Tuo Liu, Ph.D. candidate

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Education

2021 – Present **Ph.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 Dvonch
Thesis title: *Real-time personal exposure to PM2.5 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 O^{18}/O^{16} 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.

Research Experience

Firefighter Cancer Cohort Study (FFCCS)

2024 **Female Firefighters, Municipal Structure Fire** Evaluating Differential Metabolic Profiles by Structure Fire Exposure in Female Firefighters: A Comparison with Male Firefighters

- Conducted differential expression analysis using mass spectrometry and statistical tests on 107 urine samples from women firefighters who underwent municipal structure fire exposure
- Developed and validated statistical models to compare metabolic profiles across firefighter groups
- more results under way

Research Experience (continued)

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 profiles
- Integrated metabolomics datasets for comparative analysis
- Presented findings at the 2024 FFCCS Brown Bag meeting
- Drafted a manuscript as lead author (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 currently accepted by *Metabolomics*
- Co-authored a manuscript published on *Scientific Report*

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

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
- Contributed to a report and drafted a thesis that was reported back to participants

Publications

Journal Articles

1. M. A. Furlong, **T. Liu**, A. Jung, *et al.*, "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, *et al.*, "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, *et al.*, "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, *et al.*, "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.

Presentations & Media

Differential Metabolic Profiles by WUI Fires: A Comparison With Structure Fires

2024   **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.

Differential Metabolites by Structure Fire Exposure in Male Firefighters

2022   **Arizona Cancer Center Scientific Retreat**, University of Arizona.

Graduate student using data analysis to protect firefighters from cancer

2024   **University of Arizona Health Sciences Office of Communications**, 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 web application using Streamlit.
- Connected to and stored customer data in NoSQL database from deta.
- Visualized personal expense with an interactive Sankey chart using Plotly.

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

- 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

Awards and Achievements

2023 **One Health GRA Award: $50,000 (MEZCOPH)**, University of Arizona.

2021 **Dean Named Scholarship, $10,000**, University of Arizona.

Mentorship and service

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.

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