

# Yilin Zhang, Ph.D.

Postdoctoral Associate  
Massachusetts Institute of Technology

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## RESEARCH INTERESTS

**Nanotechnology, Biopolymers, Plant Engineering, Sustainability, Nanofabrication, Polymer Chemistry, Biotechnology, Emerging Contaminants, Agriculture**

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## APPOINTMENTS

Postdoctoral Associate, Massachusetts Institute of Technology. 08/2022 – present  
Postdoctoral Research Associate, Carnegie Mellon University. 09/2021 – 07/2022

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## EDUCATION

**Ph.D. Civil and Environmental Engineering** 09/2017 – 08/2021  
Carnegie Mellon University Pittsburgh, PA  
Advisors: Prof. Gregory V. Lowry and Prof. Robert D. Tilton

**M.S. Civil and Environmental Engineering** 09/2016 – 08/2017  
Carnegie Mellon University Pittsburgh, PA

**B.E. Environmental Engineering** 09/2012 – 06/2016  
Beihang University Beijing, China

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## RESEARCH PROJECTS

Massachusetts Institute of Technology 08/2022 – present  
**Postdoc Associate** PI: Prof. Benedetto Marelli

1. Synthesized and characterized cationic high aspect ratio polymer nanocarriers that enabled species independent protein delivery in plants for stress sensing.
2. Developed Silk-cellulose nanocrystal nanofibrils and nano-porous membranes for PFAS remediation.
3. Developing biopolymer derived nanocarriers for Cas9 RNP delivery and CRISPR gene editing in plants.

Carnegie Mellon University 09/2021 – 07/2022  
**Research Associate** PI: Prof. Gregory V. Lowry and Prof. Robert D. Tilton

1. Synthesized and evaluated polymer nanocarriers to deliver nucleic acids into plants for transcription and translation.
2. Synthesized polymer nanocarriers with different charge and aspect ratios and investigated their uptake, distribution and translocation pathways in monocot and dicot plants.

Carnegie Mellon University

09/2017 – 08/2021

**Research Assistant**

PI: Prof. Gregory V. Lowry and Prof. Robert D. Tilton

1. Developed temperature- and pH-responsive polymer nanocarriers, including star and bottlebrush polymers, for controlled agrochemical delivery.
2. Developed star polymers with ROS scavenging and controlled nutrient release functionalities that enhance plant photosynthesis under abiotic stress.
3. Synthesized polymer nanocarriers with tunable size, charge, shape, and surface hydrophobicity, then quantified their foliar uptake and translocation.
4. Invented amphiphilic thiol polymer nanogel for mercury removal in produced water and liquid hydrocarbon.
5. Invented phosphate polymer nanogel for rare earth element recovery from coal fly ash.

**PROPOSAL WRITING EXPERIENCE**

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**In Situ Investigation of Synergistic Assembly Processes in Biopolymers to Design Environmentally Responsive Materials.** Benedetto Marelli (PI, Massachusetts Institute of Technology). ONR DURIP. Role: Drafted two sections of the proposal. \$ 1,428,817. Awarded.

**Elucidating Polymer Nanocarrier Phloem Loading Pathways, Cellular Uptake and Distribution to Organelles in Leaf Mesophyll after Foliar Application.** Gregory V. Lowry (PI, Carnegie Mellon University). NSLS-II Synchrotron beamtime proposal. Role: Drafted the proposal. Awarded.

**Efficient Bioremediation of Environmentally Persistent Contaminants with Nanomaterial-Fungus Framework (NFF).** Gregory V. Lowry (PI, Carnegie Mellon University). NIEHS. Role: helped with proposal writing. \$ 296,855. Awarded.

**Foliar Applied Plant-Activated Nitrogen Delivery Agents for Sustainable Crop Production.** Gregory V. Lowry (PI, Carnegie Mellon University). NSF ECO-CBET. Role: helped with proposal writing. \$1,699,995. Awarded.

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**PEER-REVIEWED PUBLICATIONS**

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**Citation: 1936, h-index: 15, 9 first-author, 19 total (Oct 25, 2024)**

19. **Zhang, Y.**, Sun, H., Cao, Y., Kalinowski, M.J., Li, M., Marelli, B. (2024) Directed Assembly of Proteinaceous-Polysaccharide Nanofibrils to Fabricate Membranes for Emerging Contaminant Remediation. *ACS Nano*, 18(36), 25205–25215.

18. **Zhang, Y.**, Cao, Y., Jiang, W., Ma, Q., Shin, J., Sun, H., Cui, J., Chen, Y., Giraldo, J.P., Strano, M.S., Lowry, G.V., Sheen, J., Marelli, B. (2024). Polymeric Nanocarriers Autonomously Cross the Plant Cell Wall and Enable Protein Delivery for Stress Sensing. *Advanced Materials*, 2409356.

17. Ristroph, K., **Zhang, Y.**, Nava, V., Wielinski, J., Kohay, H., Kiss, A., Thieme, J., Lowry, G.V. (2023). Flash Nanoprecipitation as an Agrochemical Nanocarrier Formulation Platform: Phloem Uptake and Translocation After Foliar Administration. *ACS Agricultural Science & Technology*, 3(11), 987-995.

16. Jeon, S., **Zhang, Y.**, Castillo, C., Nava, V., Ristroph, K., Therrien, B., Meza, L., Lowry, G.V., Giraldo, J.P. (2023). Targeted Delivery of Sucrose Coated Nanocarriers with Chemical Cargos to the Plant Vasculature Enhances Long Distance Translocation. *Small*, 2304588.
15. **Zhang, Y.**, Martinez, M.R., Sun, H., Sun, M., Yin, R., Yan, J., Marelli, B., Giraldo, J.P., Matyjaszewski, K., Tilton, R.D., Lowry, G.V. (2023). Charge, Aspect Ratio and Plant Species Affect Uptake Efficiency and Translocation of Polymeric Agrochemical Nanocarriers. *Environmental Science & Technology*, 57(22), 8269-8279.
14. **Zhang, Y.**, Fu, L., Martinez, M.R., Sun, H., Nava, V., Yan, J., Ristroph, K., Averick, S.E., Marelli, B., Giraldo, J.P., Matyjaszewski, K., Tilton, R.D., Lowry, G.V. (2023). Temperature Responsive Bottlebrush Polymers Deliver a Stress Regulating Agent *in vivo* for Prolonged Plant Heat Stress Mitigation. *ACS Sustainable Chemistry & Engineering*, 11(8), 3346-3358.
13. **Zhang, Y.**, Fu, L., Jeon, S., Yan, J., Giraldo, J.P., Matyjaszewski, K., Tilton, R.D., Lowry, G.V. (2022). Star Polymers with Designed Reactive Oxygen Species Scavenging and Agent Delivery Functionality Promote Plant Stress Tolerance. *ACS Nano*, 16(3), 4467-4478.
12. **Zhang, Y.**, Yan, J., Xu, J., Tian C., Matyjaszewski, K., Tilton, R.D., Lowry, G.V. (2021). Phosphate Polymer Nanogel for Selective and Efficient Rare Earth Element Recovery. *Environmental Science & Technology*, 55(18), 12549-12560.
11. **Zhang, Y.**, Fu, L., Li, S., Yan, J., Sun, M., Giraldo, J.P., Matyjaszewski, K., Tilton, R.D., Lowry, G.V. (2021). Star Polymer Size, Charge Content and Hydrophobicity Affect their Leaf Uptake and Translocation in Plants. *Environmental Science & Technology*, 55(15), 10758-10768.
10. **Zhang, Y.**, Bland, G. D., Yan, J., Avellan, A., Xu, J., Wang, Z., ... & Lowry, G. V. (2021). Amphiphilic Thiol Polymer Nanogel Removes Environmentally Relevant Mercury Species from Both Produced Water and Hydrocarbons. *Environmental Science & Technology*, 55(2), 1231-1241.
9. **Zhang, Y.**, Yan, J., Avellan, A., Gao, X., Matyjaszewski, K., Tilton, R. D., & Lowry, G. V. (2020). Temperature-and pH-Responsive Star Polymers as Nanocarriers with Potential for *in Vivo* Agrochemical Delivery. *ACS Nano*, 14(9), 10954-10965.
8. Guan, X., Gao, X., Avellan, A., Spielman-Sun, E., Xu, J., Laughton, S., Yun, J., **Zhang, Y.**... & Lowry, G. V. (2020). CuO nanoparticles alter the rhizospheric bacterial community and local nitrogen cycling for wheat grown in a Calcareous soil. *Environmental Science & Technology*, 54(14), 8699-8709.
7. Avellan, A., Yun, J., **Zhang, Y.**, Spielman-Sun, E., Unrine, J. M., Thieme, J., ... & Lowry, G. V. (2019). Nanoparticle size and coating chemistry control foliar uptake pathways, translocation, and leaf-to-rhizosphere transport in wheat. *ACS Nano*, 13(5), 5291-5305.
6. Gao, X., Rodrigues, S. M., Spielman-Sun, E., Lopes, S., Rodrigues, S., **Zhang, Y.**, ... & Lowry, G. V. (2019). Effect of soil organic matter, soil pH, and moisture content on solubility and dissolution rate of CuO NPs in soil. *Environmental Science & Technology*, 53(9), 4959-4967.

5. Xu, J., Cao, Z., Wang, Y., **Zhang, Y.**, Gao, X., Ahmed, M. B., ... & Lowry, G. V. (2019). Distributing sulfidized nanoscale zerovalent iron onto phosphorus-functionalized biochar for enhanced removal of antibiotic florfenicol. *Chemical Engineering Journal*, 359, 713-722.
4. Zhou, J., Lou, Z., Xu, J., Zhou, X., Yang, K., Gao, X., **Zhang, Y.** & Xu, X. (2019). Enhanced electrocatalytic dechlorination by dispersed and moveable activated carbon supported palladium catalyst. *Chemical Engineering Journal*, 358, 1176-1185.
3. Xu, J., Cao, Z., **Zhang, Y.**, Yuan, Z., Lou, Z., Xu, X., & Wang, X. (2018). A review of functionalized carbon nanotubes and graphene for heavy metal adsorption from water: Preparation, application, and mechanism. *Chemosphere*, 195, 351-364.
2. Zuo, J., Fan, W., Wang, X., Ren, J., **Zhang, Y.**, Wang, X., ... & Li, X. (2018). Trophic transfer of Cu, Zn, Cd, and Cr, and biomarker response for food webs in Taihu Lake, China. *RSC Advances*, 8(7), 3410-3417.
1. Fan, W., Liu, T., Li, X., Peng, R., & **Zhang, Y.** (2016). Nano-TiO<sub>2</sub> affects Cu speciation, extracellular enzyme activity, and bacterial communities in sediments. *Environmental Pollution*, 218, 77-85.

## MANUSCRIPTS IN PREPARATION/SUBMITTED

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21. **Zhang, Y.**, Shin, J., Sun, H., Chang, H., Martinez, M.R., Eutsey, L., Yan, J., Cao, Y., Giraldo, J.P., Matyjaszewski, K., Sheen, J., Tilton, R.D., Marelli, B., Lowry, G.V. High Aspect Ratio Polymer Nanocarriers for Gene Delivery and Expression in Plants. *Nano Letters* (Under review)
20. Cao, Y., # Kim, D., # Koh, S., Li, Z., Rigoldi, F., Fortmueller, J., Goh, K., **Zhang, Y.**, Lim, E., Sun, H., Ueyhara, E., Ram, R.J., Urano, D., Marelli, B., Phase Front Assembly of Biopolymers for Mesostructured Materials Design. *Nature Nanotechnology* (Under review)

## BOOK CHAPTERS

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1. Avellan, A., Rodrigues, S.M., Morais, B.P., Therrien, B., **Zhang, Y.**, Rodrigues, S., Lowry, G.V. Inorganic nanopesticides and nanofertilizers: A view from the mechanisms of action to field applications. Springer Nature.

## PATENTS

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2. Hatakeyama, E.S., Lowry, G.V., **Zhang, Y.**, Thompson, J.A., Hoelen, T.P., Polymer Additives and Solid Liquid Separation Process to Remove Mercury from Liquids. US provisional patent. Filed March 2020.
1. Lowry, G.V., **Zhang, Y.**, Matyjaszewski, K., Tilton, R.D., Polymer Carriers for Delivery of Agrochemicals in Crop Plants. US patent 18012048. Filed June 2021.

## SELECTED PRESENTATIONS

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2025 Millipore Sigma Curiosities of Chemistry Lecture Series. "Directed Assembly of

Biopolymer Nanofibrils to Fabricate Membranes for Emerging Contaminant Remediation” Milwaukee, WI (Invited).

**2024 The Connecticut Agricultural Experiment Station Research Seminar.** “Nano- and Biotechnology Enable Plant Engineering for Sustainability” New Haven, CT (invited).

**2024 ACS Fall Meeting.** “Biopolymer-based technologies to boost food security” Denver, CO (Invited).

**2024 Zhejiang University Research Seminar.** “Multifunctional Polymer Nanomaterials for Sustainability and Environmental Protection” Virtual meeting (Invited).

**2024 University of North Carolina at Charlotte Research Seminar.** “Nano- and Biotechnology Enable Plant Engineering for Sustainability” Charlotte, NC (invited).

**2023 AEESP Conference Oral Presentation.** “Polymeric Agrochemical Nanocarrier Uptake and Translocation, Effects of Charge, Aspect Ratio and Plant Species” Northeastern University, MA

**2022 AEESP Conference Poster Presentation.** “Meet the Candidate: Yilin Zhang” Washington University in St. Louis, MO

**2022 AEESP Conference Oral Presentation.** “Efficient Plant Stress Alleviation by Reactive Oxygen Species Responsive Polymer Nanocarriers for Sustainable Agriculture” Washington University in St. Louis, MO

**2022 Gordon Research Conference Poster Presentation.** “Smart Polymer Nano-Carriers for Environmentally Responsive Agrochemical Delivery and Plant Stress Management” Southern New Hampshire University, NH (Awarded)

**2022 Gordon Research Seminar Oral Presentation.** “Smart Polymer Nano-Carriers for Environmentally Responsive Agrochemical Delivery and Plant Stress Management” Southern New Hampshire University, NH (Invited talk, Awarded)

**2021 Sustainable Nanotechnology Organization Conference Oral Presentation.** “Reactive oxygen species (ROS)-responsive star polymers promote plant photosynthesis under abiotic stress” Virtual meeting due to pandemic

**2021 ACS Colloid and Surface Science Symposium Oral Presentation.** “Foliar applied reactive oxygen species (ROS)-responsive star polymers protect plant photosynthesis under abiotic stress” Virtual meeting due to pandemic

**2020 Sustainable Nanotechnology Organization Conference Oral Presentation.** “Temperature-responsive delivery platforms for controlled foliar delivery of plant protection agents” Virtual meeting due to pandemic

**2019 CEINT Meeting Oral Presentation.** “Temperature and pH responsive star polymer as nanocarrier for *in vivo* agrochemical delivery in tomato plants” Duke University, NC

**2018 ICEEN Meeting Poster Presentation.** “Environmentally responsive star polymers for high efficiency agrochemical delivery in tomato plants” Duke University, NC

## TEACHING EXPERIENCE

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*Teaching Assistant, Carnegie Mellon University* 01/2018 – 05/2021

**12-725: Fate, Transport, and Physicochemical Processes of Organic Contaminants in Aquatic Systems.**

Roles: Gave lectures, designed exam and homework questions, graded homework and exams, prepared homework solutions, operated office hours

**Topic of Lectures:**

‘Mass Transfer, Diffusion’ 03/2020

‘Organic chemistry principles’ 02/2021

‘Environmental systems’ 03/2021

*Teaching Assistant, Carnegie Mellon University* 09/2021 – 12/2021

**12-720: Water Resource Chemistry.**

Roles: Prepared homework solutions, operated office hours, graded homework

*Guest Lecture, Memorial University of Newfoundland* 08/2024

**CIV7260: Environmental Geotechniques.**

**Topic of Lecture:** Nanotechnology improves agrochemical delivery to prevent soil and water contamination.

## MENTORING

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*Massachusetts Institute of Technology* **Graduate students (1):**

Jessica Cui (Ph.D. student, MIT)      Research Topic: Fabrication of biopolymer nanofibrils

*Carnegie Mellon University* **Graduate students (5):**

Hosea Santiago (Ph.D. student, CMU)      Research Topic: Enzyme mediated PFAS biodegradation

Ben Therrien (Ph.D. student, CMU)      Research Topic: Nanoparticle phloem loading pathway

Valeria Nava (Ph.D. student, CMU)      Research Topic: Plant leaf cross section imaging

Emma Clement (M.S., CMU)      Research Topic: Adjusting nanoparticle hydrophobicity

Jialin Dong (M.S., CMU)      Research Topic: Mercury removal from liquid hydrocarbon

## SELECTED AWARDS AND HONORS

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Excellent Oral Presentation Award, Gordon Research Seminar 2022

Excellent Poster Presentation Award, Gordon Research Seminar 2022

Mao Yisheng Outstanding Dissertation Award, Carnegie Mellon University 2022

Mao Yisheng Graduate Fellowship, Carnegie Mellon University 2019

Dean’s Fellowship, Carnegie Mellon University 2017

CEE Graduate Student Scholarship, Carnegie Mellon University 2016

Top 10 Outstanding Students in School of Chemistry, Beihang University 2014

## **PROFESSIONAL AND ACADEMIC SERVICE**

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Reviewer for journals: *Nature Communications*, *Environmental Science & Technology*, *ACS Sustainable Chemistry and Engineering*, *Journal of Colloid and Interface Science*, *Environmental Science: Nano*, *NanoImpact*, *Sensors and Actuators B: Chemical*, *Frontiers of Environmental Science & Engineering*, *Pharmaceutics*, *ACS Omega*, *Gels*, *Pest Management Science*, *Environmental Science: Processes & Impacts*

Proposal reviewer for NSF SBIR/STTR program 2024.

Reviewer for National Fellowship Program-Graduate Woman in Science (GWIS) fellowship 2021.

Chair for Resource Recovery Session and Judge for Student Poster Awards in AEESP 2023.

Invited speaker for Cambridge Science Festival 2023.

## **SKILLS**

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Spectroscopy: NMR, UV-Vis, FT-IR, fluorimetry, ICP-MS, Circular Dichroism, LC-MS  
Imaging: Dark field hyperspectral microscope (Cyto-viva), Confocal microscope, Atomic force microscope, Transmittance Electron Microscope, Scanning Electron Microscope  
Other: CVAFS mercury analyzer, DLS, Li-Cor photosynthesis system, Cryotome, Atom Transfer Radical Polymerization, GPC, Nanoindentation, recombinant protein production and purification  
Software: ChemOffice, OriginLab, Matlab, Topspin, MestReNova, BioRender, Igor, ImageJ

## **LANGUAGE**

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Chinese	Native speaker, writer, reader
English	Professional speaker, writer, reader