

Ye Zhang

Assistant Professor

Department of Biomedical Engineering and Mechanics (BEAM)

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Education

Massachusetts Institute of Technology

Cambridge, MA

- Postdoc in Koch Institute for Integrative Cancer Research Center

2019-2025

Johns Hopkins University

Baltimore, MD

- Ph.D. in Biomedical Engineering
- Concurrent Master of Health Science (MHS) in Biostatistics

2019

2019

Tsinghua University

Beijing, China

- B.E. in Biomedical Engineering

2011

Research Experience

Koch Institute for Integrative Cancer Research at MIT

2019 - 2025

Research Scientist in Prof. Scott Manalis's Lab

Development and application of microfluidic platforms using suspended microchannel resonator (SMR) to investigate biophysical properties of single cells for cancer and immunology research

- Pioneered the integration of SMR with single-cell RNA sequencing, establishing a novel pipeline for identifying gene signatures associated with cellular mass and stiffness in lymphoma
- Discovered a bimodal distribution in the buoyant mass of resting T cells, and developed a microfluidic sorting system that enables flow-cytometry-like bin-gated sorting of live, unstained cells based on mass, allowing linked transcriptional and functional analyses of these T cell subsets
- Employed the SMR technology to analyze mechanical properties of cancer cells and discovered that metastatic cells from immunodeficient mice were significantly stiffer than their those from wild type mice, suggesting that cell stiffness may serve as a biomarker for susceptibility to immune cell-mediated killing

Johns Hopkins University, Biomedical Engineering

2011 - 2019

Graduate Student with Prof. Tza-Huei Jeff Wang in BioMEMS & Single Molecule Dynamics Lab

Application of functional nanoparticles, microfluidics and single molecule confocal spectroscopy for multiplex nucleic acid analyses and molecular study of diseases

- Developed a novel silica nanomembrane material providing greatly enhanced extraction yields of highly-pure, high-molecular weight DNA
- Employed a quantum-dot based fluorescence resonance energy transfer (FRET) scheme for multiplex genetic and epigenetic assays
- Established a novel method of fluorescence encoding for multiplexed padlock probe diagnostic assays
- Leveraged confocal single-molecule fluorescence spectroscopy for absolutely quantitative assessment of telomere length
- Devised novel digital microfluidic devices to achieve highly-multiplexed detection of infectious diseases and epigenetic biomarkers in ovarian cancer

Tsinghua University, Biomedical Engineering

2009 - 2011

Undergraduate Student in Prof. Jing Liu's lab and Prof. Jing Cheng's lab

- Employed functional nanoparticles for advanced physical hyperthermia treatments of cancer
- Developed and optimized a microfluidic system incorporating isothermal detection for real-time monitoring of cancer biomarkers

Publications (*co-first author, #corresponding author)

1. **Zhang, Y. ***, Debaize, L., et al. Integrating Single-Cell Biophysical and Transcriptomic Features to Resolve Functional Heterogeneity in Mantle Cell Lymphoma. Preprint at bioRxiv (under review at *Science Advances*)
2. Yu, J., **Zhang, Y. #**, et al. Bimodal cell mass distribution separates CD8⁺ T cells into two distinct types with divergent differentiation dynamics. Preprint at bioRxiv (under review at *Nature BME*)
3. **Zhang, Y.**, et al. ddRFC: A scalable multiplexed droplet digital nucleic acid amplification test platform. *Biosens. Bioelectron.* 167, 112499 (2020)
4. **Zhang, Y.**, Chen, L., Hsieh, K. & Wang, T.-H. Ratiometric Fluorescence Coding for Multiplex Nucleic Acid Amplification Testing. *Anal. Chem.* 90, 12180–12186 (2018)
5. Beh, C. W., **Zhang, Y. ***, Zheng, Y.-L., Sun, B. & Wang, T.-H. Fluorescence spectroscopic detection and measurement of single telomere molecules. *Nucleic Acids Res.* 46, e117 (2018)
6. **Zhang, Y.** et al. A Simple Thermoplastic Substrate Containing Hierarchical Silica Lamellae for High Molecular Weight DNA Extraction. *Adv. Mater.* 28, 10630 (2016)
7. Wu, W., Ishamuddin, H.S., ..., **Zhang, Y.**, et al. Measuring single-cell density with high throughput enables dynamic profiling of immune cell and drug response from patient samples. *Nature BME* (2025)
8. Elbanna, Y.A., Tello-Lafoz, M., Holland, A., **Zhang, Y.**, et al. Mechanoimmunological Control of Metastatic Site Selection. Preprint at bioRxiv (under review at *Immunity*)
9. Winter, P. S., Ramseier, M.L., ..., **Zhang, Y.**, et al. Mutation and cell state compatibility is required and targetable in Ph⁺ acute lymphoblastic leukemia minimal residual disease. Preprint at bioRxiv (under review at *Cell*)
10. Miller, A. B., Rodriguez, F.H., ..., **Zhang, Y.**, et al. Leukemia circulation kinetics revealed through blood exchange method. *Commun. Biol.* 7, 1–10 (2024)
11. Park, J. S., Pisanic, T., **Zhang, Y.** & Wang, T.-H. Ligation-Enabled Fluorescence-Coding PCR for High-Dimensional Fluorescence-Based Nucleic Acid Detection. *Anal. Chem.* 93, 2351–2358 (2021)
12. Lee, J., Robinson M.E., N. ..., **Zhang, Y.**, et al. IFITM3 functions as a PIP3 scaffold to amplify PI3K signalling in B cells. *Nature* 588, 491–497 (2020)
13. Athamanolap, P., Hsieh, K., O’Keefe, C. M., **Y. Zhang**, Yang, S., & T.-H. Wang. Nanoarray Digital Polymerase Chain Reaction with High-Resolution Melt for Enabling Broad Bacteria Identification and Pheno–Molecular Antimicrobial Susceptibility Test. *Anal. Chem.* 91, 12784–12792 (2019)
14. Pisanic II, T. R., **Zhang, Y.** & Wang, T. H. Quantum dots in diagnostics and detection: principles and paradigms. *Analyst* 139, 2968–2981 (2014)
15. Tang, F., **Zhang, Y.**, Zhang, J., Guo, J. & Liu, R. Assessment of the efficacy of laser hyperthermia and nanoparticle-enhanced therapies by heat shock protein analysis. *AIP Adv.* 4, 031334 (2014)
16. Zhang, L., Song, Y., Fujita, T., **Zhang, Y.**, Chen, M. & Wang, T.-H. Large Enhancement of Quantum Dot Fluorescence by Highly Scalable Nanoporous Gold. *Adv. Mater.* 26, 1289 (2013)
17. Wang, T., **Zhang, Y.**, et al. Detect early stage lung cancer by a LAMP microfluidic chip system with a real-time fluorescent filter processor. *Sci. China Chem.* 55, 508–514 (2012)

Conference proceedings and presentations

Peer-reviewed Conference Publications

1. Debaize, L., **Zhang, Y.**, et al. Cell Mass and Stiffness as Integrative Biomarkers of Cell State in Mantle Cell Lymphoma. *Blood* 2022; 140 (Supplement 1), p. 3581–3582
2. **Zhang, Y.**, Zhang, P.F. & Wang, T. H. Droplet-based digital ratiometric fluorescence coding for multiplex nucleic acid amplification testing. 32nd International Conference on Micro Electro Mechanical Systems (IEEE MEMS 2019), p. 588-591

3. Beh, C. W., **Zhang, Y.**, Zheng, Y. -L., Sun, B. & Wang, T. H. Fluorescence spectroscopic detection and measurement of single telomere molecules. 13th IEEE International Conference on Nano/Micro Engineered and Molecular Systems (IEEE NEMS 2018), p. 28-31
4. Beh, C. W., **Zhang, Y.**, & Wang, T. H. Fluorescence Flow Moriometry – Flow Cytometry-Like Analysis Method for Single Molecule and Particle Cauterization. 20th International Conference on Miniaturized Chemical and Biochemical Analysis Systems (micro-TAS 2016), p. 1362-1363
5. Zhang, Y., **Zhang, Y.**, Keeley, B., Stark, A. & Wang, T. H. Spontaneous Shrinking Silica Nanomembrane for Solid Phase. 8th Annual IEEE International Conference on Nano/Micro Engineered and Molecular Systems (IEEE NEMS 2013), p. 444-445
6. Zhang, Y., **Zhang, Y.** & Wang, T. H. Hierarchical Silica Nanomembrane Driven by Thermal Shrinkage and its Application for Solid Phase DNA Extraction. Proc. 13th IEEE International Conference on Nanotechnology (IEEE NANO 2013)
7. Keeley, B., Zhang, Y., **Zhang, Y.**, Stark, A. & Wang, T. H. Quantum dot FRET linker probes for highly sensitive DNA methylation detection. Proc. 12th IEEE International Conference on Nanotechnology (IEEE NANO 2012)

Conference Presentation

1. **Zhang, Y.**, et al. Revealing Heterogeneity in Mantle Cell Lymphoma by Integrating Single-cell Biophysical and Transcriptomic Features. Cell Bio 2024, San Diego, CA. December 2024
2. **Zhang, Y.** et al. Revealing Heterogeneity in Mantle Cell Lymphoma by Integrating Single-cell Biophysical and Transcriptomic Features. Physical Sciences in Oncology (PS-ON) Annual Investigators Meeting, Philadelphia, PA. November 2024
3. **Zhang, Y.**, et al. Biophysical Characterization of Cytotoxic T cell Heterogeneity in Cancer Progression. Physical Science of Cancer *Gordon Research Seminar*, Galveston, Texas, Feb 5th, 2023.
4. **Zhang, Y.**, et al, Biophysical Characterization of Cytotoxic T cell Heterogeneity in Cancer Progression. Cell Bio 2022, Washington, DC. December 2022
5. **Zhang, Y.**, et al. Highly Quantitative Cylindrical Illumination Confocal Spectroscopy (CICS) for Single Molecule Analysis of Genomic Content. Chesapeake Bay Area Single Molecule Biology Meeting, Baltimore, MD. April 2017.
6. **Zhang, Y.**, et al. Heat-Shrunken Hierarchical Silica Nanomembrane for Solid Phase DNA Extraction. Nano Engineering for Medicine and Biology Conference (NEMB), Houston, TX, February 2016
7. **Zhang, Y.**, et al. Heat-Shrunken Hierarchical Silica Nanomembrane for Solid Phase DNA Extraction. Biomedical Engineering Society (BMES), San Antonio, TX, October 2014
8. **Zhang, Y.**, et al. Hierarchical Nanomembrane Driving by Heat-shrinkage of Polyolefin Film and Application for Solid Phase DNA Isolation. Mid-Atlantic Micro/Nano Alliance Symposium (MAMNA), Baltimore, MD, March 2014.

Awards

- Koch Institute Marlena Felter Bradford Research Travel Award, 2025
- Best Lightning Talk Prize at Physical Sciences in Oncology Investigators Meeting, 2024
- Koch Institute Convergence Scholar, 2020-2021
- Science as Art Finalist at Materials Research Society (MRS) Spring Meeting, 2017
- China National Scholarship (highest scholarship in China; top 2% of all university students), 2011
- Third Prize in MCM/ICM, Consortium for Mathematics and Its Applications, 2011
- Goldman Sachs Global Leaders Program Scholarship, 2009

Mentoring Experience

Koch Institute for Integrative Cancer Research at MIT

Mar. 2019 - Now

- Mentored two graduate students on their research projects, guiding them through experimental design, data analysis, and manuscript preparation.
- Trained one undergraduate student as part of the MIT Undergraduate Research Opportunities Program (UROP), focusing on the use of MATLAB and R for analyzing single-cell biophysical data

Johns Hopkins University, Biomedical Engineering

Baltimore, MD

Teaching Assistant

2014 -2016

- Led recitations, evaluated assignments, and provided feedback to undergraduates in two core biomedical engineering courses
- Conducted interactive laboratory sessions on microfabrication, guiding students in the fabrication of microfluidic devices

Mentor, Women in Science and Engineering (WISE) Program

2017 -2018

- Supervised a high school student, providing hands-on training in microfluidic device fabrication and PCR techniques, while fostering the student's interest in STEM fields

Mentor, Study Buddy Tutoring Program at Hampden Family Center

2016

- Provided one-on-one tutoring to a 4th-grade student in mathematics, utilizing personalized learning strategies to enhance his understanding and engagement

Mentor, STEM Achievement in Baltimore Elementary School (SABES)

2014

- Guided 3rd-grade students in hands-on science experiments, cultivating early interest and engagement in STEM subjects through community-relevant projects