

Liheng Cai

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❖ EDUCATION AND TRAINING

- 2013-2017 Postdoctoral Fellow
School of Engineering and Applied Science
Harvard University, Cambridge, MA
Mentors: David A. Weitz and Jeffrey J. Fredberg
- 2012-2013 Postdoctoral Researcher
Department of Chemistry and Marsico Lung Institute, School of Medicine
University of North Carolina, Chapel Hill, NC
Mentors: Michael Rubinstein and Richard C. Boucher
- 2012 Ph.D. in Materials Science
University of North Carolina, Chapel Hill, NC
Advisor: Michael Rubinstein
Thesis: Structure and Function of Airway Surface Layer of the Human Lungs
& Mobility of Probe Particles in Complex Fluids
- 2006 B.S. in Physics (*Summa cum laude*)
Lanzhou University, China

❖ PROFESSIONAL APPOINTMENTS

- 01/2018 – Assistant Professor, Department of Materials Science and Engineering
01/2018 – Assistant Professor, Department of Chemical Engineering
01/2019 – Assistant Professor, Department of Biomedical Engineering (by courtesy)
08/2024 – Assistant Professor, Department of Chemistry (by courtesy)
University of Virginia, Charlottesville, VA

❖ HONORS AND AWARDS (Selected)

- 2024 NIH Maximizing Investigators' Research Award (MIRA R35)
2024 ACS PMSE Early Investigator Award
2023 UVA Research Excellence Award [as the only awardee from UVA Engineering School]
2023 *ACS Polymers Au* Rising Star
2022 UVA Research Communications Fellow
2021 *Soft Matter* Emerging Investigator
2020 ACS PRF Doctoral New Investigator Award
2019 National Science Foundation CAREER Award
2014 Harvard University Postdoctoral Award for Professional Development
2013 North Carolina Impact Award (for best Ph.D. dissertation research)
2012 NSF Fellowship, Boulder Soft Condensed Matter Summer School
2012 Invited Student Speaker, Gordon Research Conference: Cilia, Mucus & Mucociliary Interactions
2011 NSF Fellowship, Kavli Institute for Theoretical Physics at Santa Barbara
2004 Chun-Tsung Scholar

❖ RESEARCH OVERVIEW

My lab's research lies at the interface of soft (bio)materials and biology. We seek to understand and control the interactions between soft (bio)materials and living systems, with the mission of addressing challenges in sustainability and health. We achieve this through a combination of experimental and theoretical approaches. Our core expertise includes polymers and soft matter, biomaterials, voxelated bioprinting, and additive manufacturing of soft and inorganic matter. Complementary expertise includes cell biology, nonlinear fluid dynamics, macro-/micro-rheology, advanced characterization, microscopy and image analysis, microfluidics, and *in vivo* animal studies. Our research program is highly collaborative and interdisciplinary, integrating synthesis, theory, experiment, and translation. The philosophy of our research is to identify and solve problems of both fundamental importance and practical value; this is often accomplished by working closely with experts from various fields.

Research, Mentoring, and Teaching - Summary

- Publications: >3900 Google Scholar Citations; *h*-index = 22; *h*10-index = 29; 35 papers published/in press in e.g., *Science*, *Science Advances*, *PNAS*, *Physical Review Letters*, *Nature Communications*, *Advanced Materials*, *ACS Nano*, *Macromolecules*, *AJP-Lung Cellular and Molecular Physiology*. Notable contributions include:
 - **Polymer science** – Developed Cai-Panyukov-Rubinstein theoretical framework for nanoparticle diffusion in complex fluids [*Macromolecules* 2011, >380 citations; *Macromolecules* 2015, >270 citations], the first molecular theory [*Macromolecules* 2013, >350 citations] and experimental validation [*Adv. Mater.* 2017 (front cover), >380 citations] for tough self-healing polymers, and renormalized Rouse model for associative polymers [*PRL* 2023 (front cover), selected as Editors' Choice, and highlighted as a *Synopsis* in *Physics*]; discovered entanglement-free bottlebrush polymer networks [*Adv. Mater.* 2015 (front cover), >210 citations; *ACS Macro Lett* 2019, *Soft Matter* 2020], foldable bottlebrush polymers [*Macromolecules* 2023 (front cover)] and networks [*Science Advances* 2024 (front cover)].
 - **Advanced (bio)manufacturing** – Proposed and proved the concept of voxelated bioprinting for engineering highly heterogeneous and tightly organized 3D tissue mimics [*Adv. Funct. Mater.* 2022 (front cover), *Acta Biomaterialia* 2023, *Nature Comms.* 2024]; developed direct-ink-write (DIW) and stereolithography (SLA) platforms for printing soft stretchable polymers [*Chem. Mater.* 2021 (front cover), highlighted as Editors' Choice in *Science*].
 - **Bioengineering** – Discovered the biophysical basis (gel-on-brush model) for human lung defense [*Science* 2012 (front cover), >900 citations], developed *in vitro* systems for modeling human lung diseases [*AJP-Lung Cell Mol. Physiol.* 2024], and designed drug carriers for mucosal delivery [*ACS Nano* 2024].
- Invited talks: Since joined UVA, >30 invited seminars at e.g., Harvard, Duke, UMass Amherst, UMD, Georgia Tech, APS, World Biomaterials Congress, & overseas on three research areas: (1) bottlebrush polymers, (2) voxelated bioprinting, and (2) soft matter approaches to human lung defense.
- Student presentations: 20 oral talks and 20 poster presentations.
- Intellectual property: 7 US/International patent applications filed; 4 provisional patent applications filed.
- Research support: > \$4.3 million to Cai lab from e.g., NSF, NIH, ACS, JDRF, CHRB, Foundations, and UVA.
- Postdoctoral researchers: 4 advised; 2 moved to faculty positions, 1 moved to industry.
- Ph.D. students: 12 advised; 1 graduated – was accepted into a top Internal Medicine Residency program to start his career as a physician-scientist.
- MSE students: 3 advised; 3 graduated and moved to industry.
- Undergraduate students: 22 advised; 3 moved to graduate school.
- Visiting scholars/students: 6 advised.
- Teaching: Co-developed a Concentration in Polymers and Soft Matter for UVA MSE department; developed an undergraduate course (Science of Cooking, MSE 2300) and a graduate course (Polymer Physics, MSE 4220/6220) from scratch; ratings as high as 4.75/5; evaluations that “The labs at the teaching kitchen were one of the greatest things I have experienced at UVA. Being able to apply the concepts we learned in (the) lecture

and during the homework was amazing, because it gave me perspective on the way that the chemistry and science behind it work” and that “this is the most solid, deep, and comprehensive course I have ever taken”.

Professional Activities, Service, Outreach - Summary

- Reviewer: ~20 manuscripts per year for >20 journals covering chemistry, soft matter, biophysics, bioengineering, and biomedicine.
- Organizer or chair: APS (2021, 22, 23, 24, 25), Society of Rheology (2021), World Biomaterials Congress (2024); Virginia Soft Matter Workshop (2019); UVA Squishy Materials Seminar Series from 2018 – present.
- Grant proposal reviewer: NSF, NIH, DOE, ACS PRF, National Research Council Canada; NSF Gen-4 Engineering Research Center (ERC) (pre-proposal, full proposal, on site visit).
- Outreach activities: Developed “Science of Cooking” demos for UVA SEAS open house.
- Journal editor: *Frontiers in Physics* special issue on active matter in complex environments.
- Service at UVA: Led the development of a 10-year growth strategy in soft (bio) materials for the MSE department; committee members at various levels in MSE, ChE, and SEAS.

In the News

- 2024: UVA Engineering - [In Major Materials Breakthrough, UVA Team Solves a Nearly 200-Year-Old Challenge in Polymers](#)
- 2024: UVA Engineering - [UVA Engineers Design Lookalike Drug Carrier To Evade Lung’s Lines of Defense](#)
- 2024: UVA Engineering - [UVA Engineering Professor Lands \\$1.9 Million NIH Award To Maximize Biomedical Research](#)
- 2024: UVA Engineering - [Organs on Demand? UVA Prints Its First Voxel Building Blocks](#)
- 2024: UVA Engineering - [2023 Research Achievement Awards Honor UVA Engineering Faculty Members](#)
- 2023: UVA Engineering - [UVA-Led Discovery Challenges 30-Year-Old Dogma in Associative Polymers Research](#)
- 2023: *Physics Magazine* - [Bond Density Not Strength Controls Polymer Stickiness](#)
- 2022: UVA Engineering - [University of Virginia Engineering Researchers Strive to Match Artistry of Biological Tissues](#)
- 2022: UVA Engineering - [UVA Researchers Advance Bioprinting - New Technique Uses Hydrogel Particles to Build 3D Structures](#)
- 2021: Washington Post - [Science of Cooking](#)
- 2021: UVA Engineering - [Research Team Develops New Class of Soft Materials](#)
- 2020: UVA Engineering - [UVA Researcher Imagines Super Rubber, and Has a Strategy to Make It](#)
- 2020: UVA Engineering - [CAREER Award: Running Hot and Cold](#)
- 2017: Harvard SEAS - [Harvard researchers develop tough, self-healing rubber](#)
- 2015: Harvard SEAS - [Eliminating entanglements: A new strategy towards ultra-soft yet dry rubber](#)
- 2012: UNC Chapel Hill - [ENDEAVORS - For Cilia's Sake](#)

❖ **PUBLICATIONS (>3,900 [Google Scholar](#) Citations as of November 2024; *h*-index: 22; *i10*-index: 29)**

†Equal contribution; +Undergraduate researcher; *Corresponding author; Trainees
Research Areas: [Polymers and Soft Matter](#); [Advanced \(Bio\)Manufacturing](#); [Biomaterials](#), [Bioengineering](#)

Work from UVA

In Preparation (7 total)

45. Failure in the working curve: Determining interlayer adhesion in stereolithography printing via photorheology.
Z. Benton†,+, D.A. Rau†, M. Kim, **L.-H. Cai***.
[[Advanced \(Bio\)Manufacturing](#)]
44. High-resolution copper lattices from 3D printed PEG bottlebrush hydrogels for enhanced catalysis.
E. Oduro, Y. Zhang, D.A. Rau, B. Huang, S. Zhang, **L.-H. Cai***.
[[Polymers and Soft Matter](#); [Advanced \(Bio\)Manufacturing](#)]
43. Dynamics of polymers with controlled distribution and density of associative groups.
M. Kim†, S Patil†, P. Wasik, W. Lutz, S. Cheng*, **L.-H. Cai***.
[[Polymers and Soft Matter](#)]
42. Molecular architecture encoded modular biomimetic cell-instructive hydrogels for 3D printing high-resolution scaffolds.
B. Huang†, J. Zhu†, **L.-H. Cai***.
[[Advanced \(Bio\)Manufacturing](#); [Bioengineering](#)]
41. Multi-material additive manufacturing of composites with seamless soft-hard interface integration from molecular bonding.
D.A. Rau†, B. Huang†, **L.-H. Cai***.
[[Advanced \(Bio\)Manufacturing](#); [Polymers and Soft Matter](#)]
40. Elasticity promotes directional transport of *Pseudomonas aeruginosa* in human airway mucus.
R. Dickson, Z.-J. He, **L.-H. Cai***.
[[Bioengineering](#)]
39. Supramolecular bottlebrush hydrogels.
X. Ma†, B. Huang†, J. Zhu, K.U. Lao, **L.-H. Cai***.
[[Biomaterials](#)]

Submitted (3 total)

38. Molecular structure of foldable bottlebrush polymers in melts.
L.-H. Cai*.
[[Polymers and Soft Matter](#); [Theory](#)]
37. Additive manufacturing of molecular architecture encoded stretchable modular polyethylene glycol hydrogels and elastomers.
B. Huang, P. Zhang, D.A. Rau, E. Oduro, **L.-H. Cai***.
[[Advanced \(Bio\)Manufacturing](#); [Polymers and Soft Matter](#); [Biomaterials](#)]
36. Modular soft stretchable low-cost elastomer resin for stereolithography printing structures with extreme dissipative properties.
D.A. Rau†, M. Kim†, **L.-H. Cai***.
Preprint: 10.26434/chemrxiv-2024-pj7s0
[[Advanced \(Bio\)Manufacturing](#); [Polymers and Soft Matter](#)]

Published or in press (22 total)

35. A universal strategy for decoupling stiffness and extensibility of polymer networks.
B. Huang, S. Nian, **L.-H. Cai***.
Science Advances 10, eadq3080 (2024).
 Featured as [Front Cover](#); [News Report](#)
 [Polymers and Soft Matter; Theory + Experiment]
34. Bottlebrush polyethylene glycol nanocarriers translocate across human airway epithelium via molecular architecture enhanced endocytosis.
Z.-J. He[†], B. Huang[†], **L.-H. Cai***.
ACS Nano 18, 17586-17599 (2024).
[News Report](#)
 [Bioengineering; Biomaterials; Theory + Experiment]
33. Voxlated bioprinting of modular double-network bio-ink droplets.
J. Zhu, Y. He, Y. Wang, **L.-H. Cai***.
Nature Communications 15, 5902 (2024).
[News Report](#)
 [Advanced (Bio)Manufacturing; Bioengineering; Biomaterials; Theory + Experiment]
32. A gel-coated air-liquid-interface culture system with tunable substrate stiffness matching healthy and diseased lung tissues.
Z.-J. He[†], C. Chu[†], R. Dickson, **L.-H. Cai***.
[American Journal of Physiology - Lung Cellular and Molecular Physiology](#) 326, L292-L302 (2024).
 [Bioengineering]
31. 3D printable modular soft elastomers from physically crosslinked homogeneous associative polymers.
M. Kim[†], S. Nian[†], Daniel Rau[†], B. Huang, J. Zhu, G. Freychet, M. Zhernenkov, **L.-H. Cai***.
[ACS Polymers Au](#) 4, 98–108 (2024).
 2023 Virtual Issue of Rising Stars in Polymers.
[News Report](#)
 [Advanced (Bio)Manufacturing; Polymers and Soft Matter]
30. Dynamics of associative polymers with high density of reversible bonds.
S. Nian[†], S. Patil[†], S. Zhang, M. Kim, Q. Chen, M. Zhernenkov, T. Ge, S. Cheng*, **L.-H. Cai***.
[Physical Review Letters](#), 130, 228101 (2023).
 Selected for a [Synopsis](#) in *Physics* and an Editors' Suggestion, and featured as [Front Cover](#); reported by [EurekAlert](#) and [many others](#)
 [Polymers and Soft Matter; Theory + Experiment]
29. Unexpected folding of bottlebrush polymers in melts.
S. Nian[†], B. Huang[†], G. Freychet, M. Zhernenkov, **L.-H. Cai***.
Macromolecules 56, 2551-2559 (2023).
 Featured as Front Cover
 [Polymers and Soft Matter; Theory + Experiment]
28. All-aqueous printing of viscoelastic droplets in yield-stress fluids.
J. Zhu, **L.-H. Cai***.
[Acta Biomaterialia](#) 165, 60-71 (2023).
 [Advanced (Bio)Manufacturing; Theory + Experiment]
27. Dynamic mechanical properties of self-assembled bottlebrush polymer networks.
S. Nian, **L.-H. Cai***.
[Macromolecules](#) 55, 8058-8066 (2022).
 [Polymers and Soft Matter; Theory + Experiment]
26. A high-throughput multiparameter screen for accelerated development and optimization of soluble genetically encoded fluorescent biosensors.

- D. Koveal, P.C. Rosen, D.J. Meyer, C.M. Díaz-García, Y. Wang, **L.-H. Cai**, P. Chou, D.A. Weitz, G. Yellen.
Nature Communications 13, 1-14 (2022).
[[Bioengineering](#)]
25. Self-assembly of flexible linear-semiflexible bottlebrush-flexible linear triblock copolymers.
S. Nian, F. Zhou, G. Freychet, M. Zhernenkov, S. Redemann, **L.-H. Cai***
Macromolecules 54, 9361-9371 (2021).
[[Polymers and Soft Matter](#)]
24. Digital assembly of spherical viscoelastic bio-ink particles.
J. Zhu[†], Y. He[†], L. Kong, Z. He, K.Y. Kang⁺, S.P. Grady⁺, L.Q. Nguyen⁺, D. Chen, Y. Wang, J. Oberholzer,
L.-H. Cai*.
Advanced Functional Materials 32, 2109004 (2021).
[[Advanced \(Bio\)Manufacturing](#); [Bioengineering](#)]
Featured as [Front Cover](#); reported by [public media](#)
23. Three-dimensional printable, extremely soft, stretchable, and reversible elastomers
from molecular architecture-directed assembly.
S. Nian[†], J. Zhu[†], H. Zhang, Z. Gong, G. Freychet, M. Zhernenkov, B. Xu, **L.-H. Cai***.
Chemistry of Materials 33, 2436–2445 (2021).
[[Polymers and Soft Matter](#); [Advanced \(Bio\)Manufacturing](#)]
Featured as [Front Cover](#); highlighted as Editor's Choice in *Science*; reported by [EurekAlert](#) and many others
22. Effects of vimentin intermediate filaments on the structure and dynamics of
in vitro multicomponent interpenetrating cytoskeletal networks.
Y. Shen, H. Wu, P.J. Lu, D. Wang, M. Shayegan, H. Li, W. Shi, Z. Wang, **L.-H. Cai**, J. Xia, M. Zhang, R.
Ding, H. Herrmann, R. Goldman, F.C. MacKintosh, A. Moncho-Jorda, and D. A. Weitz.
Physical Review Letters 127, 108101 (2021).
[[Bioengineering](#)]
21. Anomalous mechanics of Zn²⁺ modified fibrin networks.
J. Xia, **L.-H. Cai**, H. Wu, F.C. MacKintosh, D.A. Weitz.
Proceedings of the National Academy of Sciences 118, e2020541118 (2021).
[[Bioengineering](#)]
20. Dissolvable polyacrylamide beads for high-throughput droplet DNA barcoding.
Y. Wang, T. Cao, J. Ko, Y. Shen, W. Zong, K. Sheng, W. Cao, S. Sun, **L.-H. Cai**, Y.-L. Zhou, X.-X. Zhang,
C. Zong, R. Weissleder, D.A. Weitz.
Advanced Science 1903463 (2020).
[[Bioengineering](#)]
19. Molecular understanding for large deformations of soft bottlebrush polymer networks.
L.-H. Cai*.
Soft Matter 16, 6259-6264 (2020).
[[Polymers and Soft Matter](#); [Theory + Experiment](#)]
Featured as Editor's Choice.
18. Capillary transfer off soft films.
Y. Zhang, M. Yin, Y. Baek, K. Lee, G. Zangari, **L.-H. Cai**, B. Xu.
Proceedings of the National Academy of Sciences 117, 5210-5216 (2020).
[[Polymers and Soft Matter](#)]
17. The rheology property of organogels based on 3D helical nanofilament networks
self-assembled by bent-core liquid crystals.
X.Z. Wang, C.J. Yang, **L.-H. Cai***, D. Chen*.
Acta Physica Sinica 69, 086102 (2020).
[[Polymers and Soft Matter](#)]

16. Rapid isolation of antigen-specific B-cells using droplet microfluidics.
R. Ding, K.-H. Hung, A. Mitra, L. Ung, D. Lightwood, R. Tu, D. Starkie, **L.-H. Cai**, L. Mazutis, S. Chong, D.A. Weitz, J. Heyman
[RSC Advances](#) 10, 27006-27013 (2020).
[Bioengineering]
15. Molecular architecture directs linear-bottlebrush-linear triblock co-polymers to self-assemble to soft, reprocessable elastomers.
S. Nian, H. Lian, Z. Gong, Z. Mikhail, J. Qin, **L.-H. Cai***.
[ACS Macro Letters](#) 8, 1528-1534 (2019).
[Polymers and Soft Matter]
14. Millimeter-size pickering emulsions stabilized with Janus micro-particles.
B. Haney, D. Chen, **L.-H. Cai**, D.A. Weitz, S. Ramakrishnan.
[Langmuir](#) 35, 4693-4701 (2019).
[Polymers and Soft Matter]
13. Roles of mucus adhesion and cohesion in cough clearance.
B. Button, H. Goodell, E. Atieh, Y.-C. Chen, R. Williams, S. Shenoy, E. Lackey, N. Shenkute, **L.-H. Cai**, R. Dennis, R. Boucher, M. Rubinstein.
[Proceedings of the National Academy of Sciences](#) 115, 12501-12506 (2018).
[Bioengineering]

Before Independent Career (12 total)

12. Biocompatible amphiphilic hydrogel-solid dimer particles as colloidal surfactants.
D. Chen, E. Amstad, C. Zhao, **L.-H. Cai**, J. Fan, Q. Chen, M. Hai, S. Koehler, H. Zhang, F. Liang, Z. Yang, D.A. Weitz.
[ACS Nano](#) 11, 11978-11985 (2017).
[Polymers and Soft Matter]
11. Tough self-healing elastomers from molecular enforced integration of covalent and reversible networks.
J. Wu, **L.-H. Cai***, D. A. Weitz*.
[Advanced Materials](#) 29, 1702616 (2017).
[Polymers and Soft Matter]
Highlighted as Cover Article, reported by [Harvard News](#) etc.
10. Graphene oxide induced crosslinking and reinforcement of elastomers.
W. Xing, H. Li, G. Huang*, **L.-H. Cai***, J. Wu*.
[Composites Science and Technology](#) 144, 223-229 (2017).
[Polymers and Soft Matter]
9. Ultrafast nanofiltration through large-area single-layered graphene membranes.
Y. Qin, Y. Hu, S. A. Koehler, **L.-H. Cai**, J. Wen, X. Tan, W. L. Xu, Q. Sheng, X. Hou, J. Xue, M. Yu, D.A. Weitz
[ACS Applied Materials & Interfaces](#) 9, 9239-9244 (2017).
[Polymers and Soft Matter]
8. One-step microfluidic fabrication of polyelectrolyte microcapsules in aqueous condition for protein release.
L. Zhang†, **L.-H. Cai†**, L. S. Philipp, T. Rossow, Q. Vallmajo-Martin, D. Ingmar, M. Ehrbar, H. Na, D. Mooney, D.A. Weitz.
[Angewandte Chemie International Edition](#) 55, 13470-13474 (2016).
[Bioengineering]
7. Soft elastomers from architecture-driven entanglement free design.
L.-H. Cai, T.E. Kodger, R.E. Guerra, A.F. Pegoraro, M. Rubinstein, D.A. Weitz.

[Advanced Materials](#) 27, 5132-5140 (2015).

[Polymers and Soft Matter]

Selected as [Cover Article](#), reported by [Harvard News](#), [Science Daily](#) and etc.

6. Hopping diffusion of non-sticky nanoparticles in polymer matrices.
L.-H. Cai, S. Panyukov, M. Rubinstein.
[Macromolecules](#) 48, 847-862 (2015).
[Polymers and Soft Matter; Theory]
5. Cystic fibrosis airway secretions exhibit mucin hyperconcentration and increased osmotic pressure.
A. G. Henderson, C. Ehre, B. Button, L.H. Abdullah, **L.-H. Cai**, M.W. Leigh, G. DeMaria, H. Matsui, S.H. Donaldson, C. W. Davis, J. K. Sheehan, R. C. Boucher, M. Kesimer.
[Journal of Clinical Investigation](#) 124, 3047-3060 (2014).
[Bioengineering]
4. Self-healing of unentangled polymer networks with reversible bonds.
E. B. Stukalin†, **L.-H. Cai**†, N. A. Kumar, L. Leibler, M. Rubinstein.
[Macromolecules](#) 46, 7525-7541 (2013).
[Polymers and Soft Matter; Theory]
3. A periciliary brush promotes the lung health by separating the mucus layer from airway epithelia.
B. Button†, **L.-H. Cai**†, C. Ehre, M. Kesimer, D. B. Hill, J. K. Sheehan, R. C. Boucher, M. Rubinstein.
[Science](#) 337, 937-941 (2012).
[Bioengineering]
Selected as [Cover Article](#), highlighted by a [Perspective](#), and reported by [BBC](#), [US News & World Report](#) and etc.
2. Mobility of nonsticky nanoparticles in polymer liquids.
L.-H. Cai, S. Panyukov, M. Rubinstein.
[Macromolecules](#) 44, 7853-7863 (2011).
[Polymers and Soft Matter; Theory]
1. Template synthesis and magnetic behavior of FeNi alloy nanotube arrays.
D. Zhou, **L.-H. Cai**, F.-S. Wen, F.-S. Li.
[Chinese Journal of Chemical Physics](#) 20, 821 (2007).

Book Chapters

1. Advanced Materials for Self-Healing Applications.
Design, Fabrication, Properties and Applications of Smart and Advanced Materials, 308 (2016).
J. Wu*, **L.-H. Cai***, H. Wang*
[Polymers and Soft Matter]

Editorials

2. Active matter in complex environments.
L.-H. Cai*, S. Datta*, X. Cheng*.
Editorial, *Frontiers in Physics* (2022)
1. Hidden in mist no more: Physical force in cell biology.
K. Wang, **L.-H. Cai**, B. Lan, and J. J. Fredberg.
[Nature Methods](#) 13, 124 (2016).

❖ PATENTS

1. **L.-H. Cai, B. Huang.** 3D printing of molecular architecture encoded modular stretchable PEG hydrogels and elastomers. US Provisional Patent Application. 63/675,180. Filed on July 24, 2024
2. **L.-H. Cai, D.A. Rau, M. Kim.** Modular soft stretchable low-cost elastomers for stereolithography printing structures and thereof. US Provisional Patent Application. Filed on January 30, 2024
3. **L.-H. Cai, Z.-J. He, C. Chu.** A gel coated air-liquid-interface culture system with tunable substrate stiffness matching healthy and diseased lung tissues. US Patent Application. 18/623,437. Filed on April 02, 2024 (priority date July 5, 2023)
4. **L.-H. Cai, Z.-J. He, B. Huang.** Bottlebrush polyethylene glycol nanocarriers translocate across human airway epithelium via molecular architecture enhanced endocytosis. US Provisional Patent Application. 63/626,879. January 30th, 2024
5. **L.-H. Cai and J. Zhu.** Double-network hydrogel particles, methods of making double-network hydrogel particles, and methods of making objects. US Patent Application No. 63/538,260. September 13, 2023
6. **L.-H. Cai, B. Huang, S. Nian.** Polymers, polymer networks, and methods of making polymer networks. PCT/US24/40656. August 2, 2024.
7. **L.-H. Cai and J. Zhu.** Method and system for all-aqueous printing of viscoelastic droplets in yield-stress fluids and related compositions thereof. PCT/US2023/067234. May 19, 2022
8. **L.-H. Cai, S. Nian.** Intrinsically reprocessable double-network elastomers. PCT/US2023/23566. May 25, 2023. International Application, November 22, 2024.
9. **L.-H. Cai, S. Nian.** Method and system for providing mechanically adaptive polymers. U.S. Patent Application No. 63/193,344 (priority date May 26, 2021)
10. **L.-H. Cai, S. Nian, J. Zhu.** Ultrasoft, stretchable, reversible elastomers for direct-write printing deformable structures. PCT/US2021/028987. April 23, 2021.
11. **L.-H. Cai and J. Zhu.** Digital assembly of spherical hydrogel voxels to form 3D lattice structures. PCT/US21/37811, WO2021257815A1. June 17, 2021

❖ MENTORING

Awards received by trainees

Doctoral Students

2023	Doris Kuhlmann-Wilsdorf Outstanding Graduate Student Award	Jinchang Zhu
2023	Victor Orphan Graduate Fellowship	Jinchang Zhu
2024	APS DPOLY Short Course Travel Award	Jinchang Zhu
2023	3 rd place, Best Poster for the 7 th Virginia Soft Matter Workshop	Riley Dickson
2024	2 nd place, Oral Presentations at the Chemical Engineering Research Symposium (CHEERS)	Riley Dickson
2024	2 nd place, Best Poster Design, 20 th Annual University of Virginia Engineering Research Symposium (UVERS)	Riley Dickson
2023	American Thoracic Society Abstract Scholarship	Zhijian He

Postdocs

2023	Climate Fellow, UVA Environmental Resilience Institute	Daniel Rau
2023	Best Poster Award, 7 th Virginia Soft Matter Workshop	Daniel Rau
2024	APS DPOLY Short Course Travel Award	Daniel Rau
2024	Finalist, UVA Postdoctoral Symposium Lightning Talk Competition	Daniel Rau
2024	Climate Fellow, UVA Environmental Resilience Institute	Shahryar Ramezani

Undergraduates

2018	NanoSTAR Summer Research Fellowship	Sneha Tara Ravi
2018	NanoSTAR Summer Research Fellowship	Brandon Phan
2019	NanoSTAR Summer Research Fellowship	Anthony Ouertani
2020	CAD-Bio Summer Research Fellowship	Anthony Ouertani
2019	Chemistry Undergraduate Research Fellowship	Sean Lee
2020	Graduate with distinction (<i>Magna cum laude</i>) in Chemistry	Sean Lee
2021	Summer Diabetes Research Internship	Isabella Powell
2022	Best presentation award for Summer Diabetes Research Internship	Gabriella Recce
2024	Dean's Undergraduate Engineering Summer Fellowship	Zoe Benton

List of trainees

F: Female; URM: Underrepresented Minority; Capstone: Undergraduate thesis project
Q: Passed qualifying exam; P: Passed dissertation proposal; D: Defended

Doctoral Students (Total #:12; 1 graduated, 11 current)

Name	Department	Milestone	Start	End	Placement
Zhijian He (M.D., Ph.D.) ¹	Biomedical Engineering (BME)	D	08/2019	05/2024	Residency, AdventHealth Orlando
Pu (Bruce) Zhang*	Mechanical and Aerospace Engineering (MAE)	P (to defend in Feb 2025)	08/2019		
Jinchang Zhu	Materials Science and Engineering (MSE)	P (to defend in May 2025)	01/2020		
Riley Dickson	Chemical Engineering (ChE)	P	08/2020		
Myoeum Kim (F)	MSE	Q	05/2021		
Baiqiang Huang	MSE	Q	08/2021		
Xiaoxiao Ma (F)	MSE	Q	08/2022		
Emmanuel Oduro (URM)	MSE	Q	08/2023		
Weining (Winne) Zhang (F)	MSE		08/2024		
Muskan Aslam (F)	BME	Rotation	08/2024		
Sara Olsen (F)	CHE		08/2024		
Ning Ran (F)	CHE		08/2024		

¹Dissertation: "Biophysical Cues on Human Lung Defense: From Airway Remodeling to Mucosal Drug Delivery"

*Co-advised by Melur K. Ramasubramanian

Master Students (Total #: 3; current: 0)

Name	Department	Start	End	Placement
Zihao Gong (M.S.)	MSE	01/2018	12/2021	NA

Zhouhao Fan (M.E.)	ChE	08/2020	02/2022	NA
Catherine Chu (F; M.S.)	MSE	01/2020	07/2022	Process Engineer, TSMC, Arizona

Undergraduates, summer students, REUs, and high school students (Total #: 22; current: 4)

Name	Major/Institution	Start	End	Placement
Yafu Xu (F)	Chemistry, UVA	06/2024		
Zoe Benton (F)	MAE, UVA	09/2023		
Alexander Church	ChE, UVA	01/2023		
Amelia Preble (F)	MSE, UVA	01/2023	06/2023	
Avery Baker (F)	ChE, UVA	06/2022	12/2022	
Gabriella Recce (F)	Summer Diabetes Research Internship	06/2022	08/2022	
Isabella Powell (F)	Summer Diabetes Research Internship	06/2021	08/2021	
Sean Lee	Chemistry, UVA	08/2019	05/2020	U Chicago
Anthony Ouertani (URM)	ChE, UVA	05/2018	05/2020	
Lauren Weiss (F)	MAE, UVA	08/2018	05/2020	
Mucui Lin (F)	ChE, UVA	09/2018	01/2020	
Brandon Minh-Truc Phan	BME, UVA	05/2018	08/2018	
Sneha Tara Ravi (F)	UVA	05/2018	08/2018	
Rebecca Richardson (F)	ChE, UVA	05/2018	08/2018	
Brian Heidler	Virginia's Community Colleges, REU	06/2022	08/2022	
Elizabeth Cotter (F)	Princeton University, REU	06/2024		
Leander Nguyen	BME Capstone, UVA	09/2020	05/2021	
Kaylen Kang (F)	BME Capstone, UVA	09/2020	05/2021	
Shannon Grady (F)	BME Capstone, UVA	09/2020	05/2021	
Noah Stern	BME Capstone, UVA	09/2019	05/2020	UT Austin
Sean Wei	High School Student	07/2019	08/2019	UCLA

Visiting Scholars/Students (Total #: 6; current: 0)

Name	Home Institution	Start	End	Placement
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Yuehui Wu (F)	Zhejiang University	10/2020	09/2021	Zhejiang University
Zhinan Yang	Sichuan University	08/2019	10/20198	The Chinese University of Hong Kong
Bocheng Liu	Zhejiang University	07/2019	08/2019	Zhejiang University
Baiqiang Huang	Zhejiang University	07/2019	08/2019	University of Virginia
Le Pan (F)	Beihang University	05/2018	08/2018	University of Pennsylvania
Zhongwei Ma	Lanzhou University	05/2018	08/2018	Rensselaer Polytechnic Institute

Postdoctoral Fellows (Total #: 4; current: 2)

Name	Ph.D. Institution	Start	End	Placement
Shahryar Ramezani	Rice University	06/2024		
Daniel A. Rau	Virginia Tech	07/2022	08/2024	Assistant professor, U Wyoming
Shifeng Nian	University of Virginia	07/2018	06/2021	Associate Professor, Northwestern Polytechnical University, China
Genyu Du	University of Virginia	11/2020	02/2021	Senior Scientist, Hongene Biotech, USA

❖ **TEACHING**

- Fall 2024: MSE 4220/6220 – *Polymer Physics*; 13 students
Instructor rating: TBD; Overall course rating: TBD
- Spring 2024: MSE 2090 – *Introduction to Materials Science*; 19 students
Instructor rating: 4.56/5; Overall course rating: 4.38/5
Evaluated as “Professor Cai is the best lecturer I have ever had!”, “an effective, engaging lecturer”, “Cai broke down information in a manageable and cohesive way that allowed for the best understanding of a concept.”
- Fall 2023: MSE 2300 – *Science of Cooking: From Modern Cuisine to Soft Matter Science*; 46 students;
Instructor rating: 4.58/5; Overall course rating: 4.31/5
Evaluated as “it was a blast”, “the labs at the teaching kitchen were one of the greatest things I have experienced at UVA. Being able to apply the concepts we learned in lecture and during the homeworks was amazing, because it gave me perspective on the way that the chemistry and science behind it work. It was definitely a great experience and I would recommend this course to anyone”, and “Dr. Cai was a very engaging lecturer and if a student had a specific interest, he always gave them the opportunity to share it with the class, formally or informally.”
- Spring 2023: MSE 2300 – *Introduction to Materials Science*; 52 students
Instructor rating: 3.98/5; Overall course rating: 3.84/5
Evaluated as “Professor Cai was a great lecturer, he was able to simplify the complex material”, and “Professor Cai was a great professor and an amazing lecturer who was able to explain the topics in a very simple way that allowed everyone to understand. He also gave us time to digest the material in the middle of

class which was extremely useful. Even though the topics were very tricky to understand, his metaphors and the way he explained was amazing.”

- Fall 2022: MSE 4220/6220 – *Polymer Physics*; 4 students
Instructor rating: 4.75/5; Overall course rating: 5/5
- Fall 2021: MSE 4220/6220 – *Polymer Physics*; 17 students
Instructor rating: 4.18/5; Overall course rating: 4.29/5
Evaluated as “this is the most solid, deep, and comprehensive course I have ever taken”, and “Professor Cai made sure to communicate the Polymer Science from many different perspectives and connect it to other sciences.”
- Spring 2021: MSE 2090 – *Introduction to Materials Science*; 66 students
Instructor rating: 3.91/5; Overall course rating: 3.98/5
Evaluated as “Professor Cai is very kind and patient, and I greatly appreciated that as I am a slow-learner. Even during class, he welcomed questions or arguments of different positions and took the time to clarify the following confusion from students.”
- Fall 2020: MSE 2300 – *Science of Cooking: From Modern Cuisine to Soft Matter Science*; 12 students
Instructor rating: 4.10/5; Overall course rating: 4.20/5
Evaluated as “I enjoyed this course a lot. I think the instructors tried really hard to make it as enjoyable as possible since it had to be online. A class like this can be difficult to do virtually but I think they did well.”
- Spring 2020: MSE 2090 – *Introduction to Materials Science*; 20 students
Instructor rating: 3.85/5; Overall course rating: 4.37/5
- Spring 2019: ChE 5561 – *Polymer Physics*; 5 students
Instructor rating: 4.58/5; Overall course rating: 4.38/5
- Fall 2018: MSE 4055 – *Introduction to Nanoscience and Technology*; 12 students
Instructor rating: 2.62/5; Overall course rating: 2.43/5

❖ SERVICE

University of Virginia

Department

2023-present	MSE Graduate Admission Committee
2022-present	MSE Undergraduate Program Committee
2021-2022	ChE faculty search committee
2021-2023	MSE Space Committee (define, address, and allocate space needs for research and teaching)
2021-present	MSE Undergraduate Curriculum Committee (develop a curriculum for the newly established B.S. program in MSE)
2020	MSE PhD qualifiers’ exam committee (re-designed Ph.D. qualifiers’ exam format, metrics, and scope)

- 2020 **MSE Strategy Planning Committee** (developed a 10-year growth strategy in soft materials for the MSE department presented to MSE External Review Committee)
- 2019 MSE Administrator Recruiting Committee
- 2018-present Team Member for recruiting URMs

School

- 2020-present UVA Center for Advanced Biomanufacturing **Steering Committee**
- 2019-present SEAS Undergraduate Committee
- 2021 Reviewer for internal competition for Virginia Commonwealth Health Research Board grants
- 2020 Reviewer for UVA Engineering in Medicine grants
- 2019-present Co-develop a **Concentration in Polymers and Soft Matter** for MSE
- 09/2019 Co-organized 7th Virginia Soft Matter Workshop
- 09/2018 Initiated the weekly **Squishy Materials Seminar Series** at the University of Virginia (UVA). This is the first ever seminar series in soft matter/biomaterials at UVA.

PhD Dissertation Committee

Total #: 18

- | | |
|---------------------------------|---------------------------------|
| Yiran Wang (PhD, ChE, 2019) | Julia Tumbic (PhD, BME, 2024) |
| Qingchang Liu (PhD; MAE, 2020) | Jack Whitewolf (PhD, BME, 2024) |
| Shunyan Gu (PhD, MAE, 2020) | Kenneth Brown (PhD, MAE, 2024) |
| John Tomko (PhD, MSE, 2020) | Rhea Braun (PhD, ChE, 2024) |
| Xueyin Zhao (PhD, ChE, 2021) | Ho Lun Chan (MSE) |
| Yue Zhang (PhD, MAE, 2021) | Emma Tiernan (MAE) |
| Ji Zhang (PhD, Chemistry, 2021) | Lucas Kimerer (ChE) |
| Haozhe Zhang (PhD, MAE, 2023) | Sanha Kim (ChE) |
| Tracy Kuper (PhD, ChE, 2024) | Cole Love-Baker (MAE) |

Professional

- 2024 Chair of symposium “Cell Encapsulation and 3D Digital Assembly for Basic and Applied Biomedicine,” 2024 World Biomaterials Congress, Daegu, South Korea
- 2025 Co-Chair for Focus Session “Programmable Structures from Responsive Polymers and Soft Matter,” *American Physical Society March Meeting*
- 2023, 24, 25 Co-Chair for Focus Session “Programmed Responsive Polymers and Soft Matter,” *American Physical Society March Meeting*
- 2022 Session Chair for Focus Session “Sequence Controlled Polymers,” *American Physical Society March Meeting*
- 2021-2022 Guest Editor for a new Research Topic, Active Matter in Complex Environments, in *Frontiers in Physics*
- 2021 Co-Chair for Innovative Biofabrication Platforms Session, 5th *Mid-Atlantic Advanced Biomanufacturing Symposium*
- 2021 Co-Chair of Additive Manufacturing and Composites Session, 92nd *Annual Meeting of The Society of Rheology Meeting*

Proposal Review

- NSF Panelist and ad hoc reviewer for NSF DMR-Polymers, including CAREER panels DMR-Biomaterials
- Gen-4 Engineering Research Center (ERC) (pre-proposal, full proposal, on site visit)

DOE	Mail-in reviewer for Early Career Research Program, the Office of Basic Energy Sciences (BES)
NIH	Lung cellular, molecular, and immunobiology (LCMI) study section, <i>ad hoc</i> member
Others	ACS Petroleum Research Fund; New Frontiers in Research Fund, Research Council of Canada
Journal Review (selected)	Nature, PNAS, Science Advances, Advanced Materials and sister journals, Macromolecules, ACS Macro Letters, Small, Biophysics Journal, Biomacromolecules, Soft Matter, Materials Horizons, Chemical Communications, Acta Biomaterialia, Journal of Allergy and Clinical Immunology

❖ PRESENTATIONS

Invited Talks

[>30 invited talks since joined UVA; These talks cover 3 research thrusts: (i) bottlebrush polymers, (ii) voxelated bioprinting, and (iii) human lung defense]

Bottlebrush Polymers, Networks, and Devices

04/10/2025, Department of Mechanical Engineering, MIT
 03/24/2025, ACS Polymer Chemistry Prize Symposium, San Diego
 03/13/2025, Department of Materials Science and Engineering, UC Berkeley
 02/14/2025, Department of Materials Science and Engineering, Boston University
 02/7/2025, Department of Chemical and Biomolecular Engineering, North Carolina State University
 12/11/2024, Squishy Physics Seminar Series, Harvard University
 10/2024, Department of Chemistry, Duke University
 10/2024, Department of Polymer Science and Engineering, UMass Amherst
 06/2024, He Bin-Ling Lectureship, Nankai University, China
 03/2024, 2024 APS March Meeting, Minneapolis, Minnesota
 12/2023, 97th New England Complex Fluids Workshop, Harvard University
 09/2023, Department of Chemical Engineering and Materials Science, Michigan State University
 04/2023, 9th Virginia Soft Matter (VSM) Workshop, Virginia Commonwealth University
 12/2022, Department of Chemical and Biological Engineering, Drexel University

Voxelated Bioprinting: Digital Assembly of Viscoelastic Bio-ink Droplets

12/12/2024, Department of Biomedical Engineering, Tufts University
 09/2024, Department of Physics, Virginia Commonwealth University
 05/2024, 2024 World Biomaterials Congress, Daegu, South Korea
 04/2024, Department of Physics, University of Virginia
 11/2022, Department of Physics, James Madison University
 10/2022, Department of Biomedical Engineering, University of Illinois, Chicago
 09/2022, Self-Assembly of Soft Materials Symposium, Los Alamos National Laboratory

Biophysical Cues on Human Lung Defense: From Airway Remodeling to Mucosal Drug Delivery

03/2022, Department of Biochemistry and Molecular Genetics, University of Virginia
 04/2021, Department of Physics, Hunter College, CUNY
 08/2021, Department of Bioengineering, University of Maryland
 11/2020, Soft Condensed Matter and Physics of Living Systems, School of Physics, Georgia Institute of Technology

Reprocessable, soft, 3D printable elastomers

10/2021, Annual Meeting of Society of Rheology

Adaptive soft materials from sequence-controlled polymer assembly

05/2021, IUTAM Symposium on Mechanics of Smart and Tough Gels

Tough, self-healing elastomers

04/2019, Rubber Division, ACS 195th Technical Meeting, Independence, OH
04/2019, Bridgestone Americas Technology Center, Akron, OH
04/2019, ExxonMobil Clinton Research Center, Annandale, NJ

Human airway epithelial responses to chronic pathological osmotic stress

02/2018, Marsico Lung Institute, School of Medicine, University of North Carolina, Chapel Hill

Polymer science as a tool for materials design and biological discoveries

11/2017, Institute of Physics, Chinese Academy of Science, Beijing
11/2017, Department of Chemistry, Peking University, Beijing
11/2017, Institute of Chemistry, Chinese Academy of Science, Beijing
11/2017, Department of Chemical Engineering, Tsinghua University, Beijing

Before Independent Career

Biomimetic materials by design: Soft, tough, self-healing dry elastomers

2017, University of Pennsylvania, Department of Materials Science and Engineering
2017, University of Virginia, Depts. Chemical Engineering, Materials Science and Engineering
2017, University of Virginia, Department of Biomedical Engineering
2017, Syracuse U, Department of Biomolecular and Chemical Engineering
2017, Case Western Reserve University, Department of Macromolecular Science and Engineering
2017, Auburn University, Chemical Engineering

Soft matter approaches to biology: A tale of mucus hydrogel in human lung defense

2017, Virginia Tech, Department of Physics
2017, Syracuse U, Department of Physics

Soft functional materials from molecular design

05/2016, University of Massachusetts at Amherst, Polymer Science and Engineering Department.
08/2015, University of North Carolina at Chapel Hill, Department of Chemistry.

Interaction between mucus and cilia in health and disease

09/2015, Harvard University, School of Public Health.
06/2014, International Young Scholars Systems and Synthetic Biology Symposium. Beijing, China
07/2013, 7th International Discussion Meeting on Relaxation in Complex Systems (IDMRCS). Spain.
05/2013, Harvard University, Squishy Physics Seminar Series.
05/2013, Harvard University, Wyss Institute for Biologically Inspired Engineering.
02/2011, Gordon Research Conferences: Cilia, Mucus & Mucociliary Interactions, Ventura, CA.

Permeability of polyelectrolyte microcapsules

10/2015, Harvard University, Kavli Seminar Series

Droplet-based microfluidic platform for high-throughput screening of antibody producing cells

03/2014, Gordon Research Seminar: Antibody Biology & Engineering. Lucca (Barga), Italy

Best talk

Presentations by Trainees (20 oral talks; 20 poster presentations)

Oral Presentations

1. Dynamics of associative polymers with high density of reversible bonds. [Myoem Kim](#), [Shifeng Nian](#), Shalin Patil, Siteng Zhang, Quan Chen, Mikhail Zhernenkov, Ting Ge, Shiwang Cheng, and Li-Heng Cai. American Physical Society March Meeting. March 7, 2023

2. Dynamics of associative polymers with high density of reversible bonds. Myoeum Kim, Shifeng Nian, Shalin Patil, Siteng Zhang, Quan Chen, Mikhail Zhernenkov, Ting Ge, Shiwang Cheng, and Li-Heng Cai. 8th Virginia Soft Matter (VSM) Workshop. April 22, 2023
3. 3D printable modular soft elastomers from physically crosslinked homogeneous associative polymers. Myoeum Kim, Shifeng Nian, Daniel A Rau, Baiqiang Huang, Jinchang Zhu, Guillaume Freychet, Mikhail Zhernenkov, Li-Heng Cai. American Physical Society March Meeting 2024, Minneapolis, MN. March 4, 2024
4. Dynamics of polymers with controlled distribution and density of associative groups. Myoeum Kim, Shalin Patil, Siteng Zhang, Ting Ge, Shiwang Cheng, and Li-Heng Cai. International Soft Matter Conference. August 2, 2024
5. A universal strategy for decoupling stiffness and extensibility of polymer networks. Baiqiang Huang, Shifeng Nian, and Li-Heng Cai. APS March Meeting 2024, Minneapolis, MN. March 7, 2024
6. Viscoelasticity promotes directional transport of *Pseudomonas aeruginosa* in native respiratory mucus. Riley Dickson, Zhijian He, and Li-Heng Cai. Chemical Engineering Research Symposium at University of Virginia, Charlottesville, VA. March 15, 2024.
7. Quantifying the transport of *Pseudomonas aeruginosa* in healthy and diseased native mucus. Riley Dickson, Zhijian He, and Li-Heng Cai. Virginia Soft Matter Workshop at Virginia Commonwealth University, Richmond, VA. April 22, 2023.
8. Healthy airway mucus promotes directional transport of *Pseudomonas aeruginosa*. Riley Dickson. Chemical Engineering Summer Student Seminar Series at University of Virginia, Charlottesville, VA. July 6, 2023.
9. Understanding nonlinear fluid dynamics for all-aqueous printing of a viscoelastic droplet in yield-stress fluids. Xiaoxiao Ma, Jinchang Zhu, Li-Heng Cai. APS March Meeting 2024, Minneapolis MN. Mar 4, 2024.
10. Molecular architecture driven self-assembly of block copolymers. Shifeng Nian, Zihao Gong, Li-Heng Cai. American Physical Society March Meeting. Boston, MA. March 4, 2019
11. 3D printable soft elastomers. Zihao Gong, Shifeng Nian, Li-Heng Cai. American Physical Society March Meeting. Boston, MA. March 5, 2019
12. Molecule-microstructure-property relation of reversible soft materials self-assembled by bottlebrush-based triblock copolymers. Shifeng Nian, Zihao Gong, Guillaume Freychet, Mikhail Zhernenkov, Li-Heng Cai. American Physical Society March Meeting. March 19, 2021
13. 3D printable ultrasoft solvent-free elastomers. Shifeng Nian, Jinchang Zhu, Haozhe Zhang, Zihao Gong, Guillaume Freychet, Mikhail Zhernenkov, Baoxing Xu, Li-Heng Cai. American Physical Society March Meeting. March 16, 2021
14. Digital Assembly of Spherical Viscoelastic Bio-ink Droplets (DASP): a conceptually new bioprinting technology. Jinchang Zhu, Li-Heng Cai. APS March Meeting 2024, Minneapolis, MN. March 4, 2024
15. Real time quantification of shear induced molecular ordering in direct write printing of bottlebrush polymer networks. Daniel A. Rau, Myoeum Kim, and Li-Heng Cai. Solid Freeform Fabrication Symposium, Austin TX. Aug 15, 2023
16. Additive manufacturing of modular soft stretchable elastomers for adaptive dissipative structures. Daniel A. Rau, Myoeum Kim, and Li-Heng Cai. Solid Freeform Fabrication Symposium, Austin TX. Aug 15, 2023
17. 3D printing of soft elastomers for brain injury protection structures. Daniel A. Rau, Myoeum Kim, and Li-Heng Cai. UVA Postdoctoral Symposium, May 20th, 2024
18. Multi-material additive manufacturing of polymeric composites with seamless soft-hard interface integration from molecular bonding. Daniel A. Rau, Baiqiang Huang, Alexander Church, Baoxing Xu, Li-Heng Cai. International Soft Matter Conference, Raleigh NC. Aug 2, 2024

19. Additive manufacturing of modular soft stretchable elastomers for adaptive dissipative structures. Daniel A. Rau, Myoeum Kim, and Li-Heng Cai. Virginia Soft Matter Workshop, April 22, 2023.
20. Fabrication of high-resolution copper lattices through 3D printed PEG bottlebrush hydrogels for enhanced catalysis. Emmanuel Oduro, Yulu Zhang, Daniel Rau, Baiqiang Huang, Sen Zhang and Li-Heng Cai. Young Investigator Workshop at International Soft Matter Conference, Raleigh, NC. July 27, 2024

Poster Presentations

1. Dynamics of polymers with controlled distribution and density of associative groups. Myoeum Kim, Shalin Patil, Siteng Zhang, Ting Ge, Shiwang Cheng, and Li-Heng Cai. Young Investigator Workshop at International Soft Matter Conference. Raleigh NC. July 27, 2024
2. Bottlebrush polymers fold in melts. Baiqiang Huang, Shifeng Nian, Guillaume Freychet, Mikhail Zhernenkov, and Li-Heng Cai. APS March Meeting 2023, Las Vegas, NV. March 8, 2023
3. Bottlebrush polyethylene glycol nanocarriers translocate across human airway epithelium via molecular architecture enhanced endocytosis. Baiqiang Huang, Zhijian He, and Li-Heng Cai. Young Investigator Workshop at International Soft Matter Conference, Raleigh, NC. July 27, 2024
4. Bottlebrush polyethylene glycol nanocarriers translocate across human airway epithelium via molecular architecture enhanced endocytosis. Baiqiang Huang, Zhijian He, and Li-Heng Cai. International Soft Matter Conference, Raleigh NC. Aug 2, 2024
5. Viscoelasticity of healthy mucus promotes directional transport of *Pseudomonas aeruginosa*. Riley Dickson and Zhijian He. University of Virginia Engineering Research Symposium at University of Virginia, Charlottesville, VA. March 28, 2024.
6. Transport of *Pseudomonas aeruginosa* in native respiratory mucus. Riley Dickson. American Institute of Chemical Engineers Annual Meeting, Orlando, FL. November 8, 2023.
7. Transport of *Pseudomonas aeruginosa* in native respiratory mucus. Riley Dickson and Li-Heng Cai. Virginia Soft Matter Workshop at Virginia Commonwealth University, Richmond, VA. April 22, 2023.
8. Viscoelasticity of healthy mucus promotes directional transport of *Pseudomonas aeruginosa*. Riley Dickson, Zhijian He, and Li-Heng Cai. Chemical Engineering Research Symposium at University of Virginia, Charlottesville, VA. March 15, 2024.
9. Transport of *Pseudomonas aeruginosa* in native respiratory mucus. Riley Dickson, Zhijian He, and Li-Heng Cai. Chemical Engineering Research Symposium at University of Virginia, Charlottesville, VA. March 10, 2023.
10. Viscoelasticity of healthy mucus promotes directional transport of *Pseudomonas aeruginosa*. Riley Dickson, Zhijian He, and Li-Heng Cai. Young Investigator Workshop at International Soft Matter Conference, Raleigh, NC. July 27, 2024.
11. Viscoelasticity of healthy mucus promotes directional transport of *Pseudomonas aeruginosa*. Riley Dickson, Zhijian He, and Li-Heng Cai. International Soft Matter Conference, Raleigh, NC. August 2, 2024.
12. Understanding fluid dynamics for all-aqueous printing of a viscoelastic droplet in yield-stress fluids. Xiaoxiao Ma, Jinchang Zhu, Li-Heng Cai. International Soft Matter Conference, Raleigh NC. Aug 2, 2024.
13. Modeling the stiffness of healthy and diseased lung tissues by a gel-coated air-liquid-interface culture system with tunable substrate stiffness. Zhijian He, Catherine Chu, Riley Dickson, and Li-Heng Cai. American Thoracic Society International Conference 2023. Washington DC. May 2023.
14. Spatial distribution and density of fibroblasts determine angiogenic response of endothelial cells. Pu Zhang, Melur K. Ramasubramanian, Li-Heng Cai. International Soft Matter Conference, Raleigh NC. August 2, 2024

15. Voxlated Bioprinting: Voxlated Bioprinting of Mechanically Robust Multiscale Porous Scaffolds for Pancreatic Islets. Jinchang Zhu, Li-Heng Cai. Fast Movements, Impacts and Deformations: Nature, Robotics and Materials Symposium at Duke University, Durham NC. July 19, 2022
16. Digital Assembly of Spherical Viscoelastic Bio-ink Particles (DASP): a conceptually new bioprinting technology. Jinchang Zhu, Li-Heng Cai. Young Investigator Workshop at International Soft Matter Conference, Raleigh, NC. July 27, 2024
17. Digital Assembly of Spherical Viscoelastic Bio-ink Particles (DASP): a conceptually new bioprinting technology. Jinchang Zhu, Li-Heng Cai. International Soft Matter Conference, Raleigh, NC. July 30, 2024
18. Digital Assembly of Spherical Viscoelastic Bio-ink Particles (DASP): a conceptually new bioprinting technology. Jinchang Zhu, Li-Heng Cai. Young Investigator Workshop at Gordon Conference, Manchester, NH. July 21, 2024
19. Failure in the working curve: Determining interlayer adhesion in stereolithography printing via photorheology. Zoe Benton (undergraduate), Daniel A. Rau, Myoem Kim, Li-Heng Cai. International Soft Matter Conference, Raleigh NC. August 2, 2024