

HEMING ZHANG

✉ hemingzhang@wustl.edu  [heming-zhang.github.io](https://github.com/heming-zhang)  [Google Scholar](#)  [GitHub](#)

EDUCATION

Washington University in St. Louis — Ph.D. Candidate, Biomedical Informatics & Data Science <i>Large Reasoning Model, Agentic AI, Precision Medicine, Advised by Prof. Michael Province and Prof. Fuhai Li</i>	Aug 2021 – Present St. Louis, MO
Washington University in St. Louis — M.S., Computer Science <i>Drug Discovery, Explainable AI, Graph Neural Network, Co-advised by Prof. Yixin Chen and Prof. Fuhai Li</i>	Aug 2019 – May 2021 St. Louis, MO
University of British Columbia — Visiting International Research Student (VIRS), Computer Science <i>Funded by Mitacs Globalink (Top 0.5%), Decentralized Machine Learning, Advised by Prof. Ivan Beschastnikh</i>	June 2018 - Oct 2018 Vancouver, BC
Central China Normal University — B.S., Information Systems <i>Ranked 1st Among 44, Boya Plan Student (Top 1.5%)</i>	Sept 2015 – Jun 2019 Wuhan, China

PAPERS

- **OmniCellTOSG: The First Cell Text-Omic Signaling Graphs Dataset for Joint LLM and GNN Modeling**  
Heming Zhang*, Tim Xu*, Dekang Cao*, Shunning Liang, Lars Schimmelpfennig, Levi Kaster, Di Huang, Carlos Cruchaga, etc., Philip Payne, Fuhai Li
Preprint, Oct 2025
- **GALAX: Graph-Augmented Language Model for Explainable Reinforcement-Guided Subgraph Reasoning in Precision Medicine**  
Heming Zhang, Di Huang, Wenyu Li, Michael Province, Yixin Chen, Philip Payne, Fuhai Li
Preprint, Sept 2025
- **BioMedGraphica: An All-in-One Platform for Biomedical Prior Knowledge and Omic Signaling Graph Generation**  
Heming Zhang*, Shunning Liang*, Tim Xu*, Wenyu Li, Di Huang, Yuhang Dong, etc., Carlos Cruchaga, Yixin Chen, Michael Province, Philip Payne, Fuhai Li
Preprint, Sept 2025
- **OmniCellAgent: Towards AI Co-Scientists for Scientific Discovery in Precision Medicine** 
Di Huang*, Hao Li*, Wenyu Li*, **Heming Zhang***, etc., Carlos Cruchaga, Michael Province, Yixin Chen, Philip Payne, Fuhai Li
Preprint, Aug 2025
- **M3NetFlow: a novel multi-scale multi-hop modular graph AI model for multi-omics data integration and signaling network inference**  
Heming Zhang, Peter Goedgebuure, Li Ding, William Hawkins, David DeNardo, Ryan Fields, Yixin Chen, Fuhai Li
iScience, 2025
- **GraphSeqLM: A Unified Graph Language Framework for Omic Graph Learning**  
Heming Zhang, Di Huang, Yixin Chen, Fuhai Li
WWW 2025
- **mosGraphFlow: a novel integrative graph AI model mining disease targets from multi-omic data**  
Heming Zhang, Dekang Cao, Tim Xu, Emily Chen, Guangfu Li, Yixin Chen, Philip Payne, Michael Province, Fuhai Li
BMC Methods, 2025
- **Using DeepSignalingFlow to mine signaling flows interpreting mechanism of synergy of cocktails**  
Heming Zhang, Yixin Chen, Philip R Payne, Fuhai Li
NPJ Systems Biology and Applications, 2024
- **mosGraphGen: a novel tool to generate multi-omic signaling graphs to facilitate integrative and interpretable graph AI model development**  
Heming Zhang*, Dekang Cao*, Zirui Chen, Ziyuan Zhang, Yixin Chen, Cole Sessions, etc., Guangfu Li, Michael Province, Fuhai Li
Bioinformatics Advances, 2024
- **Interpreting the Mechanism of Synergism for Drug Combinations Using Attention-Based Hierarchical Graph Pooling** 
Zehao Dong, **Heming Zhang**, Yixin Chen, Philip R Payne, Fuhai Li
Cancers, 2023
- **Predicting anti-cancer drug response with deep learning constrained by signaling pathways**  
Heming Zhang, Yixin Chen, Fuhai Li
Frontiers in Bioinformatics, 2021
- **Investigate the relevance of major signaling pathways in cancer survival using a biologically meaningful deep learning model**  
Jiarui Feng, **Heming Zhang**, Fuhai Li
BMC Bioinformatics, 2020
- **Predicting Tumor Cell Response to Synergistic Drug Combinations Using a Novel Simplified Deep Learning Model**  
Heming Zhang, Jiarui Feng, Amanda Zeng, Philip Payne, Fuhai Li
AMIA 2020 (Oral Presentation)

PROJECTS

Develop an AI Co-Scientist for Scientific Reasoning in Biomedicine <i>Funded by NLM R01 LM013902; NIA R21 AG078799; NIA R56 AG065352; NINDS RM1 NS132962</i> – Design and improve OmniCellAgent—built on BioMedGraphica and Graph-Language Foundation Models (GLFMs)—integrating data querying, GLFM inference, and explanation generation in a closed loop to produce interpretable hypotheses (e.g., target prioritization, drug-combination suggestions). – Finetune the agent orchestrator to enhance task planning using reinforcement learning with reward modeling. – Establish a benchmark using expert knowledge, literature alignment, and human feedback to evaluate scientific reasoning in biomedical agentic AI.	April 2025 – Present
Biomedical AI Ecosystem for Multi-Omics Integration and Analysis <i>Funded by NLM R01 LM013902; NIA R21 AG078799; NIA R56 AG065352; NINDS RM1 NS132962</i> – Preprocess DNA methylation data based on CpG sites, then fuse multi-omics (epigenomic/genomic/transcriptomic/proteomic) into a signaling graph by mosGraphGen to generate a graph-AI ready dataset. – Build BioMedGraphica, an all-in-one platform that harmonizes biomedical nomenclature across fragmented resources and, from user-specified inputs, auto-generates a Text-Numeric Graph (TNG)—a novel data format bridging textual biological priors with quantitative features—to develop Graph-Language Foundation Models (GLFMs). To facilitate broad adoption, the platform is released as an public web interface. – Release two ontology-standardized, distribution-calibrated TNG datasets: (1) OmniCellTOSG for single-cell data (CellxGene, GEO, BrainCellAtlas) and	Feb 2024 – Present

- (2) **MOTASG** for bulk omics data (TCGA, DepMap, Synapse), enabling GLFMs pretraining and benchmarking downstream tasks for disease classification, survival prediction, CRISPR essentiality, drug response, and cell-type annotation.
- Enable interpretability via attention-based attribution or reinforcement-guided subgraph reasoning for mechanistic insights.

AI for Aging and Longevity: Integrating Omics and Phenotypic Data

June 2023 – Present

Funded by NIA R56 AG065352; research using the Long Life Family Study (LLFS) cohort

- Curate and preprocess **LLFS** records (**1,405** patients; **122** sub-features across **41** groups) and stratify labels into **187** pre-T2D, **123** T2D, and **1,095** no-T2D.
- Introduce a novel graph AI framework **Graph in Graph (GiG)** to embed omics signaling graphs into a person–phenotype graph to fuse clinical, demographic, and molecular modalities while handling sparsity and mixed data types. Meanwhile, we integrate **GWAS** information by projecting variant-level signals to genes and fusing them into the signaling graph.
- Provide interpretability via attention weights and pooled-subgraph rationales, highlighting key clinical features, signaling genes, and pathways.

Graph AI for Precision Medicine in Lower Urinary Tract Symptoms (LUTS)

Oct 2021 – Sept 2023

Supported by NIDDK U01 DK100017-09; research based on the Lower Urinary tract dysfunction Research Network (LURN) cohort

- Curate and preprocess LURN cohort (**1,053** patients, **208** sub-features across **60** characteristic groups) spanning demographics, surveys, treatments, and comorbidities. Also, we used 2 standards to split overactive bladder (OAB) medication responders, defining response labels with medication-timing rules: Level 1 (87 responders / 47 non-responders) and Level 2 (65 responders/ 69 non-responders).
- Build **LUTSPheNet**, a graph AI framework that models patient–phenotype relations to predict OAB medication response in LUTS, achieving best predictive performance than baseline models.

Pathway-Constrained Deep Learning for Precision Oncology and Drug Discovery

Feb 2020 – Aug 2024

Funded by Children’s Discovery Institute (CDI) M-II-2019-802; startup support from I2DB and the Department of Pediatrics, WashU

- Build pathway-constrained models that link genes to **46 cancer signaling pathways**, using **CCLE** with **GDSC** responses, **NCI ALMANAC** drug-combination screens, and **TCGA** multi-omics plus clinical data.
- Predict **single-drug response**, **drug-combination synergy**, and **patient survival** with biologically grounded, interpretable outputs at the pathway level.
- Achieve consistent gains over vanilla DNN baselines while highlighting candidate mechanisms and targets to guide precision oncology.

PROFESSIONAL EXPERIENCE

Research Assistant

Feb 2020 – Present

Institute for Informatics, Data Science and Biostatistics, Washington University School of Medicine

St. Louis, MO

- Build an AI Co-Scientist for Autonomous Scientific Reasoning in Biomedicine
- Develop biomedical AI ecosystem for interpretable multi-omics integration and discovery

Teaching Assistant

Jan 2023 – May 2023

BMDS 5305: Introduction to Biomedical Data Science II, Washington University School of Medicine

St. Louis, MO

- Delivered two hands-on lectures covering basic neural networks, convolutional neural networks, and graph neural networks.
- Held weekly TA hours; guided students on assignments and final projects.

Teaching Assistant

Jan 2020 – May 2020

CSE 417T: Introduction to Machine Learning, Department of Computer Science & Engineering, Washington University in St. Louis

St. Louis, MO

- Ran office hours to clarify lecture content and problem sets.
- Supported implementations of PLA, logistic regression, bagged trees/random forest, and AdaBoost.

Visiting International Research Student (VIRS)

Jul 2018 – Oct 2018

Department of Computer Science & Center for Decision-Making and Action, University of British Columbia

Vancouver, BC

- Awarded **Mitacs Globalink Research Internship** (\$4,500).
- Prototyped a privacy-preserving, decentralized blockchain workflow for distributed machine learning.

ACADEMIC SERVICE

Workshop

- Stanford Graph Learning Workshop 2025, Stanford, CA

Invited Talk

- International World Wide Web Conference 2025, Sydney, Australia
- 12th International Conference on Intelligent Biology and Medicine (ICIBM 2024), Huston, TX
- AMIA 2020 Virtual Annual Symposium, Chicago, IL (Transferred to virtual due to COVID-19)

Journal Reviewer

- Briefings in Bioinformatics
- Scientific Reports
- BMC Bioinformatics
- BMC Genomics
- NPJ Systems Biology and Applications
- Journal of Cheminformatics
- Discover Oncology
- Journal of Translational Medicine

AWARDS AND HONORS

Awards

- ICIBM 2024 Travel Award (2024, \$600)
- Mitcas Global Link Scholarship (2018, \$4,500)

Honors

- Outstanding Graduate, CCNU (2019, Top 20%)
- Grand Prize, Hubei Challenge Cup (2017, Top 3%)
- Boya Plan Student, CCNU (2016, Top 1.5%)