

Academic Experience

2026.06–2027.06	National University of Singapore	Visiting Student of School of Computing
Host Supervisor: Prof. Yang Zhang		
2024.08–Present	University of Macau	Ph.D. in Computer Science
Supervisor: Prof. Bob Zhang & Qianqian Song		
2021.09–2024.07	Beijing University of Technology	M.Eng. in Electronic Information
Supervisor: Prof. Yong Zhang & Baocai Yin		
2017.09–2021.07	Beijing Information Science and Technology University	B.Eng. in Robotics Engineering
Supervisor: Prof. Hongbo Huang		

Research Summary

My research focuses on **multimodal virtual cell modeling, phenotype-based drug discovery, and agent systems for scientific discovery**, with an emphasis on cell phenotype representation learning, cross-modal modeling, and research automation. I have published nine first-author papers, including two papers in Nature Communications, with 517 citations overall in [Google Scholar](#). Open-source projects have received 700+ stars in [GitHub](#).

[1] **Li B**, Zhang B, ..., Zhang Y, Song Q. PhenoProfiler: Advancing Phenotypic Learning for Image-based Drug Discovery. *Nature Communications*, 2026.

[2] **Li B**, Tang Z, ..., Su J, Song Q. SpaIM: Single-cell Spatial Transcriptomics Imputation via Style Transfer. *Nature Communications*, 2025.

[3] **Li B**, Zhang Y, ..., Wang G, Song Q. Gene Expression Prediction from Histology Images via Hypergraph Neural Networks. *Briefings in Bioinformatics*, 2024.

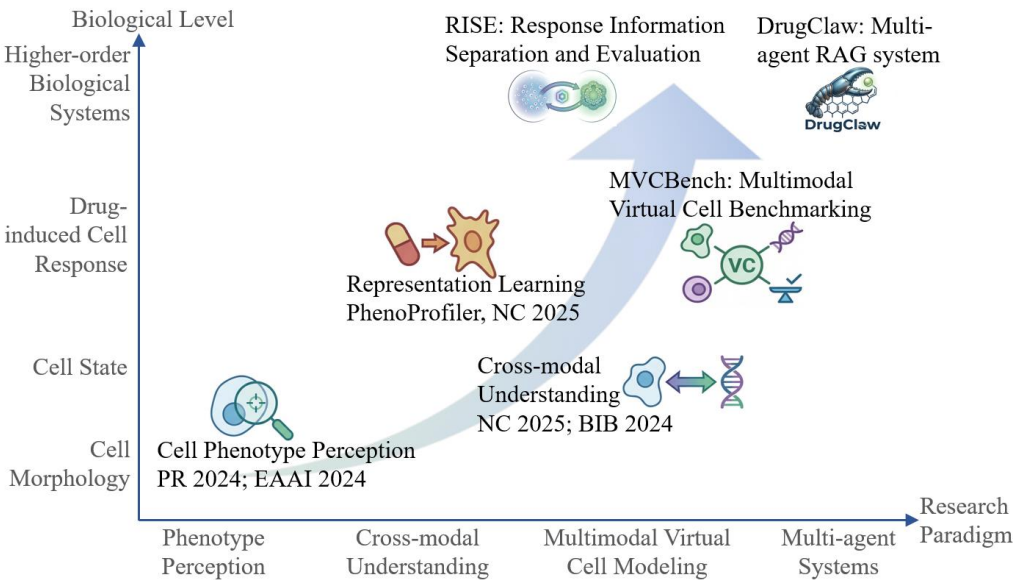
[4] **Li B**, ..., Yin B. Multi-scale Hypergraph-based Feature Alignment Network for Cell Localization. *Pattern Recognition*, 2024.

[5] **Li B**, Chen J, ..., Zhu Q, Bu H. Exponential distance transform maps for cell localization[J]. *Engineering Applications of Artificial Intelligence*, 2024.

[6] **Li B**, Zhang Y, ..., Zhang C, Yin B. Lite-UNet: a lightweight and efficient network for cell localization[J]. *Engineering Applications of Artificial Intelligence*, 2024.

[7] **Li B**, Zhang Y, ..., Piao X, Yin B. Hypergraph association weakly supervised crowd counting[J]. *ACM Transactions on Multimedia Computing, Communications and Applications*, 2023.

[8] **Li B**, ..., Song Q. MVCBench: A Multimodal Benchmark for Drug-induced Virtual Cell Phenotypes. *bioRxiv*, 2026.



Research Experience

DrugClaw: Multi-Agent System for Drug Knowledge Reasoning

2026.01–2026.05

- Developed a workflow-native agentic RAG system for drug research, aimed at traceable evidence integration, multi-step reasoning, and executable scientific workflows.
- Designed core modules for sandboxed code execution, multi-agent coordination, evidence synthesis, and confidence scoring; improved system reliability through input standardization, exception handling, and fallback design.
- Helped generalize the system into a reusable framework covering 57 skills and 15 drug-research task types, with ongoing efforts in entity normalization, molecular identifier expansion, and Web/API deployment.

Multimodal Virtual Cell Modeling and Benchmarking

2024.06–Present

- Investigated drug-induced cellular phenotypes through multimodal virtual cell modeling, with a focus on cross-modal alignment and the relationship between morphology, transcriptomics, and biological function.
- Built MVCBench to evaluate molecular and gene foundation models for virtual cell phenotype modeling.
- Explored phenotype representation learning in PhenoProfiler and autonomous virtual cell modeling in CellScientist, establishing a coherent research line from phenotype understanding to multimodal benchmarking.

Cell Image Understanding and Spatial Omics Modeling

2022.05–2024.08

- Worked on biomedical multimodal learning methods for linking images with molecular readouts, including spatial transcriptomics imputation and image-based gene expression prediction.
- Developed SpaIM, a style-transfer-based framework for single-cell spatial transcriptomics imputation.
- Introduced hypergraph neural networks to model higher-order structure in image-based gene expression prediction.

Service

- Open-Source:** Built and maintained open-source resources for AI virtual cell research; related projects have received **700+ GitHub stars** in total, including [Nature-Paper-Skills](#) and [Awesome-Virtual-Cell](#).
- Academic network:** Established research collaborations with universities in China and abroad, including the University of Florida, Cornell University, Sun Yat-sen University, and Sichuan University.
- Academic Service:** Reviewer for **Science Advances**, IEEE TIP/TNNLS/TCE/TSMCS, Medical Image Analysis, BMC Biology, EAAI, CAAI TIT, Artificial Intelligence Review, and Knowledge-Based Systems.

Patents

Co-inventor of three granted Chinese invention patents on cell image density map generation and cell localization methods (CN115457546A, CN115810046A, CN115457547A).

Honors

- UM:** Ph.D. Scholarship (2024).
- BJUT:** **National Scholarship** (2022); Beijing Outstanding Graduate (2024); Top 100 Graduates of Beijing University of Technology (2024); Xiaomi Scholarship (2023); First-Class Academic Scholarship (2022, 2023).
- BISTU:** **Beijing Outstanding Graduate** (2021); First Prize in S&T&I Scholarship (2021).

Skills

- Research Areas:** Multimodal representation learning, medical image analysis, spatial omics modeling, phenotype-based drug discovery, and virtual cell modeling and benchmarking.
- Research Systems and Agents:** Experienced in *multi-agent system design*, including *skill-based architectures*, *memory-augmented systems*, and *reusable workflow design* for scientific applications.
- Programming:** Python, PyTorch, CUDA, Linux.
- English:** CET-6, proficient in reading academic literature, scientific writing, and technical communication.