Yining ZHU

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EDUCATION

Johns Hopkins University *07/2021 – 09/2025*
- Ph.D. in Biomedical Engineering

Duke University *08/2024 – 09/2024*
- Visiting Research Scholar in Biomedical Engineering

Johns Hopkins University *08/2019 – 05/2021*
- M.S.E. in Biomedical Engineering

Sichuan University *09/2015 – 06/2019*
- B.S. in Pharmacy

PUBLICATIONS

*† Denotes equal contribution * Denotes corresponding author*

(28 peer-reviewed journal publications in total; Google Scholar)

First author publications:

- **Y Zhu†,** ZC Y†, S L†, *et al.*, HQ Mao*. An mRNA lipid nanoparticle-incorporated nanofiber-hydrogel composite for cancer immunotherapy. ***Nature Communications****,* 2025.
- C Wei†, **Y Zhu†*,** *et al.*, SC Murphy*, HQ Mao*. Systemic trafficking of mRNA lipid nanoparticle vaccine following intramuscular injection generates potent tissue-specific T cell response. ***BioRxiv,*** *2025.* ***(Nature Biomedical Engineering****, in revision*)
- **Y Zhu†,** S Cai†, *et al.*, KW Leong*, HQ Mao*. Optimization of lipid nanoparticles for gene editing of the liver via intraduodenal delivery. ***Biomaterials***, 2024.
- J Ma†, **Y Zhu†**, *et al.*, SX Sun*, HQ Mao*. Tuning extracellular fluid viscosity for enhanced transfection efficiency in genetic cell engineering. ***Nature Chemical Engineering***, 2024.
- **Y Zhu**, *et al.*, SC Murphy*, HQ Mao*. Screening for lipid nanoparticles that modulate the immune activity of helper T cells towards enhanced antitumour activity. ***Nature Biomedical Engineering***, 2023.
- **Y Zhu**, *et al.*, SC Murphy*, HQ Mao*. Multi-step screening of DNA/lipid nanoparticles and co-delivery with siRNA to enhance and prolong gene expression. ***Nature Communications***, 2022.
- Y Hu†, **Y Zhu†**, *et al.*, HQ Mao*. Size-controlled and shelf-stable DNA particles for production of lentiviral vectors. ***Nano Letters,*** 2021.
- **Y Zhu**, *et al.*, X Sun*. Albumin-biomineralized nanoparticles to synergize phototherapy and immunotherapy against melanoma. ***Journal of Controlled Release***, 2020.
- X Liu†, **Y Zhu†,** *et al.*, HQ Mao*. Post-assembly Stabilization of Lipid Nanoparticles Enhances the Delivery Efficiency and Efficacy of mRNA Vaccines. (***Nature Chemical Engineering***, *in review*)
- X Lu†, **Y Zhu†,** *et al.*, HQ Mao*. Optimized lipid nanoparticles for efficient T cell targeting intracellular delivery of genome editing proteins. (***Science Advances,*** *in revision*)
- J Lin†, **Y Zhu†,** *et al.*, HQ Mao*. Imidazolium Lipid-based Nanoparticles Enable Effective mRNA Delivery and Cellular Immune Response. (***Materials Today,*** *in revision*)

Selective collaborative publications:

- B Torkzaban, **Y Zhu**, *et al.*, J Coller*. Use of poly adenosine tail mimetics to enhance mRNA expression from genes associated with haploinsufficiency disorders. ***Molecular Therapy Nucleic Acids***, 2025.
- L Cheng, **Y Zhu**, *et al.*, HQ Mao*. Machine learning elucidates design features of plasmid deoxyribonucleic acid lipid nanoparticles for cell type-preferential transfection. ***ACS nano***, 2024.
- W Chen, **Y Zhu**, *et al.*, J He*. Potentiating the systemic immunity by bacteria-delivered STING activation in a tumor microenvironment. ***Advanced Functional Materials***, 2023.
- Z Guo, **Y Zhu**, *et al.*, X Sun*. Rapid development of a subunit nano-vaccine against drug-resistant

Pseudomonas aeruginosa with effective cross-protection. ***Nano Today***, 2022.

- J Xue, **Y Zhu**, *et al.*, X Sun*. Nanoparticles with rough surface improve the therapeutic effect of photothermal immunotherapy against melanoma. ***Acta Pharmaceutica Sinica B***, 2022.
- ZC Yao, YH Yang, J Kong, **Y Zhu**, *et al.*, HQ Mao*. Biostimulatory micro-fragmented nanofiber-hydrogel composite improves mesenchymal stem cell delivery and soft tissue remodeling. ***Small***, 2022.
- S Bai, H Jiang, Y Song, **Y Zhu**, *et al.*, X Sun*. Aluminum nanoparticles deliver a dual-epitope peptide for enhanced anti-tumor immunotherapy. ***Journal of Controlled Release***, 2022.
- W Chen, Z Guo, **Y Zhu**, *et al.*, X Sun*. Combination of bacterial-photothermal therapy with an anti-PD-1 peptide depot for enhanced immunity against advanced cancer. ***Advanced Functional Materials***, 2020.
- X Ke, L Shelton, Y Hu, **Y Zhu**, *et al.*, HQ Mao*. Surface-functionalized PEGylated nanoparticles deliver messenger RNA to pulmonary immune cells. ***ACS Applied Materials & Interfaces***, 2020.
- Y Hu, B Eder, J Lin, S Li, **Y Zhu**, et al., HQ Mao*. Liter-scale manufacturing of shelf-stable plasmid DNA/PEI transfection particles for viral vector production. ***Molecular Therapy Methods & Clinical Development***, 2024.
- C Li, X Chen, X Luo, H Wang, **Y Zhu**, *et al.*, X Sun. Nanoemulsions target to ectopic lymphoids in inflamed joints to restore immune tolerance in rheumatoid arthritis. ***Nano Letters***, 2020.
- Z Guo, F Wu, C Guo, R Hu, Y Ou, **Y Zhu**, S Luo, Y Song, P He, C He, Y Xu, et al., X Sun*. Metalloparticle-Engineered Pickering Emulsion Displaying AAV-Vectored Vaccine for Enhancing Antigen Expression and Immunogenicity Against Pathogens. ***Advanced Materials***, 2025.
- X Zhong, G Du, X Wang, Y Ou, H Wang, **Y Zhu**, *et al.*, X Sun. Nanovaccines mediated subcutis-to-intestine cascade for improved protection against intestinal infections. ***Small***, 2022.

Reviews:

- W Chen, **Y Zhu**, *et al.*, X Sun*. Path towards mRNA delivery for cancer immunotherapy from bench to bedside. ***Theranostics***, 2024.
- W Chen, **Y Zhu**, *et al.*, X Sun*. Advances in Salmonella Typhimurium-based drug delivery system for cancer therapy. ***Advanced Drug Delivery Reviews***, 2022.
- S Huang, **Y Zhu**, *et al.*, Z Zhang*. Recent advances in delivery systems for genetic and other novel vaccines. ***Advanced Materials***, 2022.

PATENTS

- **Y Zhu**, C Wei, H Mao. Lipid nanoparticles with integrated glycolipid adjuvant to promote tissue-specific cellular immunity. US Provisional Patent Application; Filed 2/18/2025.
- **Y Zhu**, C Wei, D Yu, H Mao. Lipid nanoparticle formulations capable of migrating to systemic organs following intramuscular administration. US Provisional Patent Application; Filed 1/28/2025.
- **Y Zhu**, X Lu, H Mao. Composition screening of lipid nanoparticle for intracellular delivery of gene-editing proteins. PCT/US2025/023531; Filed 4/7/2025.
- **Y Zhu**, C Wei, J Ma, H Mao, et al. A mRNA lipid nanoparticle incorporated nanofiber-hydrogel composite to generate a local immunostimulatory niche for immunotherapy. PCT/US2025/023530; Filed 4/7/2025.
- **Y Zhu**, J Ma, H Mao, et al. Composition of media with defined fluid viscosity for enhancing intracellular delivery of nanoparticles and viral vectors, and methods of use. PCT/US2024/039036; Filed 7/22/2024.
- **Y Zhu**, H Mao, *et al.* Compositions of Lipid Nanoparticles for Plasmid DNA Delivery to the Liver and Methods for Preparing the Same. PCT/US2023/016938; Filed 3/30/2023.
- **Y Zhu**, Y Hu, H Mao. Methods for preparation of plasmid DNA/lipid particles with defined size for in vitro and in vivo transfection. PCT/US2023, 18/546,221; Filed 8/11/2023.
- **Y Zhu**, Y Hu, H Mao. Composition of shelf-stable plasmid DNA/PEI particles with defined sizes for virus production and method for preparation of the same. PCT/US2023, 18/546,222, Filed 8/11/2023.
- **Y Zhu**, Y Hu, H Mao. Methods for preparation of shelf-stable plasmid DNA/polycation particles with defined sizes for cell transfection. PCT/US2022, 18/261,944; Filed 7/18/2023.

CONFERENCE PRESENTATIONS

- **Zhu Y**, Ma J, *et al.*, Mao HQ. Enhancing Cell Transfection Efficiency via Modulation of Extracellular Fluid Viscosity. *Society of Biomaterials Annual Meeting and Exposition*. 2025. **Oral Presentation.**

- **Zhu Y**, Yao Z-C, Li S, *et al.*, Mao HQ. mRNA lipid nanoparticle-incorporated nanofiber-hydrogel composite generates a local immunostimulatory niche for cancer immunotherapy. *Society of Biomaterials Annual Meeting and Exposition*. 2025. **Oral Presentation & Student Travel Achievement Recognition (STAR) award.**
- **Zhu Y**, Yao Z-C, Li S, *et al.*, Mao HQ. Engineering A Biomaterials-based Lymphoid Niche for mRNA Lipid Nanoparticle Cancer Vaccines. *Biomedical Engineering Society Annual Meeting*. 2024. **Oral Presentation.**
- **Zhu Y**, Yao Z-C, Li S, *et al.*, Mao HQ. A mRNA lipid nanoparticle incorporated nanofiber-hydrogel composite generates a local immunostimulatory niche for cancer immunotherapy. *American Society of Gene & Cell Therapy Annual Meeting*. 2024. **Oral Presentation & Meritorious Abstract Travel Award.**
- **Zhu Y**, Ma J, Shen R, Vuong I, Mao HQ. Lipid Nanoparticle Composition Shapes Immune Response to mRNA Vaccine and Potency of Anticancer Immunity. *Society of Biomaterials Annual Meeting and Exposition*. 2023. **Oral Presentation & Student Travel Achievement Recognition (STAR) award.**
- **Zhu Y**, Ma J, Shen R, Vuong I, Mao HQ. Compositional Optimization of mRNA Lipid Nanoparticles to Modulate Th1/Th2 Immune Activation Profile and Potentiate Anticancer Immunity. *American Society of Gene & Cell Therapy Annual Meeting*. 2023. **Poster Presentation.**
- **Zhu Y**, Shen R, Vuong I, Hu Y, Mao HQ. Multi-step Screening and Composition Optimization of Lipid Nanoparticles for Liver-targeted Plasmid DNA Delivery. *Society of Biomaterials Annual Meeting and Exposition*. 2022. **Oral Presentation**.

AWARDS & HONORS

- **Siebel Scholar,** *Siebel foundation, US* *2025/09*
- **Student Travel Achievement Recognition (STAR) award**, *Society for Biomaterials, US* *2025/04*
- **Meritorious Abstract Travel Award**, *American Society of Gene & Cell Therapy, US* *2024/05*
- **The Hans J. Prochaska Research Award,** *Johns Hopkins University, US* *2024/04*
- **Student Travel Achievement Recognition (STAR) award**, *Society for Biomaterials, US* *2023/04*
- **Outstanding Graduates Award in Sichuan Province** (1/153), *Sichuan Province, China* *2019/05*
- **National Scholarship** (1/153), *Ministry of Education of China* *2016/10; 2017/10; 2018/10*
- **Top 100 Students Award** (among 57,000 students at SCU), *Sichuan University, China* *2017/10*
- **Outstanding Chairman of the Student Union** (Top 10), *Sichuan University, China* *2017/10*
- **'Tang Lixin' Scholarship**, *Sichuan University, China* (60 among 57,000 students at SCU) *2018/10*

PROFESSIONAL MEMBERSHIPS

- **Society for Biomaterials** 2021 – Present
- **American Society of Gene & Cell Therapy** 2021 – Present
- **Biomedical Engineering Society** 2024 – Present

RESEARCH EXPERIENCE

- **Engineered Lipid Nanoparticles and Microgel Matrix to Program Th1/Th2 Immune Response** 09/2022 – Present
  Graduate research assistant *Mentor: Dr. Hai-Quan Mao, JHU*
  - Developed mRNA lipid nanoparticle (LNP) formulations capable of eliciting dual or biased Type 1 T helper (Th1) and/or Type 2 T helper (Th2) immune responses.
  - Engineered mRNA LNP-loaded microgels as an immunostimulatory niche in vivo to recruit and transfect host immune cells and potentiate antigen-specific immune responses.
  - Demonstrated efficacy and safety of these new LNP-based vaccine platforms in murine cancer models.
  - Discovered immune activation mechanism for these new LNP-based vaccine platforms.
- **Development of a liver-targeting, plasmid DNA-loaded lipid nanoparticles as a malaria vaccine** 10/2021 – Present
  Graduate research assistant *Mentor: Dr. Hai-Quan Mao, JHU*
  - Developed a high-throughput screening system to optimize the formulation of lipid nanoparticles for improving delivery efficiency of DNA-loaded nanoparticles to hepatocytes.

- Evaluated capability of DNA-loaded nanoparticles with varied compositions to maintain stability within the gastrointestinal tract, penetrate the mucus layer and target the liver for pDNA expression.
- Investigated *in vivo* antigen expression after oral administration of DNA LNPs.
- Developing a therapeutic nucleic acid vaccine against malaria.

- **Shelf-stable DNA/PEI complex particles with controlled size for reproducible and scalable production of lentiviral vectors** 09/2019 – 09/2021

  Graduate research assistant *Mentor: Dr. Hai-Quan Mao, JHU*
  - Illustrated that the size and kinetic stability of pDNA/PEI complex particles are critical factors determining the transfection efficiency in production of viral vectors for gene therapy.
  - Developed a novel methodology to obtain stable pDNA/PEI complex particles with controlled size and kinetic stability using the flash nanocomplexation (FNC) technique.
  - Discovered the size-dependent intracellular delivery mechanisms of cellular uptake and endosomal escape for the size-controlled pDNA/PEI complex particles.
  - Generated pDNA/PEI complex particles with different sizes at high concentrations that are suitable for applications in bioreactors at production scale.

TEACHING EXPERIENCE

- **EN.580.109.12 | Introduction to Nanomedicine** 01/2023, 01/2024

  JHU *Intersession Course Instructor*
  Introduced and offered a comprehensive view of nanomedicine, including the physical and chemical basis of biomaterials in the nano-size range, bio-interactions governing efficacy and side effects, conventional and advanced design strategies to overcome biological barriers, and examples in diverse applications.

- **EN.580.453 | Immunoengineering: Principles and Applications** 09/2024 – 12/2024

  JHU *Teaching Assistant*
  Offered insightful explanations and practical demonstrations in class, fostering a collaborative learning environment that supported students in mastering the fundamental principles of immunoengineering.

- **EN.580.642 | Tissue Engineering** 09/2022 – 12/2022

  JHU *Teaching Assistant*
  Provided insightful explanations and practical demonstrations in classes. Helped create a collaborative learning environment to assist students in learning the fundamental principles in tissue engineering.

LEADERSHIP & PROFESSIONAL SERVICES

- **Lab Manager**, Mao Laboratory, Johns Hopkins University 2021/09 – Present
  - Managing laboratory operations, study planning, and organization of supplies, resource optimization.
- **Peer Health Navigators**, Johns Hopkins University 2023/09 – 2024/09
  - PHNs are trained in supportive listening and equipped with knowledge about the health and wellness resources available at University Health Services and within the community.
  - Providing support for accessing timely and culturally appropriate health care and offer supportive listening and health coaching for students seeking mental health assistance.
- **Intern Pharmacist**, West China Hospital, Sichuan University 2018/07 – 2018/08
  - Covered drug supply and dispensing, production and quality control of hospital pharmaceutical preparations, and clinical pharmacy practice.
- **President, Student Union of West China School of Pharmacy**, Sichuan University 2015/05 – 2018/05
  - Led one of the largest student associations in the school with over 130 members; managed operation, regulations, and planning/organization of over 60 student activities.
  - Recognized as a top 10 among 36 of student unions in West China School of Pharmacy in 2017.
- **Journal Reviewer**
  - Serve as reviewers for *Biomaterials, Journal of Controlled Release, Cancer Nanotechnology, Pharmaceutical Research, Bioengineering & Translational Medicine, Journal of Drug Delivery Science and Technology, Journal of Liposome Research, Scientific Reports, Discover Chemistry, BMC Cancer, Journal of Nanobiotechnology*.