CURRICULUM VITAE

Longwei Liu. Ph.D.

Alfred E. Mann Department of Biomedical Engineering

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Summary:

Dr. Longwei Liu specializes in **immunoengineering** and **molecular engineering of biosensors** for live-cell imaging. His research focuses on developing tools for understanding and manipulating genetic and molecular activities in live cells and animals. Specifically, he develops genetically encoded biosensors based on FRET or single fluorescent proteins using a directed evolution approach to visualize molecular signals in live cells with high spatiotemporal resolution. Guided by these new signaling insights, he also develops "smart" inducible immune cells that can be precisely controlled by focused ultrasound while maintaining high efficacy for cancer treatment. This ultrasound control technology is further used to control CRISPR-toolboxes for treating genetic disorders. These genetic manipulation tools aim to rewire cellular functions both in vitro and in vivo, with accompanying signaling landscape dynamics revealed by genetically encoded biosensors and live-cell imaging. This combination of cell signaling observation and manipulation deepens the understanding of cellular networks, bridges the gap between observational biology and actionable therapeutics, and paves the way for innovative cell manipulation methodologies.

Professional Experience:

2023-	Research Assistant Professor Alfred E. Mann Department of Biomedical Engineering, University of Southern California
2019 - 2022	Postdoctoral fellow Institute of Engineering in Medicine (IEM), University of California, San Diego (UCSD).

Education:

2013 - 2018	Ph.D. in Biomedical Engineering Tsinghua University, China
2009- 2013	B.S. in Biotechnology Shandong University, China

Awards

2024	NIH, NIBIB Mentored Career Development Award (K01)
2023	Ming Hsieh Institute Research Award (MHIRA, MPI), USC
2023	SBIR/STTR Planning Award (MPI), USC
2018	The Outstanding Thesis Award, Tsinghua University.
2018	The Outstanding Ph.D. Graduate of Tsinghua University.
2018	The Outstanding Graduate of Beijing City, P.R. China.
2017	National Scholarship (Ph.D.), the highest scholarship in China.
2016	Guanghua Scholarship, awarded by Tsinghua University.
2015	Scholarship for Excellent Student, Tsinghua University.
2012	National Scholarship (B.S.), highest scholarship in China.
2012	Outstanding Student Scholarship (Grade 1), awarded by Shandong University.
2012	Top Ten Students in School of Life Science, Shandong University.
2010	Outstanding Student Scholarship (Grade 2).

Active Funding:

1. **NIH K01award; NIBIB; PI.**

   Title: Development of single fluorophore biosensors for multiplex imaging of CAR T Signaling; Project Number: K01EB035649; National Institutes of Health (NIH), NIBIB; 04/2024-04/2028; Total: $ 606,192.00

2. **NIH R01; NCI; Co-I.**

   Title: Ultrasensitive kinase biosensors for multiplex imaging of coordinated spatiotemporal signaling in cancer-immune interactions; Project Number: R01CA262815; PI: Zhang (contact), Wang; NIH/NCI; 07/15/2022-06/31/2027; $ 91,538.00 per year.

3. **Ming Hsieh Institute Research Award; MPI**

   Title: Controllable CAR T Cell Therapy by Focused Ultrasound for Pediatric Glioblastoma; PD/PI: L, Liu. (MPI), Y, Wang. (contact); 08/23-08/24; Total Award Amount: $135,000.00

4. **2024 SBIR/STTR Planning Award /USC; MPI**

   Title: Engineering Ultrasound Controllable CAR T Cells Targeting Intracellular KRAS Mutants in Solid Tumor; PD/PI: Y, Wang (contact) L, Liu (MPI);08/24-08/25; Total Award Amount: $150,000.00

5. **2023 SBIR/STTR Planning Award /USC; MPI**

   Title: Engineering Reversible and Inducible PSMA CAR T cells for Prostate Cancer Immunotherapy; PD/PI: L, Liu. (MPI), Y, Wang. (MPI); 08/23-08/24; Total Award Amount: $150,000.00

Full list of publications

Dr. Liu has published **nine *first-author papers*** in high-impact journals such as *Nature Materials* (2017), *PNAS* (2020), *Nature Communications* (2021), *Clinical and Translational Medicine* (2022) with an additional first-author paper under review at *Cell*. In addition, he has **multiple cocorresponding author papers** in *ACS Sensors* (2021), *The EMBO Journal* (2022), and *ACS Nano* (2024), and co-author papers in Nature Reviews Bioengineering (2023), Nature Materials (2022), Biomaterials (2016, 2017), two book chapters, among others.

First author* and Corresponding author# publications:

1. **Longwei Liu***#, Peixiang He*, Yuxuan Wang, Fengyi Ma, Dulei Li, Zhiliang Bai, Yunjia Qu, Linshan Zhu, Chi Woo Yoon, Xi Yu, Yixuan Huang, Zhengyu Liang, Tianze Guo, H. Kay Chung, Rong Fan, Yingxiao Wang#. Engineering Sonogenetic EchoBack-CAR T cells. ***Cell***. *In revision***.**
2. Yiqian Wu*, Ziliang Huang*, Yahan Liu*, Chi Woo Yoon, Kun Sun, Yinglin Situ, Phuong Ho, Yushun Zeng, Zhou Yuan, Linshan Zhu, Qifa Zhou, Yunde Zhao, Thomas Liu, Gabriel A Kwong, Shu Chien, **Longwei Liu**# (Corresponding author), Yingxiao Wang#. Control of Genomics and Epigenomics by Ultrasound for Cancer Immunotherapy. ***Nature Communications***. 2024. Accepted.
3. Linshan Zhu*, Chi-Wei Man*, Reed Harrison, Zhuohang Wu, Praopim Limsakul, Qin Peng, Matthew Hashimoto, Anthony Mamaril, Hongquan Xu, **Longwei Liu**# (Corresponding author), Yingxiao Wang#. Engineering a PD-L1-targeting Monobody via Directed Evolution for SynNotch-Gated Cell Therapy. ***ACS Nano***. 2024. doi.org/10.1021/acsnano.4c01597.
4. Min Tang*, Yunjia Qu*, Peixiang He, Emmie Yao, Tianze Guo, Di Yu, Nancy Zhang, Wisarut Kiratitanaporn, Yazhi Sun, **Longwei Liu**# (Corresponding author), Yingxiao Wang#, Shaochen Chen#. Heat-Inducible CAR-T Overcomes Adverse Mechanical Tumor Microenvironment in a 3D Bioprinted Glioblastoma Model. ***Materials Today Bio.*** https://doi.org/10.1016/j.mtbio.2024.101077
5. **Longwei Liu***#, Chi Woo Yoon*, Zhou Yuan*, Tianze Guo, Yunjia Qu, Peixiang He, Xi Yu, Ziyue Zhu, Praopim Limsakul, Yingxiao Wang#. Cellular and molecular imaging of CAR-T cell-based immunotherapy. ***Advanced Drug Delivery Reviews.*** 2024. https://doi.org/10.1016/j.addr.2023.115135. (# Corresponding author)
6. **Longwei Liu**, Yingxiao Wang, Danielle Schmitt#. LUNAS: a rapid and sensitive nucleic acid detection assay using split NanoLuc luciferase complementation. ***ACS Central Science.*** 2023. Invited commentary article, https://doi.org/10.1021/acscentsci.3c00366.
7. **Longwei Liu***#, Yunjia Qu*, Leonardo Cheng*, Chi Woo Yoon, Peixiang He, Abdula Monther, Tianze Guo,

Sarah Chittle, Yingxiao Wang[#]. Engineering CAR-T Cells for Solid Tumor Therapy. ***Clinical and Translational Medicine***. 2022. 12(12):e1141. doi: 10.1002/ctm2.1141. ([#] Corresponding author)

8. Yijia Pan, Linda Zhixia Shi, Daryl Preece, Veronica Gomez-Godinez, Chi Woo Yoon, Shaoying Lu, Christopher Carmona, Seung-Hyun Woo, Shu Chien#, Michael W. Berns#, **Longwei Liu #** (Corresponding author), & Yingxiao Wang#. (2022). Mechanosensor Piezo1 Mediates Bimodal Patterns of Intracellular Calcium and FAK Signaling. ***The EMBO J.*** 2022. e111799.
9. **Longwei Liu***, Limsakul P*, Meng X*, Huang Y, Harrison RES, Huang T-S, Shi Y, Yu Y, Charupanit K, Zhong S, Lu S, Zhang J, Chien S, Sun J, Wang Y. Integration of FRET and sequencing to engineer kinase biosensors from mammalian cell libraries. ***Nature Communications***. 2021;12(1):5031. doi: 10.1038/s41467-021-25323-x.
10. Ya Gong, Chujun Wei, Leonardo Cheng, Fengyi Ma, Shaoying Lu, Qin Peng, **Longwei Liu#** (Corresponding author), Yingxiao Wang#. (2021). Tracking the Dynamic Histone Methylation of H3K27 in Live Cancer Cells. ***ACS Sensors***, https://doi.org/10.1021/acssensors.1c01670
11. **Longwei Liu*,** Yu H*, Long Y*, You Z, Ogawa R, Du Y[#], Huang C[#]. Asporin inhibits collagen matrix-mediated intercellular mechanocommunications between fibroblasts during keloid progression. ***The FASEB Journal***. 2021;35(7):e21705. doi: https://doi.org/10.1096/fj.202100111R.
12. **Longwei Liu*,** Yu H*, Zhao H, Wu Z, Long Y, Zhang J, Yan X, You Z, Zhou L, Xia T, Shi Y, Xiao B, Wang Y, Huang C, Du Y[#]. Matrix-transmitted paratensile signaling enables myofibroblast-fibroblast cross talk in fibrosis expansion. ***PNAS***. 2020;117(20):10832-8. doi: 10.1073/pnas.1910650117.
13. **Longwei Liu *,** He, F.*, Yu, Y. & Wang, Y[#]. Application of FRET Biosensors in Mechanobiology and Mechanopharmacological Screening. ***Frontiers in Bioengineering and Biotechnology*** 8, 1299 (2020).
14. **Longwei Liu *,** You Z*, Yu H, Zhou L, Zhao H, Yan X, Li D, Wang B, Zhu L, Xu Y, Xia T, Shi Y, Huang C, Hou W, Du Y[#]. Mechanotransduction-modulated fibrotic microniches reveal the contribution of angiogenesis in liver fibrosis. ***Nature Materials***. 2017;16(12):1252-61. doi: 10.1038/nmat5024. (*Equal contribution)
    - Reported as news and views in *Nature Materials* 16, 1176 (2017).
    - Highlighted in *Nature Reviews Gastroenterology & Hepatology* 15, 6 (2018)
    - Highlighted in *Hepatology 69: 449-451(2019)*.

Co-author Publications:

15. H. Kay Chung*, Cong Liu*, Alex Jambor, Brian P. Riesenberg, Ming Sun, Eduardo Casillas, Brent Chick, Jun Wang, Shixin Ma, Bryan Mcdonald, Peixiang He, Qiyuan Yang, Timothy Chen, Siva Karthik Varanasi, Michael LaPorte, Thomas Mann, Dan Chen, Filipe Hoffmann, Victoria Tripple, Josephine Ho, Ukrae H. Cho, April Williams, **Longwei Liu**, Yingxiao Wang, Diana C. Hargreaves, Jessica E. Thaxton, Susan M. Kaech#, Wei Wang#. Multi-Omics Atlas-Assisted Discovery of Transcription Factors for Selective T Cell State Programming. ***bioRxiv (****under review,* ***Nature)***. doi: https://doi.org/10.1101/2023.01.03.522354
16. Shixin Ma, Michael S. Dahabieh, Thomas H. Mann, Steven Zhao, Bryan McDonald, Won-Suk Song, H.Kay Chung, Yagmur Farsakoglu, Lizmarie Garcia-Rivera, Filipe Araujo Hoffmann, Shihao Xu, Victor Y. Du, Dan Chen, Jesse Furgiuele, Michael LaPorte, Emily Jacobs, Lisa M. DeCamp, Brandon M. Oswald,Ryan D. Sheldon, Abigail E. Ellis, **Longwei Liu**, Peixiang He, Yingxiao Wang, Cholsoon Jang, Russell G. Jones, Susan M. Kaech.Nutrient-driven histone code determines exhausted CD8+ T cell fates. ***Science*** *(Revision submitted)*
17. Michelle S. Frei, Samantha A. Sanchez, **Longwei Liu**, Falk Schneider, Zichen Wang, Hiroyuki Hakozaki, Yajuan Li, Anne C. Lyons, Theresa V. Rohm, Jerrold M. Olefsky, Lingyan Shi, Johannes Schöneberg, Scott E. Fraser, Sohum Mehta, Yingxiao Wang, Jin Zhang. Far-red chemigenetic biosensors for multi-dimensional and super-resolved kinase activity imaging. bioRxiv ***(****In Revision,* ***Nature Biotech)*** 2024.02.10.579766; doi: https://doi.org/10.1101/2024.02.10.579766
18. Wei Lin, Abhishek Phatarphekar, Yanghao Zhong, **Longwei Liu**, Hyung-Bae Kwon, William H. Gerwick, Yingxiao Wang, Sohum Mehta and Jin Zhang. A Light-gated Integrator for Highlighting Kinase Activity in Living Cells. ***Nature Communications***. 2024. Accepted.
19. Min Tang, Shan Jiang, Ying Qi, Yexin Gu, Yi Xiang, Emmie Yao, Nancy Zhang, Emma Berman, Di Yu, Yunjia Qu, **Longwei Liu**, David Berry, Chunxia Ji, and Xiaoming Huang. Integration of 3D Bioprinting and Multi-Algorithm Machine Learning Identified Glioma Susceptibilities and Microenvironment Characteristics. ***Cell Discovery*** 10, 39 (2024).

20. Kai Huang, **Longwei Liu**, Yun Huang, Yingxiao Wang, Yubin Zhou, and Gang Han. Remote Control of Cellular Immunotherapy. ***Nature Reviews Bioengineering***. 2023. 1-16.
21. Yang Song, Jennifer Soto, Binru Chen, Tyler Hoffman, Weikang Zhao, Ninghao Zhu, Qin Peng, **Longwei Liu**, Chau Ly, Pak Kin Wong, Yingxiao Wang , Amy C. Rowat, Siavash K. Kurdistani , Song Li. Transient nuclear deformation primes epigenetic state and promotes cell reprogramming. ***Nature Materials***. 2022. https://doi.org/10.1038/s41563-022-01312-3
22. Duan Y, Chen J, Meng X, **Longwei Liu**, Shang K, Wu X, Wang Y, Huang Z, Liu H, Huang Y, Zhou C, Gao X, Wang Y, Sun J. Balancing activation and co-stimulation of CAR tunes signaling dynamics and enhances therapeutic potency. ***Molecular Therapy***. 2022. https://doi.org/10.1016/j.ymthe.2022.08.018
23. Wu Y, Huang Z, Harrison R, **Longwei Liu**, Zhu L, Situ Y, Wang Y. Engineering CAR T cells for enhanced efficacy and safety. ***APL Bioengineering***. 2022;6(1):011502. doi: 10.1063/5.0073746.
24. Xing D, Liu W, Li JJ, **Longwei Liu**, Guo A, Wang B, Yu H, Zhao Y, Chen Y, You Z, Lyu C, Li W, Liu A, Du Y, Lin J. Engineering 3D functional tissue constructs using self-assembling cell-laden microniches. ***Acta Biomaterialia***. 2020;114:170-82. doi: https://doi.org/10.1016/j.actbio.2020.07.058.
25. Huang, C**.,** **Longwei Liu**, Z. You, Y. Du & R. Ogawa (2019), Managing keloid scars: From radiation therapy to actual and potential drug deliveries*.* ***Int Wound J,*** 16(3): p. 852-859.
26. Zhu, L*., X. Fan*, B. Wang, **Longwei Liu**, X. Yan, L. Zhou, Y. Zeng, M. C. Poznansky, L. Wang, H. Chen & Y. Du (2017) Biomechanically primed liver microtumor array as a high-throughput mechanopharmacological screening platform for stroma-reprogrammed combinatorial therapy. ***Biomaterials,*** 124**,** 12-24.
27. Huang, C., **Longwei Liu**, Z. You, Y. Zhao, J. Dong, Y. Du & R. Ogawa (2017) Endothelial Dysfunction and Mechanobiology in Pathological Cutaneous Scarring: Lessons Learned from Soft Tissue Fibrosis. ***Br J Dermatol***. Doi: 10.1111/bjd.15576
28. Wang, J., F. Chen, **Longwei Liu**, C. Qi, B. Wang, X. Yan, C. Huang, W. Hou, M. Q. Zhang, Y. Chen & Y. Du (2016) Engineering EMT using 3D micro-scaffold to promote hepatic functions for drug hepatotoxicity evaluation. ***Biomaterials,*** 91**,** 11-22.
29. Huang, C., **Longwei Liu**, Z. You, B. Wang, Y. Du & R. Ogawa (2017) Keloid progression: a stiffness gap hypothesis. ***Int Wound J,*** 14**,** 764-771.
30. Wang, B., P. Qin, H. Zhao, T. Xia, J. Wang, **Longwei. Liu**, L. Zhu, J. Xu, C. Huang, Y. Shi & Y. Du (2016) Substrate stiffness orchestrates epithelial cellular heterogeneity with controlled proliferative pattern via E-cadherin/beta-catenin mechanotransduction. ***Acta Biomater,*** 41**,** 169-80.

Book Chapters:

31. Huang C, Longwei Liu, You Z, Wu Z, Du Y, Ogawa R. Clinical and Pathological Diagnosis of Scars. Total Scar Management: Springer; 2020. p. 83-95.
32. Huang, C., Longwei Liu, Z. You, Y. Du & R. Ogawa (2018) Gene Therapy in Pathologic Scars, in Gene Therapy in Reconstructive and Regenerative Surgery, G. Giatsidis, Editor. *Springer International Publishing: Cham.* p. 37-48.

Patents:

1. Longwei Liu, Peixiang He, Yingxiao Wang. EchoBack-CAR: Ultrasound-Controlled CAR T Cell with Sensitive Evolved Promoter and Feedback Integration. 2023; US Provisional 63/545,329. ***Licensed*** *to Acoustic Cell Therapy, Inc.*
2. Longwei Liu, Peixiang He, Yingxiao Wang. Exploiting Synthetic TGFβ Redirectors to Reinforce CAR-T Cell Therapy against Immunosuppressive Tumor Microenvironments. Patent Pending; US Provisional 63/539,382
3. Yingxiao wang, Longwei Liu, Shaoying Lu, Methods for treating and ameliorating T cell related diseases. Publication of WO2023278424A1.
4. Yingxiao Wang, Longwei Liu, Praopim Limsakul, and Shaoying Lu, Self-activating Förster Resonance Energy Transfer (saFRET) biosensors and methods for making and using them. Publication of WO2022232252A1.

Teaching:

2024	Lecture (Guest), DSR542 - Development, Stem Cells, and Regenerative Medicine, USC
2024	Lecture (Guest), SCRM 525, Tools and Techniques in Stem Cell Biology, USC
2023	Lecture (Guest), BME 533, Seminar in Bioengineering, Fall 2023, USC;

2023 Lecture (Guest), SCRM 525, Tools and Techniques in Stem Cell Biology, Fall, USC
2022 Lecture (Guest), BE-230A Biochemistry - Fall 2022, Center Hall 105, UC San Diego.
2015-2017 Teaching assistant, Tissue Engineering (Undergraduate students), Department of Biomedical Engineering, School of Medicine, Tsinghua University.
2015- 2016 Teaching assistant, Introduction for Biomedical Engineering (MOOC), Department of biomedical Engineering, School of Medicine, Tsinghua University.

Service:

2024 Session Chair of Cellular and Molecular Bioengineering (CMBE), 2024 BMES Annual Meeting
2022 Organizer-Trainee career development section. International Symposium on Biomolecular Ultrasound and Sonogenetics (ISBUS,2022),
2022 Reviewer, BMES Annual Meeting
2022 Editorial Board of Biomechanics (Review editor), Frontiers in Bioengineering and Biotechnology
2022 Editorial Board, International Journal of Biomedical Engineering and Clinical Science (IJBECS)
2022 Member, Biomedical Engineering Society
2018 Member, The Society for Biomaterials

Independent Reviewers:
Nature Communications, BMC Medicine, Small Methods, MED-X, Journal of Biophotonics, STAR protocols, Clinical and Translational Discovery, Frontiers in Systems Biology, Frontiers in Surgery, Frontiers in Bioengineering and Biotechnology, BIOCELL.

Students Supervised:

1.	Kunshu Liu,	2024-	Lab tech I. University of Southern California.
2.	Xi (Young) Yu,	2023-2024.	Master thesis committee member.
3.	Yuxuan Wang,	2023-	Lab tech I. University of Southern California.
4.	Jenny Qu,	2021-	Ph.D. candidate University of California, San Diego.
5.	Sarah Chittle,	2021-2023	Undergraduate at University of California, San Diego.
6.	Leonardo Cheng,	2020-2022	Undergraduate student at UCSD, currently Ph.D at JHU.
7.	Yiyan Yu,	2019-2020	Master student at UCSD, currently Ph.D at UCSD.
8.	Fred He,	2019-2020	Undergraduate student at UCSD, currently Ph.D at Caltech.
9.	Hongsheng Yu,	2017-2018	Master student, now Ph.D at Washington University, St. Louis.
10.	Yi Long,	2016-2018	Ph.D student at Tsinghua University.
11.	Zhifeng You,	2014-2016	Ph.D student at Tsinghua University
12.	Jun Wu,	2014	Rotation Ph.D student student at Tsinghua University
13.	Rui Hua,	2014-2015	Ph.D at Tsinghua University.

Presentations:

1. Longwei Liu (2024) Keynote Speech, 15th Graduate Research Symposium by GSG, University of Southern California (USC), USA.
2. Longwei Liu (2023) Invited department seminar, Live cell imaging, Engineering and Reprogramming of CAR-T cells for solid tumor therapy, Alfred E. Mann Department of Biomedical Engineering, University of Southern California (USC) USA.
3. Longwei Liu (2023) Talk, 'Reprogramming Ultrasound Controllable CAR-T Cells in Inhibitory Tumor Microenvironment via TGFβ Redirectors. 20223 BMES, USA.
4. Longwei Liu (2022) Invited speaker, Directed evolution of biosensors to visualize immune-tumor cell interactions. Multiphoton Absorption: Experimental and Theoretical Aspects, Montana State University, USA.
5. Longwei Liu (2022), Poster, Integration of FRET and sequencing to engineer kinase biosensors from mammalian cell libraries, 2022 BMES, USA.
6. Longwei Liu, Limsakul P, Lu SK, Wang Y. (2019). Oral, Engineering Zap70 Biosensor Through Directed Evolution for Applications in Single-Cell Imaging and Immunotherapy. MCB; The 1st International Conference on Biomechanics and Medical Engineering (ICBME 2019), San Diego, USA.
7. Longwei Liu (2018). Oral & Poster. Mechanobiologically-modulated microniches for investigation of angiogenesis induced liver fibrosis and drug testing. Talk presented at the S*ociety for Biomaterials 2018 Annual Meeting (SFB 2018)*, Atlanta, USA.
8. Longwei Liu (2017). Oral. Mechanobiology and fibrotic disease. Invited talk at Peking University People's

Hospital.

9. Longwei Liu (2017). Oral. Mechanobiologically-modulated fibrotic microniches for drug screening. Talk presented at the Graduate research seminar series of School of life sciences, Tsinghua University.
10. Longwei Liu (2017). Oral. Mechanobiologically-modulated fibrotic microniches reveal stage-specific contribution and Intervention of Angiogenesis on liver Fibrosis. Talk presented at the *2017 Tissue Engineering and Regenerative Medicine International Society-Asia Pacific Meeting (TERMIS-AP 2017, SYIS)*. Jiangsu, China.
11. Longwei Liu (2016). Oral. Mechanical-modulated angiogenesis. Invited talk presented at Tsinghua endovascular conference 2016 (TEC 2016). Beijing, China.

References:

Peter Yingxiao Wang. Ph.D.
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