Xinyu (Cynthia) Tang

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EDUCATION

Ph.D. in **Nutritional Biology**	University of California, Davis	2019 - 2024

Dissertation: Unraveling Glycosylation Alterations in Alzheimer's Disease through Multi-Omics Analysis

M.S. in **Epigenetic Nutrition**	University of Illinois, Urbana-Champaign	2016 - 2018

Thesis: Epigenetic regulation of genes related to lipid metabolism by microRNA in mice fed high fat diet

B.E. in **Food Science & Engineering**	Zhejiang University, China	2013 - 2017

RESEARCH EXPERIENCE

Graduate Student Researcher	University of California, Davis	2020 - Present

- **Glycosylation in human brains with AD**
  - Summarized the differential expression of over 200 identified glycosyltransferases involved in 15 distinct glycosylation pathways using postmortem samples from seven brain regions.
  - Investigated glycosylation changes in postmortem brains of Alzheimer's individuals through a comprehensive analysis of transcriptomic and glycomic data.
  - Identified potential transcription factors governing glycosyltransferases by employing innovative TF binding motif enrichment analysis via R.
- **Glycosylation signature in human microglia activated by AβO**
  - Revealed distinct impacts of AβO and LPS on N-glycan patterns on human iPSC microglia by optimizing the data analysis strategy of glycomic data.
  - Highlighted the consistency between the expression of glycosyltransferases and alterations in glycan structures by integrating glycomic and transcriptomic data.
- **Potential of serum glycoprotein as biomarker for AD diagnosis**
  - Identified potential serum glycan biomarkers for Alzheimer's Disease through a Partial Least Square-Linear Discriminant Analysis (PLS-LDA) analysis of glycosylation panels.

- Highlighted the importance of ethnicity, sex, age, and BMI as a variable contributing to variability in glycan profiles using various multivariate linear regression models.

- **Dietary impact on HDL protein glycosylation**
  - Examine changes in the glycoproteins on HDL particles in subjects following 4-week monosaccharide supplementation intake.
  - Demonstrated the influence of short-term dietary supplementation with monosaccharides on the glycosylation patterns of HDL proteins.
- **Lipid profile associated with HDL particle size**
  - Explored the lipid composition of the separated plasma fractions using semi-quantitative LC-MS/MS-based lipidomics, which quantifies over 600 lipid species across various lipid classes.
  - Developed a robust lipidome processing pipeline to accurately quantify the lipid composition within distinct lipoprotein particle fractions.
- **HDL particle count and quantification in TEM image**
  - Implemented and enhanced the YOLO (You Only Look Once) object detection system in python as a replacement for the existing computational tool in the recognition and analysis of Transmission Electron Microscopy (TEM) images, achieving an accuracy rate of 96% on the validation dataset.

Graduate Research Mentor University of California, Davis 2021 - Present

- **Jea Woo Kang, PhD**: Analysis and visualization of metabolomic and metabolomic data for the USANA fiber supplementation study.
- **Brian Hong, PhD**: Statistical analysis of the Ghana study
- **Eddie Romo, PhD candidate**: Statistical analysis on LCAT activity in participants from the USANA fiber supplementation study.
- **Jingyuan Jack Zheng, PhD candidate**: Lipoprotein particle detection and quantification on TEM images utilizing deep learning.
- **Jingyuan Jack Zheng, PhD candidate**: Visualization of HDL proteomic data in batches.
- **Yanshan Jin, PhD student**: Table design for clinical data collection.

Graduate Student Researcher University of Illinois at Urbana-Champaign 2016 –2018

- **Epigenetic regulation of lipid metabolism in mice fed HFD**
  - Investigated the impact of a high-fat diet on the epigenetic regulation of lipid metabolism and amino acid response pathway in mouse adipose tissues using qPCR, western blot, and ChIP technology.

- Reviewed and enhanced the protocol for protein immunoblotting in the laboratory, optimizing experimental procedures and ensuring the accuracy and reliability of protein analysis.

TEACHING AND MENTOR EXPERIENCE

Graduate Teaching Assistant University of California, Davis 2019 - Present

- NUT117 (Experimental Nutrition)
- NUT116B (Clinical Nutrition)
- NUT 10 (Discoveries and Concepts in Nutrition)

PUBLICATIONS

1. **Tang X**, Tena J, Di Lucente J, Maezawa I, Harvey DJ, Jin L-W, Lebrilla CB, Zivkovic AM (2023) Transcriptomic and glycomic analyses highlight pathway-specific glycosylation alterations unique to Alzheimer's disease. Sci Rep 13:7816

2. Jin L-W, Di Lucente J, Ruiz Mendiola U, **Tang X**, Zivkovic AM, Lebrilla CB, Maezawa I (2023) The role of FUT8-catalyzed core fucosylation in Alzheimer's amyloid-β oligomer-induced activation of human microglia. Glia 71:1346–1359

3. Hong B V, Agus JK, **Tang X**, Zheng JJ, Romo EZ, Lei S, Zivkovic AM (2023) Precision Nutrition and Cardiovascular Disease Risk Reduction: The Promise of High-Density Lipoproteins. Curr Atheroscler Rep 25:663–677

4. Hong B V, Rhodes CH, Agus JK, **Tang X**, Zhu C, Zheng JJ, Zivkovic AM (2023) A single 36-h water-only fast vastly remodels the plasma lipidome. Front Cardiovasc Med 10

5. Hong B V, Zheng JJ, Romo EZ, Agus JK, **Tang X**, Arnold CD, Adu-Afarwuah S, Lartey A, Okronipa H, Dewey KG, others (2023) Seasonal factors are associated with activities of enzymes involved in high-density lipoprotein metabolism among pregnant women in Ghana. Curr Dev Nutr 102041

6. Rhodes CH, Zhu C, Agus J, **Tang X**, Li Q, Engebrecht J, Zivkovic AM (2023) Human fasting modulates macrophage function and upregulates multiple bioactive metabolites that extend lifespan in Caenorhabditis elegans: a pilot clinical study. Am J Clin Nutr 117:286–297

7. Tena J*, **Tang X***, Zhou Q, Harvey D, Barajas-Mendoza M, Jin L-W, Maezawa I, Zivkovic AM, Lebrilla CB (2022) Glycosylation alterations in serum of Alzheimer's disease patients show widespread changes in N-glycosylation of proteins related to immune function, inflammation, and lipoprotein metabolism. Alzheimer's Dement Diagnosis, Assess Dis Monit 14:e12309

8. **Tang X,** Wong M, Tena J, Zhu C, Rhodes C, Zhou Q, Vinjamuri A, Oloumi A, Boddu S, Luxardi G, others (2022) Quantitative glycoproteomics of high-density lipoproteins. RSC Adv 12:18450–18456

9. Hong B V, Zheng J, Agus JK, **Tang X**, Lebrilla CB, Jin LW, Maezawa I, Erickson K, Harvey DJ, DeCarli CS, others (2022) High-Density Lipoprotein Changes in Alzheimer's Disease Are APOE Genotype-Specific. Biomedicines 10:1495

10. Kang JW, **Tang X**, Walton CJ, Brown MJ, Brewer RA, Maddela RL, Zheng JJ, Agus JK, Zivkovic AM (2022) Multi-Omic Analyses Reveal Bifidogenic Effect and Metabolomic Shifts in Healthy Human Cohort Supplemented With a Prebiotic Dietary Fiber Blend. Front Nutr 9:908534

11. Zheng JJ, Agus JK, Hong B V., **Tang X,** Rhodes CH, Houts HE, Zhu C, Kang JW, Wong M, Xie Y, Lebrilla CB, Mallick E, Witwer KW, Zivkovic AM (2021) Isolation of HDL by sequential flotation ultracentrifugation followed by size exclusion chromatography reveals size-based enrichment of HDL-associated proteins. Sci Rep 11. doi: 10.1038/s41598-021-95451-3

12. Hernández-Saavedra D, Moody L, **Tang X**, Goldberg ZJ, Wang AP, Chen H, Pan Y-X (2021) Caloric restriction following early-life high fat-diet feeding represses skeletal muscle TNF in male rats. J Nutr Biochem 91:108598

13. Zhu C, Sawrey-Kubicek L, Bardagjy AS, Houts H, **Tang X**, Sacchi R, Randolph JM, Steinberg FM, Zivkovic AM (2020) Whole egg consumption increases plasma choline and betaine without affecting TMAO levels or gut microbiome in overweight postmenopausal women. Nutr Res 78:36–41

14. Ma L, Xu GB, **Tang X**, Zhang C, Zhao W, Wang J, Chen H (2020) Anti-cancer potential of polysaccharide extracted from hawthorn (Crataegus.) on human colon cancer cell line HCT116 via cell cycle arrest and apoptosis. J Funct Foods 64:103677

PRESENTATIONS

1. **Tang X**, Lebrilla CB, Jin L-W, Maezawa I, Harvey DJ, Zivkovic AM "Distinct glycosylation changes in Alzheimer's Aβ oligomer- and lipopolysaccharide-activated human microglia" (poster) AD/PD 2024

2. **Tang X**, Lebrilla CB, Jin L-W, Maezawa I, Harvey DJ, Zivkovic AM "Unique N-glycosylation signatures in Aβ oligomer- and lipopolysaccharide-activated human iPSC-derived microglia" (poster) Alzheimer's Disease Research Center Symposium 2023

3. **Tang X**, Lebrilla CB, Jin L-W, Maezawa I, Harvey DJ, Zivkovic AM "Multi-omics approach reveals disturbances in brain phosphatidylcholine metabolism in Alzheimer's Disease." (poster) Alzheimer's Association International Conference 2023

4. **Tang X**, Lebrilla CB, Jin L-W, Maezawa I, Harvey DJ, Zivkovic AM "Brain Glycosylation Alterations are Highly Pathway-Specific and Unique to Alzheimer's Disease" (oral) Graduate Group of Nutritional Biology Symposium 2022

5. **Tang X**, Lebrilla CB, Jin L-W, Maezawa I, Harvey DJ, Zivkovic AM "N-glycosylation patterns dramatically changed in brains of AD patients" (poster) Alzheimer's Disease Research Center Symposium 2022

6. **Tang X**, Lebrilla CB, Jin L-W, Maezawa I, Harvey DJ, Zivkovic AM "Cell-type deconvolution analysis of RNAseq data reveals cell-specific glycosylation changes in the brains of Alzheimer's Disease patients." (poster) Alzheimer's Association International Conference 2022

7. **Tang X**, Lebrilla CB, Jin L-W, Maezawa I, Harvey DJ, Zivkovic AM "Brain-region-specific, glycosylation-related transcriptomic alterations in Alzheimer's disease." (poster) Alzheimer's Association International Conference 2021

8. **Tang X**, Xu G, Pan Y-X, Chen H "Epigenetic Regulations of Genes Related to Lipid Metabolism by MicroRNA in Mice Fed High Fat Diet." (poster) ASBMB annual meeting 2018

9. **Tang X**, Moody L, Chen H, Pan Y-X "CCAAT/Enhancer Binding Protein Beta (C/EBPβ) gene expression is regulated by epigenetic mechanisms in human colon cancer cells." (poster) Experimental Biology 2017

SKILLS

Programming: R, python, SQL

Data analysis on glycomics, glycoproteomics, transcriptomics, lipidomics, metabolimics, metagenomics

Deep learning: YOLO, object detection

Other technical skills: High-Performance Computing (HPC), Linux, Git

AWARDS

2023 Mar Family Dissertation Year Fellowship, UC Davis

2023 Carpenter Travel Award, UC Davis

2023 Rucker Family Fellowship Award, UC Davis

2023 Graduate Studies: Travel Awards, UC Davis

2020-2022 Jastro award, UC Davis

2018 Graduate College Conference Travel Awards, UIUC

2017 Elizabeth Jeffery Travel Award, UIUC

2017 Kathryn Van Aken Burns Memorial Fund Merit Award, UIUC

2014-2015 Scholarship for outstanding Merits, Zhejiang University

Statement of Research Interests

Xinyu (Cynthia) Tang

I'm a fifth-year Ph.D. candidate in the Graduate Group of Nutritional Biology at the University of California, Davis, expected to graduate in June 2024. My research has focused on the implications of glycosylation on Alzheimer's disease (AD) using bioinformatics and computational methods.

Dissertation research: My dissertation focused on uncovering the intricate pathology of Alzheimer's disease (AD), identifying precise biomarkers for early AD diagnosis, and investigating the potential dietary impacts in AD outcomes, with a special emphasis on glycosylation using glycomics, glycoproteomics, and transcriptomics approaches.

Collaboration on Lab Projects: Beyond my primary research, I contributed to my labmates' work by assisting with processing and analyzing metagenomics, metabolomics, and lipidomics data. Furthermore, I collaborated with them to develop an object detector based on a pre-trained YOLO object detection system to accurately detect high-density lipoprotein (HDL) particles from hundreds of TEM images.

Passion Meets Expertise: My Ph.D. research has deepened my understanding of AD and underscored the critical role of bioinformatics and computational approaches in deciphering challenging diseases. With a diverse background in processing and analyzing data from various sources such as transcriptomes, glycans, glycoproteomes, lipidomes, metabolomes, and metagenomes, I have acquired expertise in bioinformatics and computational biology. Additionally, my strong skills in scientific writing, communication, and presentation enable me to effectively bridge the gap between computational analysis and biological interpretation. The position at Sirota's lab aligns well with my expertise and passions. I believe I am well-suited to contribute to the lab.

Future Research Direction

In the past few years, a significant shift has occurred in the generation of biomedical information. Advances in high-throughput screening technology and the establishment of digital biomarker platforms have enabled a steady increase in the volume of data that can be acquired from disease samples. The vast amount of data holds promises for deeper and more systematic insights into challenging diseases, such as Alzheimer's disease. However, the vast amount of data can overwhelm and hinder the extraction of meaningful information. While contemporary data science and artificial intelligence techniques enable sophisticated analyses, they often struggle to evaluate outcomes and discern biologically significant patterns from irrelevant ones. My passion lies in bridging the gap between computational methodologies and biomedical disease research. Neurogenerative and other complex human diseases have been the focal point of my research, and I am eager to unravel their complexities.

I envision my future research spanning interdisciplinary areas of bioinformatics and human disease, intending to pursue the following research directions:

1) Mechanistic Insight into Diseases from Multi-Omics. Most human diseases are complex and multifaceted. Advances in multi-omics, including transcriptomics, proteomics, and glycomics, offer an unbiased view of disease pathogenesis. For example, characterizing alterations in the intra-uterine environment using these multi-omics approaches can provide insights into factors that contribute to embryonic development and preterm birth at specific stages.

2) Biomarkers in Precision Diagnoses. Changes in the uterus may be reflected by corresponding compounds in cervicovaginal fluid, potentially serving as biomarkers for predictive machine learning models. In addition to fluid biomarkers, biomedical images and digital biomarkers can also aid in identifying individuals at risk for certain diseases. I am interested in utilizing advanced deep learning models to improve the diagnostic process.

3) The Impact of the Maternal Uterine Environment and Brain Development in Preterm Births. Glycosyltransferases (GTs) in the transcriptome data are often overlooked in most studies due to the lack of systematic curation in mainstream pathway databases. Given my doctoral research focuses on glycosylation and its implications in Alzheimer's disease, I am keenly aware of the critical role glycosylation plays in brain development. Furthermore, I understand that dysregulated glycosyltransferase expression can directly affect phenotypic glycosylation changes. Exploring the potential association between the glycosylation in the intra-uterine environment and brain development in preterm births is an intriguing avenue for further investigation.

In summary, the postdoctoral position in Sirota's lab aligns perfectly with my expertise and career vision. I am excited about the professional environment and expertise in bioinformatics and computational approaches offered by Sirota's lab. I am eager to further explore the application of state-of-the-art computational methods in analyzing clinical data. I'm committed to not only meeting but exceeding the demands of this role, ensuring that I contribute meaningfully and significantly to your lab's groundbreaking research journey.

Reference List

Dr. Angela Zivkovic, PhD: amzivkovic@ucdavis.edu
Dr. Izumi Maezawa, PhD: imaezawa@UCDAVIS.EDU
Dr. Carlito Lebrilla, PhD: cblebrilla@ucdavis.edu