Yining ZHU

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EDUCATION

Johns Hopkins University *07/2021 – current*
- 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*

Lead author publications:

- **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.

Collaborative publications:

- 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.
- 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.
- 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.
- 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.
- 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.
- 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.

- 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.
- W Chen, Y Song, S Bai, C He, G Zhao, **Y Zhu**, *et al.*, X Sun*. Cloaking mesoporous polydopamine with bacterial membrane vesicles to amplify local and systemic antitumor immunity. ***ACS nano***, 2023.
- S Li, Y Hu, A Li, J Lin, K Hsieh, Z Schneiderman, P Zhang, **Y Zhu**, *et al.*, HQ Mao*. Payload distribution and capacity of mRNA lipid nanoparticles. ***Nature Communications,*** 2022.
- Y Hu, S Tzeng, L Cheng, J Lin, A Rueda, S Yu, S Li, Z Schneiderman, **Y Zhu**, *et al.*, HQ Mao*. Supramolecular assembly of polycation/mRNA nanoparticles and in vivo monocyte programming. ***Proceedings of the National Academy of Sciences of the United States of America,*** 2024.

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**, 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. US Provisional Patent Application; Filed 7/20/2023.
- **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**, 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

- **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* *2022/05*
- **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

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.
- **Combining phototherapy and immunotherapy against melanoma by albumin nanoparticles co-encapsulated with Ce6 and aluminum adjuvant** 09/2017 – 08/2019
  Undergraduate research assistant *Mentor: Dr. Xun Sun, SCU*
  - Engineered the photosensitizer Chlorin e6 (Ce6) and the immunoadjuvant aluminum hydroxide into bovine serum albumin by biomineralization method as a novel nanosystem (Al-BSA-Ce6 NPs) for photo-immunotherapy against melanoma.
  - Confirmed that the nanoparticles not only effectively destroyed tumor cells but protected animals against tumor rechallenge and metastasis by inducing accumulation of T cells in both lymph nodes and tumor sites, high levels of serum antibodies/cytokines, and higher proportions of cytotoxic T cells.
  - Illustrated that the robust therapeutic effect of aluminum NPs cannot be achieved by commercially available alumina gels, nor replacement of aluminum hydroxide with ferric hydroxide.

TEACHING EXPERIENCE

- **Introduction to Nanomedicine** JHU *Intersession Course Instructor* 01/2023, 01/2024
  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.
- **Tissue Engineering** JHU *Teaching Assistant* 09/2022 – 12/2022
  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.

ACTIVITIES

- **Peer Health Navigators**, Johns Hopkins University 2023/09 – Present
  - 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.
- **Lab Manager**, Mao Laboratory, Johns Hopkins University 2021/09 – Present
  - Managing laboratory operations, study planning, and organization of supplies, resource optimization.
- **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.