Pamela C. Cai

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Education

Stanford University — Stanford, CA
Ph.D. in Chemical Engineering, Advisor: Andrew Spakowitz, Sarah Heilshorn — 2023
- Thesis: "Polymer physics driven design and understanding of biological materials"

Massachusetts Institute of Technology (MIT) — Cambridge, MA
B.S. in Chemical Engineering, GPA: 5.0/5.0, Phi Beta Kappa — 2016
- Minor: Music Performance and Theory

Professional Appointments

University of Chicago — Chicago, IL
Arnold O. Beckman Postdoctoral Fellow — 2024–Current
Postdoctoral Scholar — 2023–2024

Publications

1. **PC Cai**, A Ghosh, and AJ Spakowitz. "Fluctuation-driven theory for polyelectrolyte rheology," *In preparation*, 2024.
2. EB Burgener, LS Rojas-Hernandez, NS Joo, **PC Cai**, MJ Kratochvil, A Gupta, K Nakano, S Gibbs, M Bach, C Dunn, J Spano, P Secor, L Tian, SC Heilshorn, AJ Spakowitz, JJ Wine, PL Bollyky, and CE Milla. "Effects of the *Pseudomonas* phage Pf on mucociliary transport and lung function in cystic fibrosis," *In preparation*, 2024.
3. Q Chen*, **PC Cai***, THW Chang, EB Burgener, MJ Kratochvil, A Gupta, A Hargill, PR Secor, J Nielsen, AE Barron, CE Milla, SC Heilshorn, AJ Spakowitz, and PL Bollyky. "Pf bacteriophages hinder sputum antibiotic diffusion via electrostatic binding," *In revision*, 2024.
4. M Ayushman, G Mikos, S Sinha, E Lopez-Fuentes, S Jones, **PC Cai**, X Tong, AJ Morrison, AJ Spakowitz, SC Heilshorn, A Sweet-Cordero, and F Yang. "Cell Dancing Enhances Stem Cell Differentiation in 3D Hydrogels via Nuclear Mechanotransduction," *In revision*, 2024.
5. **PC Cai***, M Braunreuther*, A Shih, AJ Spakowitz, SC Heilshorn, and GG Fuller. "Air-liquid intestinal cell culture allows *in situ* rheological characterization of intestinal mucus," in *APL Bioengineering (Accepted)*, 2024.
6. **PC Cai**, B Su, L Zou, MJ Webber, SC Heilshorn, and AJ Spakowitz. "Rheological Characterization and Theoretical Modeling Establish Molecular Design Rules for Tailored Dynamically Associating Polymers," in *ACS Central Science*, 8(9), 1318-1327, 2022.
7. Q Chen, T Dharmaraj, **PC Cai**, EB Burgener, NL Haddock, AJ Spakowitz, and PL Bollyky. "Bacteriophage Impact on Bacterial Susceptibility, Resistance, and Tolerance to Antibiotics," in *Pharmaceutics*, 17(7), 1425, 2022.
8. MJ Kratochvil*, G Kaber*, S Demirdjian*, **PC Cai**, EB Burgener, N Nagy, GL Barlow, MC Popescu, MR Nicolls, MG Ozawa, DP Regula, AE Pacheco-Navarro, S Yang, V de Jesus Perez, H Karmouty-Quintana, A Peters, B Zhao, LM Buja, PY Johnson, RB Vernon, TN Wight, Stanford COVID-19 Biobank Study Group, AJ Rogers, AJ Spakowitz, CE Milla, SC Heilshorn, and PL Bollyky. "Biochemical, biophysical, and immunological characterization of respiratory secretions in severe SARS-CoV-2 infections," in *JCI Insight*, 7(12), 2022.
9. DR Hunt, KC Klett, S Mascharak, H Wang, D Gong, J Lou, X Li, **PC Cai**, RA Suhar, JY Co, BL LeSavage, AA Foster, Y Guan, MR Amieva, G Peltz, Y Xia, CJ Kuo, and SC Heilshorn. "Engineered Matrices Enable the Culture of Human Patient-Derived Intestinal Organoids," in *Advanced Science*, 8: 2004705, 2021.

10. BA Krajina, BL LeSavage, JG Roth, AW Zhu, **PC Cai**, AJ Spakowitz, and SC Heilshorn. "Microrheology reveals simultaneous cell-mediated matrix stiffening and fluidization that underlie breast cancer invasion," in *Science Advances*, 7: eabe1969, 2021.

11. **PC Cai**, BA Krajina, MJ Kratochvil, L Zou, A Zhu, EB Burgener, PL Bollyky, CE Milla, MJ Webber, AJ Spakowitz, and SC Heilshorn. "Dynamic light scattering microrheology for soft and living materials," in *Soft Matter*, 17: 1929-1939, 2021.

12. **PC Cai**, BA Krajina, AJ Spakowitz. "Brachiation of a polymer chain in the presence of a dynamic network," in *Physical Review E*, 102, 020501(R), 2020.

Awards and Honors

American Chemical Society (ACS) PMSE Future Faculty	2024
ACS Global Oustanding Student Award in PMSE	2024
UChicago PME Postdoc Travel Award	2024
Frank J. Padden, Jr. Award for Excellence in Polymer Physics Research	2023
Stanford Bio-X Travel Award	2023
AIChE 1st Place Speaker Award for Graduate Excellence in Polymer Research	2022
MIT Rising Star in Chemical Engineering	2022
Stanford Justice Equity Diversity Inclusion (JEDI) Graduation Award	2022
Stanford Chemical Engineering Department Service Award	2022
American Physical Society (APS) Braslau Family Travel Award	2022
Biophysical Society (BPS) Best Grad Student or Postdoc Talk Award	2022
MIT Polymer Day 1st Place Poster	2021
Robert T. Haslam Cup for showing most promise as a future chemical engineer	2016
Excellence in Leadership as AIChE President	2016
Lourdes C. and Wing S. Fong Memorial Prize	2016
BP Prize for Excellence in Chemical Engineering	2015
MISTI-China Victor and William Fung Foundation Scholar	2013

Grants and Fellowships

Arnold O. Beckman Postdoctoral Fellowship, Arnold & Mabel Beckman Foundation	2024
Director's Discretionary Allocation, Argonne Leadership Computing Facility (ALCF)	2023
Graduate Research Fellowship Stanford Bio-X	2019
Graduate Research Fellowship, National Science Foundation (NSF)	2019

Presentations

Invited

1. "Linking molecular structure to macroscopic rheology of dynamically associating polymer networks," *APS March Meeting*. Las Vegas, NV. 2023. ***Padden Award Winner***.

2. "Molecular-Level Theory for Rational Design of Dynamic Polymer Networks," *AIChE Annual Meeting*. Phoenix, AZ. 2022. ***1st Place Speaker Award Winner***.

3. "Molecular-Level Theory for Rational Design of Dynamic Polymer Networks," *Polymer Physics Gordon Research Seminar*. South Hadley, MA. 2022.

4. "Leveraging Polymer Physics to Reduce Respiratory Secretions in Severe Cases of SARS-CoV-2 (COVID-19) Infection," *Biophysical Society Annual Meeting*. San Francisco, CA. 2022. ***Best Speaker Award Winner***.

5. "Biophysical Characterization of Respiratory Secretions in Severe SARS-CoV-2 (COVID-19) Infections," *8th Annual Chemical Engineering Convocation and Research Symposium*. Stanford, CA. 2021.

Contributed

1. "Fully recyclable plastics from biopolymer-based polyelectrolyte complexes," *ACS Spring Meeting*. New Orleans, LA. 2024.

2. "Molecular-Level Theory for Rational Design of Dynamic Polymer Networks," *Polymer Physics Gordon Research Conference*. South Hadley, MA. 2022.

3. "Dynamic Light Scattering Microrheology for Soft and Living Materials," *Society for Biomaterials Annual Meeting*. Baltimore, MD. 2022.

4. "A Molecular-Level Theory for Predicting Rheological Behavior of Dynamically Associating Polymer Networks," *American Physical Society Annual Meeting*. Chicago, IL. 2022.

5. "Brachiation of a polymer chain in the presence of a dynamically associating network," *2nd Annual Virtual Polymer Physics Symposium*. Virtual. 2021.

6. "Biophysical Characterization of Respiratory Secretions in Severe SARS-CoV-2 (COVID-19) Infections," *10th Annual MIT Polymer Day*. Virtual. 2021. ***1st Place Poster Award Winner***.

Teaching

Teaching Assistant at Stanford University — Fall 2020
Applied Mathematics in the Chemical and Biological Sciences (CHEMENG300)

Teaching Assistant at Stanford University — Fall 2019
Applied Mathematics in the Chemical and Biological Sciences (CHEMENG300)

Outreach and Service

Session Chair in ACS PMSE Centennial Session, *New Orleans, LA*	2024
Volunteer in Girls Advancing in STEM (GAINS), *Chicago, IL*	2023
Math Tutor at Wendell Phillips High School, *Chicago, IL*	2023
Vice President of Stanford Polymer Collective (SPC), *Stanford, CA*	2022
Discussion Leader at Polymer Physics Gordon Research Seminar (GRS), *South Hadley, MA*	2022
Chair of Stanford Chemical Convocation, *Stanford, CA*	2021
Research Mentor for Stanford Undergraduate Research Fellows (SURF) Program, *Stanford, CA*	2021
Vice President of Chemical Engineering Graduate Student Action Committee, *Stanford, CA*	2020
Room Leader for Stanford Future Advancers of Science and Technology (FAST), *San Jose, CA*	2019
Community Associate in Stanford Graduate Life Office (GLO),*Stanford, CA*	2019
Mentor in Minds Matter, *New York, NY*	2017
President of MIT American Institute of Chemical Engineers (AIChE), *Cambridge, MA*	2015
Co-founder of MIT Code It!, *Cambridge, MA*	2015
Outreach Program Director of MIT Society of Women Engineers (SWE), *Cambridge, MA*	2014