Curriculum Vitae

Wei GAO, Ph.D.

Wei GAO, PhD
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Short Bios

I am an Assistant Professor at the University of Houston, College of Pharmacy. My research focuses on developing advanced nanomedicine and nanovaccine strategies for cancer immunotherapy. Specifically, I aim to modulate B cell and myeloid cell immunity using these strategies to enhance anticancer immunotherapy. I have been awarded NCI R01 grants for the period 2024-2029. My work has resulted in 28 publications in prestigious journals such as Science Translational Medicine, ACS Nano, and Biomaterials, accumulating over 2000 citations and an H-index of 19. Additionally, I have filed 9 PCT patents.

Education

2003–2007 B.S., School of Life Science and Technology, China Pharmaceutical University.
2008–2009 Master, University of Calabria, School of Pharmacy, Italy.
PI: Prof. Nevio Picci
2007–2010 M.S. in Pharmaceutics, School of Pharmaceutical Science, China Pharmaceutical University.
2010–2014 Ph.D in Pharmaceutics, School of Pharmaceutical Science, Peking University Health Science Center. PI: Qiang Zhang (Academician of the Chinese Academy of Engineering)

Academic Appointments

2013-2014 Research Assistant, Institute of Chinese Medical Science, University of Macau, China
2014-2017 Assistant Professor, School of Pharmacy, Tianjin Medical University, China
2017-2021 Postdoctoral Research Fellow, University of Michigan, USA.
PI: Duxin Sun (Associated Dean of College of Pharmacy)
2022-2024 Assistant Research Scientist, University of Michigan, USA.

Major Research Projects

1. **Developing Nanovaccines to Promote B/CD4 T Cell Crosstalk for Durable Anticancer Efficacy (2017-present)**

   Current cancer vaccines focused on dendritic cell-mediated antigen presentation to active T cell response often yield only short-term efficacy. Our research investigates the pivotal role and underlying mechanisms of B cell-mediated antigen presentation in enhancing CD4 and CD8 responses against cancer. Building on these insights, we are developing peptide and mRNA-based nanovaccines aimed at augmenting B cell antigen presentation, fostering B/CD4 T cell crosstalk for sustained anticancer immunity.

   Grant: NIH R01 CA285790-01 (2024-2029, awarded), PI: Duxin Sun (PI), Wei Gao (MPI).

   Publication:
   - Viral Antigen-Cluster Mimicry Nanovaccine Promotes B Cell Antigen Presentation Mediated B/CD4 T Cell Crosstalk Achieving Long-Term Tumor Remission. Chengyi Li, Ryan Clauson, Luke F. Bugada, Wei Gao*, Duxin Sun*. 2022, ACSnano

   Patent:
   - Duxin Sun, Ryan Clauson, Hongwei Chen, Chengyi Li, Wei Gao, Luke Bugada, Fei Wen, Brett Hill, Syed Monem Rizvi. Nano-satellite complex. US 2021/0346478, Nov. 11, 2021.

- Duxin Sun, Chengyi Li, Jia Yi, Wei Gao, Zera Montemayor, Alejandra Duran. Vaccine compositions, components, and methods of use. U.S. Provisional Patent Application 63/578,634, Filed Aug 24, 2019.

2. Developing Lymph node and Tumor Dual Targeting Immunomodulating Nanomedicine to Improve Cancer Immunotherapy.

Current immunomodulators largely focus on tumor-associated macrophages, neglecting the role of lymph node macrophages in cancer progression. Our approach involves developing PI3K inhibitors and STING agonists and utilizing albumin nanoformulations for targeted drug delivery to macrophages in both tumors and lymph nodes. These nanomedicines reprogram macrophages at both sites, effectively altering the cancer microenvironment, and has demonstrated long-term tumor remission in mouse cancer models. Additionally, our work is dedicated to understanding how modulating lymph node macrophages impacts systemic immune responses against cancer.

Grant: NIH R01CA285789 (2023-2028), PI: Duxin Sun (PI), Wei Gao (MPI). (Pending outcomes)

Publications:

- Yudong Song, Luke Bugada, Ruiting Li, Hongxiang Hu, Luchen Zhang, Chengyi Li, Hebao Yuan, Fei Wen, **Wei Gao***, and Duxin Sun*. Albumin nanoparticle of PI3Kγ inhibitor and paclitaxel combined with α-PD1 induces tumor remission in mouse metastatic breast. **Science Translational Medicine**, 2022, 643, eabl3649 (Cover Story)
- Xin Luan, Hebao Yuan, Yudong Song, Hongxiang Hu, Bo Wen, Miao He, Huixia,Zhang, Yan Li, Feng Li, Pan Shu, Joseph P. Burnett, Nathan Truchan, Maria Palmisano, Manjunath P. Pai, Simon Zhou*, **Wei Gao***, Duxin Sun*. Reappraisal of anticancer nanomedicine design criteria in three types of preclinical cancer models for better clinical translation. Biomaterials, 2021, Jun, 120910.
- Sun Duxin*, Simon Zhou, **Wei Gao.** What Went Wrong with Anticancer Nanomedicine Design and How to Make It Right. ACS Nano. 2020 Oct 27;14(10):12281-12290.

Patents:

- Duxin Sun, **Wei Gao**, Fei Wen, Ruiting Li, Hongxiang Hu, Luke F. Bugada. PI3K inhibitors, nanoformulations, and uses thereof. U.S. Prov Pat Appl 63/176,930, Filed April 20, 2021
- Duxin Sun, Chengyi Li, **Wei Gao**, Mahamadou Djibo. Sting agonists, formulations, and uses Thereof (63/334,433). April 25, 2022.
- Duxin Sun, Hongyi Zhao, Zhongwei Liu, Shuai Mao, Jinsong Tao, Wei Gao, Bo Wen, Meilin Wang, Miao He. Sting agonists, compositions, and uses thereof. U.S. Prov Pat Appl (63/594, 272), Oct 30, 2023.

3. Developing albumin nanoformulaion of dual functional compound overcomes STING resistance by eliminating Bregs for long-term efficacy in pancreatic cancer.

The immune suppression in pancreatic ductal adenocarcinoma (PDAC), regulated by suppressive myeloid cells and regulatory B cells (Bregs), significantly hinders the effectiveness of immunotherapy. Most immune modulators, primarily targeting myeloid cells, only achieved limited clinical success. Although STING agonist activates myeloid cells through IRF3 phosphorylation, it expands Bregs via the same mechanism to confer STING resistance in PDAC. We developed a first-in-class dual functional compound SH-273, by stimulating STING and inhibiting PI3kγ, to mitigate suppression of myeloid cells and Bregs. SH273 abolished STING-induced IRF3 phosphorylation to eliminate Bregs, but it did not alter IRF3 phosphorylation to preserve STING activation in myeloid cells. Systemic administration of albumin nanoformulation of SH-273 (Nano-273), in combined with anti-PD-1, extended median survival of 200 days in transgenic KPC PDAC mice, outperforming other treatment groups. Nano-273 achieved systemic antitumor immunity by remodeling microenvironment and decreasing Bregs in tumors and lymph nodes, offering potential for PDAC treatment.

Grant: Submit a R01 grant in Feb. 2024. (GRANT14053205 (2024-2029), MPI)

Publications:

- Chengyi Li, Shuai Mao, **Wei Gao***, Duxin Sun*. Dual functional compound overcomes suppressive microenvironment and STING resistance by eliminating Bregs for long-term efficacy in pancreatic cancer. Nature Cancer, 2024 (submitted)

Patents:

- Duxin Sun, Chengyi Li, Wei Gao, Mahamadou Djibo, Mohamed Dit Mady. Dual functional immune modulating compounds, formulations, and uses thereof. U.S. Prov Pat Appl (63/334,4441) April 25, 2022.

Teaching Experience

- Biopharmaceutics and Biology of Drug Delivery (Pharmaceutical Sciences 300)
  Role: Lecturer; *Audience*: Undergraduates; *Semester*: Fall 2023; *Institution:* University of Michigan
- Basic and Clinical Pharmacokinetics (Pharmaceutical Science 608)
  Role: Lecturer; *Audience*: PharmD students; *Semester*: Fall 2023; *Institution*: University of Michigan
- Biopharmaceutics and Pharmacokinetics
  Role: Lecturer; *Audience*: Undergraduates; *Semester*: 2015 Spring- 2017 Spring; *Institution*: Tianjin Medical University
- **Award**: The third prize in the National Teaching Basic Skills Competition for my expertise in teaching "Clinical Pharmacokinetics" (2016).

Grants

- NCI R01 CA285790-01 (2024-2029), Therapeutic Cancer NanoVaccine Promotes B/CD 4 T Cell Crosstalk for Durable Anticancer Efficacy MPI. Awarded, $2.64 M.
- GRANT14053205 (2024-2029), MPI. Dual Targeting of STING and PI3Kγ Eliminates Regulatory B Cells and Overcome STING Resistance for Pancreatic Cancer Immunotherapy. (Pending outcomes)
- NCI R01CA285789 (2024-2029), Nanomedicine of PI3Kγ inhibitor combined with immunotherapy to treat metastatic breast cancer, MPI. (Pending outcomes).
- APRA-H 75N99223S0001(2024-2027), X7 Enhance Cancer Drug Development Success Sevenfold, Co-PI. (Pending outcomes)
- MTRAC, University of Michigan, (2025-2027), First-in-class dual functional drug stimulates STING and inhibits PI3Kγ to eliminate Bregs for long-term anticancer efficacy in pancreatic cancer Co-PI (Pending outcomes)

Publications (Citation 1344, H-index 19)

https://scholar.google.com/citations?user=DCYcYDgAAAAJ&hl=en&oi=ao

1. Yudong Song, Luke Bugada, Ruiting Li, Hongxiang Hu, Luchen Zhang, Chengyi Li, Hebao Yuan, Fei Wen, **Wei Gao***, and Duxin Sun*. Albumin nanoparticle of PI3Kγ inhibitor and paclitaxel combined with α-PD1 induces tumor remission in mouse metastatic breast. Science Translational Medicine, 2022, 643, eabl3649
2. **Wei Gao***, Hongxiang Hu, Lipeng Dai, Miao He, Hebao Yuan, Huixia Zhang, Jinhui Liao, Bo Wen, Yan Li, Maria Palmisano, Mohamed Dit Mady Traore, Simon Zhou, Duxin Sun*. Structure-Tissue Exposure/Selectivity Relationship (STR) Correlates with Clinical Efficacy/Safety. Acta Pharmaceutic Sinica B, 2021,12 (5), 2462-2478.
3. Xin Luan, Hebao Yuan, Yudong Song, Hongxiang Hu, Bo Wen, Miao He, Huixia, Zhang, Yan Li, Feng Li, Pan Shu, Joseph P. Burnett, Nathan Truchan, Maria Palmisano, Manjunath P. Pai, Simon Zhou*, **Wei Gao***, Duxin Sun*. Reappraisal of anticancer nanomedicine design criteria in three types of preclinical cancer models for better clinical translation. Biomaterials, 2021, Jun, 120910.

4. Duxin Sun*, Simon Zhou, **Wei Gao.** What Went Wrong with Anticancer Nanomedicine Design and How to Make It Right. ACS Nano. 2020 Oct 27;14(10):12281-12290.
5. Duxin Sun*, **Wei Gao**, Hongxiang Hu, Simon Zhou. Why 90% of Clinical Drug Development Fails and How to Improve It? Acta Pharmaceutic Sinica B, 2022, 12, 304.
6. Hongxiang Hu, Mohamed Dit Mady Traore, Ruiting Li, Hebao Yuan, Miao He, Bo Wen, **Wei Gao**, Colleen B. Jonsson, Elizabeth A. Fitzpatrick, and Duxin Sun. Optimization of the Prodrug Moiety of Remdesivir to Improve Lung Exposure/Selectivity and Enhance Anti-SARS-CoV-2 Activity. J. Med. Chem. 2022, 65, 12044−12054
7. Guihua Ye, Yajun Jiang, Xiaoying Yang, Hongxiang Hu, Beibei Wang, Lu Sun, Victor C. Yang, Duxin Sun, and **Wei Gao***. Smart Nanoparticles Undergo Phase Transition for Enhanced Cellular Uptake and Subsequent Intracellular Drug Release in a Tumor Microenvironment, ACS Applied Materials& Interfaces. 10 (1): 278–289, 2018.
8. **Wei Gao**, Xiucong Yang, Zhiqiang Lin, Bing He, Dong Mei, Dan Wang, Haoran Zhang, Hua Zhang, Wenbing Dai, Xueqing Wang, Qiang Zhang*. The use of electronic-neutral penetrating peptides cyclosporin A to deliver pro-apoptotic peptide: a possibly better choice than positively charged TAT, Journal of Controlled Release, 261:174-186,2017.
9. Yajun Jiang, Zhaoyang Guo, Jing Fang, Beibei Wang, Zhiqiang Chen, Yan Chen, Ning Zhang, Xiaoying Yang*, **Wei Gao***. A multi-functionalized nanocomposite constructed by gold nanorod core with triple-layer coating to combat multidrug resistant colorectal cancer. Materials Science and Engineering: C. 107: 110224, 2020.
10. Zheng Cui, Xiaofei Zhang, Xiaojin Zhang, Suna He, **Wei Gao**, Bing He, Xueqing Wang, Hua Zhang, Zhenlin Zhong, Qiang Zhang, Visualizing in vitro-in vivo correlation of miktoarm copolymer nanomicelles in cancer cellular uptake and trafficking. bioRxiv, 2019.
11. Beibei Wang, Sunyi Wu, Zhiqiang Lin, Yajun Jiang, Yan Chen, Zhe-Sheng Chen, Xiaoying Yang, **Wei Gao***. A personalized and long-acting local therapeutic platform combining photothermal therapy and chemotherapy for the treatment of multidrug-resistant colon tumor. International Journal of Nanomedicine, 13: 8411–8427, 2018.
12. **Wei Gao*,** Guihua Ye, Xiaochuan Duan, Xiaoying Yang, Victor C. Yang. Transferrin receptor-targeted pH sensitive micellar system for diminution of drug resistance and targetable delivery in multidrug-resistant breast cancer, International Journal of Nanomedicine, 12: 1047–1064, 2017.
13. **Wei Gao**, Xiucong Yang, Zhiqiang Lin, Shanyun Gao, Bing He, Qiang Zhang* . The Use of a Hydrophobic Binding Peptide Modified Lipid Nanocarrier Improving Tumor Distribution and Antitumor Efficacy, Journal of Biomedical Nanotechnology, 12: 1–16, 2016.
14. Xinru Li, Xiucong Yang, Zhiqiang Lin, Qiang Zhang, and **Wei Gao***, A folate modified pH sensitive targeted polymeric micelle alleviated systemic toxicity of doxorubicin (DOX) in multi-drug resistant tumor bearing mice, European Journal of Pharmaceutical Science, 76: 95-101, 2015.
15. **Wei Gao**, Zhiqiang Lin, Meiwan Chen, Xiucong Yang, Zheng Cui, Xiaofei Zhang, Lan Yuan, Qiang Zhang*, The co-delivery of a low-dose P-glycoprotein inhibitor with doxorubicin sterically stabilized liposomes against breast cancer with low P-glycoprotein expression, International Journal of Nanomedicine, 7, 1–13, 2014.
16. Yaru Zou, **Wei Gao**, Huizhen Jin, Chenmei Mao, Yi Zhang, Xiaoling Wang, Dong Mei, Libo Zhao*, Cellular Uptake and Transport Mechanism of 6-Mercaptopurine Nanomedicines for Enhanced Oral Bioavailability, International Journal of Nanomedicine, 79-94, 2023.
17. Hongxiang Hu, Mohamed Dit Mady Traore, Ruiting Li, Hebao Yuan, Miao He, Bo Wen, **Wei Gao**, Colleen B Jonsson, Elizabeth A Fitzpatrick, Duxin Sun, Journal of Medicinal Chemistry, 12044, 2022.
18. Liting Wu, Yujia Xin, Zhaoyang Guo, **Wei Gao**, Yanpeng Zhu, Yinsong Wang, Ruixue Ran, Xiaoying Yang, Cell Membrane-camouflaged Multi-functional Dendritic Large Pore Mesoporous Silica Nanoparticles for Combined Photothermal Therapy and Radiotherapy of Cancer, Chemical Research in Chinese Universities volume 562, 2022.

19. Defu Cai, **Wei Gao**, Bing He, Wenbing Dai, Hua Zhang, Xueqing Wang, Jiancheng Wang, Xuan Zhang, Qiang Zhang*, Hydrophobic penetrating peptide PFVYLI-modified stealth liposomes for doxorubicin delivery in breast cancer therapy, Biomaterials, 35:2283-2294, 2013.
20. Zhiqiang Lin, **Wei Gao**, Hongxiang Hu, Kun Ma, Bing He, Wenbing Dai, Xueqing Wang, Jiancheng Wang, Xuan Zhang, Qiang Zhang*, Novel thermo-sensitive hydrogel system with paclitaxel nanocrystals: High drug-loading, sustained drug release and extended local retention guaranteeing better efficacy and lower toxicity, Journal of Controlled Release, 174, 161–170, 2014.
21. Zhiqiang Lin, Shuxin Xu, **Wei Gao**, Hongxiang Hu, Meiwan Chen, Yitao Wang,Bing He,Wenbing Dai,Hua Zhang, Xueqing Wang, Anjie Dong,*Yuxin Yin* and Qiang Zhang*. A comparative investigation between paclitaxel nanoparticle- and nanocrystal-loaded thermosensitive PECT hydrogels for peri-tumoural administration. Nanoscale,8:18782-18791,2016.
22. Xinghua Liu, Chunhui Gao, Junheng Gu, Yunfang Jiang, Xinlin Yang, Shaoyong Li, **Wei Gao**, Tong An, Hongquan Duan, Jingwei Fu, Yinsong Wang*, and Xiaoying Yang*. Hyaluronic Acid Stabilized Iodine-Containing Nanoparticles with Au Nanoshell Coating for X-ray CT Imaging and Photothermal Therapy of Tumors. ACS applied materials & interfaces. 2016, 8, 27622−27631.
23. Bing He, Lan Yuan, Wenbing Dai, **Wei Gao**, Hua Zhang, Xueqing Wang, Weigang Fang and Qiang Zhang*, Dynamic bio-adhesion of polymer nanoparticles on MDCK epithelial cells and its impact on bio-membranes, endocytosis and paracytosis, Nanoscale, 8, 6129-6145, 2016.
24. Xiaoyou Wang, Xianhui Chen, Xiucong Yang, **Wei Gao**, Bing He, Wenbing Dai, Hua Zhang, Xueqing Wang, Jiancheng Wang, Xuan Zhang, Zhifei Dai, Qiang Zhang, nanomedicine-based combination therapy based on QLPVM peptide functionalized liposomal tamoxifen and doxorubicin against Luminal A breast cancer, Nanomedicine : nanotechnology, biology, and medicine, 12(2): 387-97, 2016.
25. Dong Mei, Zhiqiang Lin, Jijun Fu, Bing He, **Wei Gao**, Ling Ma, Wenbing Dai, Hua Zhang, Xueqing Wang, Jiancheng Wang, Xuan Zhang, Wanliang Lu, Demin Zhou, Qiang Zhang*， The use of a-conotoxin ImI to actualize the targeted delivery of paclitaxel micelles to a 7nAChR-overexpressing breast cancer. Biomaterials, 42:52-65, 2015.
26. Zhang J, Li Y, **Gao W**, Repka MA, Wang Y, Chen M. Andrographolide-loaded PLGA-PEG-PLGA micelles to improve its bioavailability and anticancer efficacy. Expert Opinion on Drug Delivery, 11(9):1367-80, 2014.
27. Huang Xin, Wu Zhenghong*, **Gao Wei**, Chen Qin and Yu Bin, Polyamidoamine dendrimers as potential drug carriers for enhanced aqueous solubility and oral bioavailability of silybin, Drug Development and Industrial Pharmacy, 37(4):419-427, 2011.
28. U. Gianfranco Spizzirri*, Francesca Iemma, Francesco Puoci, Feng Xue, **Gao Wei**, Giuseppe Cirillo, Manuela Curcio, Ortensia I.Parisi, Nevio Picci, Synthesis of hydrophilic microspheres with LCST close to body temperature for controlled dual-sensitive drug release, Polymers for Advanced Technologies, 22(12):1705-1712,2011.

Patents

1. Duxin Sun, **Wei Gao**, Hongxiang Hu, Mohamed Dit Mady Traore, Yudong Song, and Bo Wen. Remdesivir and Remdesivir Analogs, Solutions, and Nanoparticle, Liposomal, and Microparticle Compositions for Treating Viral Infections. US Provisional Patent Application 63/004 122, Filed April 2, 2020
2. Duxin Sun, **Wei Gao**, Hongxiang Hu. Compositions and methods for systemic delivery of Bcl-2 and Bcl-xL antagonists. U.S. Provisional Patent Application 62/958,779, Filed Jan 9, 2019.
3. Duxin Sun, **Wei Gao**, Fei Wen, Ruiting Li, Hongxiang Hu, Luke F. Bugada. PI3K inhibitors, nanoformulations, and uses thereof. U.S. Prov Pat Appl 63/176,930, Filed April 20, 2021
4. Duxin Sun, Ryan Clauson, Hongwei Chen, Chengyi Li, **Wei Gao**, Luke Bugada, Fei Wen, Brett Hill, Syed Monem Rizvi. Nano-satellite complex. US 2021/0346478, Nov. 11, 2021.
5. Duxin Sun, Chengyi Li, **Wei Gao**, Mahamadou Djibo. Sting agonists, formulations, and uses Thereof (63/334,433). April 25, 2022.
6. Duxin Sun, Chengyi Li, **Wei Gao**, Mahamadou Djibo, Mohamed Dit Mady. Dual functional immune modulating compounds, formulations, and uses thereof. U.S. Prov Pat Appl (63/334,4441) April 25, 2022.

7. Duxin Sun, **Wei Gao,** Mahamadou Djibo, Mohamed Dit Mady. Lipids for Nucleic Acid Based Vaccines. U.S. Prov Pat Appl (63/334,437). May 3, 2022.
8. Qiang Zhang, Wenbing Dai, **Wei Gao**, Defu Cai, Chinese Patent, CN103393597A, Hydrophobic peptides modified injectable long circulating liposome drug delivery system.
9. Duxin Sun, Hongyi Zhao, Zhongwei Liu, Shuai Mao, Jinsong Tao, Wei Gao, Bo Wen, Meilin Wang, Miao He. Sting agonists, compositions, and uses thereof. U.S. Prov Pat Appl (63/594, 272), Oct 30, 2023.
10. Duxin Sun, Chengyi Li, Jia Yi, Wei Gao, Zera Montemayor, Alejandra Duran. Vaccine compositions, components, and methods of use. U.S. Provisional Patent Application 63/578,634, Filed Aug 24, 2019

Award

- Third prize in the National Teaching Basic Skills Competition for my expertise in teaching "Clinical Pharmacokinetics". (2016)
- "2022 Outstanding guest editor", awarded by Frontiers in Pharmacology
- "2022 High Impact Paper Award" for the paper "Why 90% of clinical drug development fails and how to improve it" published in Acta Pharm Sin B.

Professional Affiliations

- American Association of Cancer Research (AACR), member
- American Association of Pharmaceutical Scientists (AAPS), member

Journal Editorial Board

I served as guest editors for *Frontiers in Oncology, Frontiers in Pharmacology, Frontiers in Bioengineering and Biotechnology, and Frontiers in Molecular Biosciences.*

Invited Journal Review

I was invited as the reviewer of various high-level journals in the field of pharmaceutical science and nanomedicine, such as "Advanced Functional Materials", "Advanced healthcare materials", "ACS Applied Materials & Interfaces", "International Journal of Nanomedicine", "Molecular Pharmaceutics", "Acta Pharmaceutica Sinica B".

Invited Presentations

- "What Went Wrong With Nanomedicine Design And How To Make It Right" Oral presentation in the 4th International Conference on Nanomedicine, Guangzhou, Chian, 2020
- "Modulating the Lymph Node and Tumor Immune Microenvironment with Nano-PI: A Revolutionary Approach to Treating Metastatic Breast Cancer." Keynote Presentation on World Pharma, 2nd Global Virtual Summit on Pharmaceutical & Novel Drug Delivery System, Online, 2023.
- "Stable Albumin BCL-2/xL Inhibitor Nanocomplex Reduce Drug Platelet Toxicity and Improve Anticancer Efficacy." Poster Presentation in 2023 Controlled Release Society Annual Meeting, Las Vegas, 2023
- "Developing nanomedicine for better clinical translation". Smart Nanomedicine Summit, Online, 2023.
- "What Went Wrong With Anticancer Nanomedicine Design and How to Make It Right?" Oral presentation in Luye Pharma Group, 2021