-2023.
- 2023 ■ **Arizona Pesticide Usage Map, 1992-2016**
 - URL: <https://tuoliu.shinyapps.io/Arizona-Pesticide-Usage-Map/>
 - Built a Shiny application with R to explore pesticide use in the State of Arizona, 1992-2016.
 - Visualized pesticide usage with an interactive map & chart using Leaflet & Plotly.
- 2020 ■ **Exploring neighborhoods & Chinese Restaurants in Toronto**
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 - Defined a business problem, searched for open source data to answer the question.
 - Applied machine learning algorithms to identify biomarkers related to Hispanic ethnicity.
 - Used Foursquare API to compare different neighborhoods of Toronto to evaluate the distribution of Asian & Chinese restaurants.
 - Determined which neighborhood is most suitable for starting a new Chinese restaurant.

Miscellaneous Experience





Mentorship and Teaching

- May-Aug, 2024  **Graduate-Mentor for the Undergraduate Research Opportunities Consortium (UROC)-Summer Research Institute (SRI)**, University of Arizona.
- 2022-2024  **Volunteer for Graduate Orientation**, University of Arizona.
- 2025  **Teaching Assistant, Principles of Public Health**, University of Arizona.

Certification

- 2024  **Deep Learning Specification**. Awarded by Coursera.
- 2020  **IBM Data Science Professional Certificate**. Awarded by Coursera.

Skills

- Languages  Strong reading, writing and speaking, work fluent in English, native in Mandarin Chinese.
- Coding  Python, R, SQL, \LaTeX , ...
- Databases  MySQL, PostgreSQL.
- Misc.  Academic research, statistical analysis, fisherman weightlifting expert.

References

Available on Request