


Tuo Liu, Ph.D.

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Education

- 2021 – 2025  **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 rain-water.*

Employment History


- 2025.6 – Present  **Postdoc-Research Associate.** Department of Population and Public Health, University of Southern California, USA.
- 2022.8 – 2025.5  **Research Associate.** Department of Community, Policy, and Environment, University of Arizona, USA.
- 2021.8 – 2022.8  **Research Assistant.** Department of Community, Policy, and Environment, University of Arizona, USA.
- 2021  **Research Assistant.** SCIES, China.
- 2019  **Research Assistant (Summer 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 **T. Liu**, M. A. Furlong, J. M. Snider, D. I. Walker, and J. L. Burgess, “Evaluating differential metabolic profile by wildland-urban-interface (wui) fire exposure: A comparison with structure fire (msf),” *Environmental Health*, 2025, Q1.  DOI: 10.1186/s12940-025-01239-7
- 2 **T. Liu**, D. Stea, M. A. Furlong, and J. L. Burgess, “Proteomic profiling towards understanding long covid in frontline and essential workers: A prospective cohort study,” *BMJ Global Health*, 2025, Q1, internal review.

- 3 **T. Liu**, J. Hollister, K. J. Kern, M. Valenti, S. Beitel, J. J. Gulotta, S. A. Jahnke, H. Buren, J. Haseney, B. O'Neill, C. S. Clair, Y. Liu, F. von Hippel, C. E. Mullins, D. I. Walker, J. M. Goodrich, J. L. Burgess, and M. A. Furlong, "Differential metabolic profile by training fire exposure in female firefighters," *International Journal of Hygiene and Environmental Health*, 2025, Q1, peer review.
- 4 **T. Liu**, M. A. Furlong, J. M. Snider, M. Tfaily, C. Itson, S. C. Beitel, J. Gulotta, K. Parsawar, K. Keck, J. Galligan, D. I. Walker, J. Goodrich, and J. Burgess, "Differential metabolic profiles by hispanic ethnicity among male tucson firefighters," *Metabolomics*, 2025, Q2.  DOI: 10.1007/s11306-024-02198-9
- 5 **T. Liu**, J. Roorkeewal, M. Furlong, S. Beitel, J. L. Burgess, B. R. Lee, J. Chipollini, J. M. Snider, and K. Batai, "Evaluating differential metabolic profile by prostate cancer risk among prostate cancer patients," *Metabolites*, 2025, Q2.  DOI: 10.3390/metabo15120757
- 6 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," *PLoS ONE*, 2025, Q2, peer review.
- 7 R. Ramos, P. L. Ramirez, R. S. Wagoner, **T. Liu**, J. Hoover, K. Ernst, M. Arora, J. McLelland, N. Z. Lothrop, and M. Furlong, "Extreme heat exposure during pregnancy and birth outcomes: A review of epidemiological evidence and policy implications," *In prep*, 2025.
- 8 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 in firefighters," *Environmental Research*, 2024, Q1.  DOI: 10.1016/j.envres.2025.121766
- 9 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. 20872, 2023, Q1.  DOI: 10.1038/s41598-023-47799-x

Conference

- 1 **T. Liu**, "Differential metabolite expressions in firefighters by fireground exposure: A comparative metabolomics analysis.," in *2025 AIHA Arizona Local Section-Spring PDC*, Tucson, US, 2025.
- 2 **T. Liu** and M. Furlong, "Variations in urine metabolome pre- and post-fire in women firefighters," in *Proceedings of the Joint Annual Meeting of the International Society of Exposure Science and the International Society for Environmental Epidemiology (ISES-ISEE 2025)*, accepted, Atlanta, US, 2025.
- 3 R. Wagoner, A. Yang, R. Ramos, **T. Liu**, and M. Furlong, "Residential herbicide exposure and eclampsia risk during pregnancy," in *Proceedings of the Joint Annual Meeting of the International Society of Exposure Science and the International Society for Environmental Epidemiology (ISES-ISEE 2025)*, Atlanta, US, 2025.

Research Experience

Firefighter Cancer Cohort Study (FFCCS)


- 2025 ■ **Women Firefighters, Training Fire** Differential Metabolic Profile by Training Fire Exposure in Female Firefighters
- Conducted **differential expression analysis** on 204 urine samples to compare metabolic profiles across firefighter groups.
 - Identified metabolic signatures potentially associated with training fire exposure in female firefighters.
 - Lead author for a manuscript (under peer review with *International Journal of Hygiene and Environmental Health*).
- 2024 ■ **Men Firefighters, Wildland-Urban-Interface Fire** Evaluating Differential Metabolic Profiles by Wildland-Urban-Interface (WUI) Fire Exposure: A Comparison with Municipal Structure Fires (MSF)
- Analyzed N=85 urine samples to identify **WUI-specific metabolic changes**.
 - Integrated metabolomics datasets for comparative analysis across fire types.
 - Presented findings at the 2024 FFCCS Brown Bag meeting.
 - Lead author for a manuscript (under peer review with *Environmental Health*).
- 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 with firefighter cohorts.
 - Metabolic profiling 100 urine samples to find Hispanic **ethnicity-specific metabolic profiles** in response to fire exposure.
 - 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*.

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

- 2023-present ■ **Long COVID** Proteomic Profiling to Investigate Biomarkers and Biological Functions Associated with Long COVID in Frontline Workers in the United States (US)
- Developed an analytical **pipeline** for proteomics with firefighters.
 - **Led** the analytical team, processing and analyzing proteomics data from 130+ frontline workers with long COVID.
 - Identified inflammatory and oxidative markers and pathways associated with long COVID.
 - Lead author for 1 manuscript currently under internal review.
- 2023-2024 ■ **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
 - Coauthored a manuscript currently under peer review


Research Experience (continued)

Prostate Cancer risk factors among Prostate Cancer (PCa) Patients

2024-2025  **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 peer review with *Metabolites*





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.
-  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**

- Built a Shiny application with R to explore covid-related mortality in the United States of America, 2020-2024.

US COVID progression, 2019-2023

- 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**

- 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.

Expense Tracker


- Built a full-stack web application with Python, SQL, Streamlit, and MongoDB to track monthly expenses.
- Implemented user authentication, data visualization, and responsive design for an enhanced user experience.

2020 **Exploring neighborhoods & Chinese Restaurants in Toronto**


- Defined a business problem, searched for open source data to answer the question.
- Used Foursquare API to compare different neighborhoods of Toronto to evaluate the distribution of Asian & Chinese restaurants.
- Applied K-means clustering to identify hotspot for new restaurant.
- 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.**

Miscellaneous Experience (continued)

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