

Yusheng Liu

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Department of Materials Science and Engineering,
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EDUCATION AND TRAINING

University of Illinois Urbana-Champaign (UIUC) PhD candidate in the department of Materials Science and Engineering	Illinois, USA Aug 2021–Present
University of Science and Technology of China (USTC) Bachelor of Science (Hons.) in Chemistry, School of Chemistry and Materials Science	Anhui, China Aug 2016 – Jun 2020
Princeton University (Department of Molecular Biology) International Student Internship Program (ISIP)	New Jersey, USA Jun 2019 – Aug 2019

SELECTED AWARDS AND HONORS

- Racheff-Intel Award May 2025
- CCIL Graduate Cancer Scholarship Award Nov 2023
- Outstanding Graduate Award for Top Performance Jun 2020
- Guo Moruo Scholarship (Top 1%, the highest USTC honor for undergraduates) Oct 2019
- Tang Lixin Scholarship (Top 5%) Oct 2019
- Overseas Research Scholarship for Outstanding Undergraduates (Top 10%) Jun 2019

PUBLICATIONS

- **Liu, Y.**, Zhou, J., Wang, Y., Nguyen, D., Baskaran, D., Liu, Y., & Wang, H. (2025). RENBP inhibition amplifies metabolic glycan labeling efficiency of antigen-presenting cells in vitro and in vivo. **Cell Chemical Biology**.
- **Liu, Y.**, Zhou, J., Wang, Y., Baskaran, D., Wang, H. Unnatural Lipids for Simultaneous mRNA Delivery and Metabolic Cell Labeling. **Biomaterials Science** 2024, 12(16), 4170-4180.
- **Liu, Y.**, & Wang, H. Biomarkers and targeted therapy for cancer stem cells. **Trends in Pharmacological Sciences** 2023, 45, 56-66.
- **Liu, Y.**, Han, J., Bo, Y., Bhatta, R., & Wang, H. Targeted delivery of liposomal chemoimmunotherapy for cancer treatment. **Frontiers in Immunology** 2022, 13, 6031.
- Zhou, J., **Liu, Y.**, Xu, W., Bhatta, R., Han, J., Baskaran, D., ... & Wang, H. (2025). Macroporous Hydrogel-Based mRNA Cancer Vaccine for In Situ Recruitment and Modulation of Dendritic Cells. **Acta Biomaterialia**.
- Baskaran D, **Liu Y**, Zhou J, Wang Y, Nguyen D, Wang H. In Vitro and In Vivo Metabolic Tagging and Targeted Modulation of Platelets. **Materials Today Bio** 2025, 32, 101719.
- Dwivedy A, Baskaran D, Sharma G, Hong W, Gandavadi D, Krissanaprasit A, Han J, **Liu Y**, Zimmers Z, Mafokwane T, Hayah I, Chauhan N, Zheng M, Yao S, Fraser K, Decker J, Jin X, Wang H, Friedman A, Wang X. Engineering Novel DNA Nanoarchitectures for Targeted Drug Delivery and Aptamer Mediated Apoptosis in Cancer Therapeutics. **Advanced Functional Materials** 2025.
- Bhatta R, Han J, **Liu Y**, Bo Y, Wang H*. Extracellular Vesicle Hydrogels with Tunable Viscoelasticity and Injectability for Depot Vaccines. **Nature Communications** 2025. Accepted.
- Bo, Y., Wang, Y., Han, J., Bhatta, R., **Liu, Y.**, Baskaran, D., Zhou, J., Wang, H. Primary Adipocytes as Targetable Drug Depot to Prevent Post-Surgical Cancer Recurrence. **Materials Today Bio** 2024, 25, 101020.
- Han, J., Bhatta, R., **Liu, Y.**, Bo, Y., Elosegui-Artola, A., & Wang, H. Metabolic glycan labeling immobilizes dendritic cell membrane and enhances antitumor efficacy of dendritic cell vaccine. **Nature Communications** 2023, 14 (1), 5049.
- Bhatta, R., Han, J., **Liu, Y.**, Bo, Y., Lee, D., Zhou, J., ... & Wang, H. Metabolic tagging of extracellular vesicles and development of enhanced extracellular vesicle based cancer vaccines. **Nature Communications** 2023, 14 (1), 8047.

- Bhatta, R., Han, J., **Liu, Y.**, Bo, Y., & Wang, H. T cell-responsive macroporous hydrogels for in situ T cell expansion and enhanced antitumor efficacy. **Biomaterials** 2023, 293, 121972.
- Han, J., Bhatta, R., **Liu, Y.**, Bo, Y., & Wang, H. In Situ Dendritic Cell Recruitment and T Cell Activation for Cancer Immunotherapy. **Frontiers in Pharmacology** 2022, 13, 954955.
- Han, J., Park, J., Bhatta, R., **Liu, Y.**, Bo, Y., Zhou, J., & Wang, H. A double crosslinking adhesion mechanism for developing tough hydrogel adhesives. **Acta Biomaterialia** 2022, 150, 199-210.
- Wang, W., Hao, Y., **Liu, Y.**, Li, R., Huang, D. B., & Pan, Y. Y. Nanomedicine in lung cancer: Current states of overcoming drug resistance and improving cancer immunotherapy. *Wiley Interdisciplinary Reviews: Nanomedicine and Nanobiotechnology* 2021, 13(1), e1654.

In Revision/Under Review

- **Yusheng Liu**, Yizun Wang, Yueji Wang, Jiadiao Zhou, Dhyanesh Baskaran, Joonsu Han, Rimsha Bhatta, Daniel Nguyen, Fan Lam, Hua Wang*. In Vivo Metabolic Tagging and Targeting of Red Blood Cells. *Nature Communications*. Under Revision.
- **Yusheng Liu**, Jiadiao Zhou, Dhyanesh Baskaran, Yueji Wang, Daniel Nguyen, Yuan Liu, Hua Wang*. RNA Antibody Abrogates the Priming of Antigen-Specific T cells and Reverses Type-1 Diabetes. In preparation.
- Kecheng Wu, Juan Mi, Zhaoji Liu, **Yusheng Liu**, Guiyuan Chen, Yun Xing, Zechenxi Song, Haocheng Zheng, Jillian Perry, Shaomin Tian, Xiaoyuan Chen, Yuanzeng Min1, Jianping Weng. Spleen homing multivalent nanovaccine induces immune tolerance and protects against early onset type 1 diabetes. *Advanced Science*. Under Review.
- Joonsu Han, Abhisek Dwivedy, Tianrui Xue, Rimsha Bhatta, **Yusheng Liu**, Yang Bo, Jiadiao Zhou, Yueji Wang, Joseph Irudayaraj, Shuming Nie, Xing Wang, Hua Wang. Self-Adjuvanting α -Helical Polypeptides for Potent mRNA Cancer Vaccines. *PNAS*. Under Revision.
- Yang Bo, Yueji Wang, Nilmani Singh, Joonsu Han, Jingyi Zhou, David Zhou, Rimsha Bhatta, **Yusheng Liu**, Dhyanesh Baskaran, Shanny Hsuan Kuo, Gee W. Lau, Huimin Zhao, Hua Wang*. Universal Transplant-Specific CAR Regulatory T Cells Prolong Transplant Survival. *Nature Chemical Biology*. Submitted.

PATENTS

- Wang H, **Liu Y.** Metabolic Tagging and Targeting of Red Blood Cells. U.S. Provisional Patent Application No. 63/402,413

PRESENTATIONS

Oral Presentations

- "A Facile Strategy for Long-acting Drug Production via Metabolic Glycoengineering of Erythrocytes" 2023 BMES Annual Meeting | Seattle Convention Center | Seattle, WA
- "Dual-Functional Azido-Lipids for Efficient Gene Delivery and Membrane Tagging" 2023 Fall Soft Material Seminar | Room 100, Materials Science and Engineering Building | Urbana, IL
- "Surface GlycoRNA on Dendritic Cells: A Hidden Regulator of T Cell Activation" 2024 Fall Soft Material Seminar | Room 100, Materials Science and Engineering Building | Urbana, IL
- " In vivo Metabolic Tagging and Targeting of Circulating Red Blood Cells" 2025 Spring MatSE Colloquium | Room 100, Materials Science and Engineering Building | Urbana, IL

Poster Presentations

- "T cell-responsive Macroporous Hydrogel for in situ T Cell Expansion" 2022 BMES Annual Meeting | Henry B. Gonzalez Convention Center | San Antonio, TX
- "In vivo Metabolic Tagging and Targeting of Circulating Red Blood Cells" 2024 Chicago BioEngineering Conference| Chan Zuckerberg Biohub Chicago | Chicago, IL
- "Unnatural Lipids for Simultaneous mRNA Delivery and Metabolic Cell Labeling" 2024 BMES Annual Meeting| The Baltimore Convention Center | Baltimore, MD
- " In vivo Metabolic Tagging and Targeting of Circulating Red Blood Cells " 2025 Society For Biomaterials Meeting | Hilton Chicago | Chicago, WA

RESEARCH EXPERIENCE

University of Illinois at Urbana-Champaign

IL, USA

Aug 2021-Present

I) Engineering of RNA antibody for enhanced binding affinity and delivery

- Designed and engineered single-chain variable fragments (scFvs) and nanobodies with improved affinity for cell-surface RNA, guided by structural modeling (AlphaFold, RNAfold, Hdock) and mutational optimization.
- Designed plasmids and established mammalian expression systems for scFvs; purified recombinant proteins for in vitro validation of RNA-binding activity.

II) GlycoRNA presents on dendritic cells and primes antigen-specific CD8+ and CD4+ T cells

- First validate the expression of RNAs on DCs and confirm the O-glycosylation of RNAs.
- Uncover the altered expression of RNAs on DCs with varied activation status and subtypes.
- Demonstrate that anti-RNA treatment can abrogate DC-mediated priming of both antigen-specific CD8+ T cells (OT-I cells) and antigen-specific CD4+ T cells (OT-II and BDC2.5 T cells).
- Demonstrate that anti-RNA treatment decreases islet-reactive T cells and glucose and hemoglobin A1c levels, increases insulin levels in NOD mouse model.

III) In vivo metabolic glycoengineering of red blood cells (RBCs) for biological application

- Tested the metabolic labeling of RBCs both in vitro and in vivo.
- First time discover the long-term in vivo labeling and cargo targeting of RBCs.
- Conduct blood vessel fluorescence imaging with RBCs labeling technique.
- Successfully image brain blood vessel with MRI imaging over 10 days.
- Controlled blood sugar level in T1D mouse model with RBCs labeling technique.

IV) Unnatural lipids for simultaneous mRNA delivery and metabolic cell labeling

- Report a class of unnatural lipid (azido-DOTAP) that can efficiently deliver mRNAs into cells and meanwhile metabolically label cells with unique chemical tags.
- Demonstrate that the dual-functional unnatural lipid is applicable to different types of cells including dendritic cells, potentially opening a new avenue to developing enhanced mRNA vaccines.

V) RENBP inhibition amplifies metabolic glycan labeling efficiency of antigen presenting cells

- Report that antigen presenting cells (APCs) upregulate expression of GlcNAc 2-epimerase (REBP), and RENBP inhibition leads to improved labeling efficiency of N-azidoacetylmannosamine in APCs.
- Demonstrate that RENBP inhibitors can improve AAM-mediated labeling of B cells and other APCs in vivo, with the largest enhancement for B cells (>3-fold) for 7 days.

VI) Lipids coated nanogel for intracellular delivery via membrane fusion for sustained sugar delivery

- Fabricated nano-sized hydrogel via emulsion polymerization and successfully coated with lipids.
- Tested the membrane fusion with cancer cell line for intracellular delivery.

VII) Targeted delivery of liposomal chemoimmunotherapy for cancer treatment

- Use metabolic glycan labeling to facilitate cancer-targeted delivery of liposomal chemo-immunotherapy.
- Targeted delivery of liposomes encapsulating doxorubicin and R837 to 4T1 tumors, enabled by metabolic glycan labeling and click chemistry, showed the promise to reshape the immunosuppressive tumor microenvironment of solid tumors.

University of Science and Technology of China

Anhui, China

Nov 2019 – Jun 2021

I) Cancer cell antigen-based colloidal gel for cancer immunotherapy

- Fabricated different composition of the colloidal gel and obtained suitable properties.
- Obtained the colloidal gel with ideal properties and tested the gel in the 4T1 cancer model.

II) Engineered red blood cell for type 1 diabetes(T1D) treatment

- Optimized the protocol to conjugate nanoparticle with the red blood cell membrane via click chemistry.
- Conducted in vivo study with NOD mouse model with engineered red blood cells.

Princeton University

New Jersey, USA

Jun 2019 – Aug 2019

I) The structure of membrane protein A and B

- Purified membrane protein A and B from the recombinant plasmids with HEK293 expression system.

II) The structure of protein C in Nanodisc

- Purified mutated membrane protein C from the mutated plasmid constructed via overlap PCR.

- Synthesized Nanodisc containing protein C and obtained its structure by Cryo-EM with 3D reconstruction.

RELEVANT SKILLS

- Chemistry: Organic/inorganic synthesis, nanoparticle and bioconjugation chemistry, NMR, MS, HPLC, DLS, SEC.
- Molecular Biology: PCR, cloning, protein expression/purification, RNA/protein analysis, CRISPR, proximity labeling.
- Cell Biology: Flow cytometry, confocal/live-cell imaging, metabolic glycan & lipid labeling, stable cell line construction, ex vivo culture.
- Animal Studies: Cancer, T1D, and EAE models; mouse surgery.
- Computational Biology: RNA-seq (Salmon, STAR, DESeq2, Seurat), pathway enrichment, docking & MD (HADDOCK, GROMACS), AI-driven protein/RNA design (RFdiffusion, proteinMPNN).
- Visualization & Analysis: R, Python, GraphPad Prism, FlowJo, ImageJ, PyMOL, ChimeraX, VMD.
- Design & Communication: BioRender, Adobe Illustrator, Photoshop.

TEACHING & MENTORING

1. TA for MSE474 Biomaterials and Nanomedicine, Spring 2023
2. TA for MSE457/CHEM480 Polymer Chemistry, Fall 2022
3. Have mentored three undergraduate researchers since Fall 2021