

Ramya Kumar

CONTACT INFORMATION	Alderson Hall 337 1613 Illinois St, Colorado School of Mines Golden, CO 80401	<i>Mobile:</i> (734) 834-3807 <i>Office:</i> (303) 384-2756 <i>E-mail:</i> ramyakumar@mines.edu <i>WWW:</i> kumarbiomaterials.org
POSITIONS HELD	Colorado School of Mines , Golden, CO, USA Assistant Professor, Department of Chemical and Biological Engineering, January 2022 – Biomaterials for gene delivery, surface modification, polymer brushes, statistical modeling in materials discovery and optimization.	
POST-DOCTORAL EXPERIENCE	University of Minnesota , Twin Cities Campus, Minneapolis, USA Postdoctoral Associate, Department of Chemistry, July 2018 – September 2021 <ul style="list-style-type: none">• Advisor: Prof. Theresa M. Reineke	
EDUCATION	University of Michigan , Ann Arbor, Michigan, USA Ph.D., Chemical Engineering, September 2012 – April 2018 <ul style="list-style-type: none">• Advisor: Prof. Joerg Lahann Birla Institute of Technology & Science Pilani , Pilani, India B.E. (Hons.), Chemical Engineering, August 2009	
HONORS AND AWARDS	PMSE Future Faculty Scholar, 2019, Polymeric Material Science and Engineering Division, American Chemical Society. Career Development Award, Spring 2019, Post-doctoral Association, University of Minnesota, Twin Cities. Travel award, 2019, Center for Genome Engineering (CGE), University of Minnesota, Twin Cities. Rackham Predoctoral Fellowship, 2017-18, University of Michigan. Finalist, AIChE Graduate Student Awards, Biomaterials, 2018, Minneapolis. Departmental nominee, Richard & Eleanor Towner Prize for Outstanding PhD research, College of Engineering, University of Michigan. Poster award, Second Place, Material Science & Engineering, Engineering Graduate Symposium, 2016, University of Michigan. Procter & Gamble Team Innovation Award, 2016, 40th Annual Macro Symposium, University of Michigan. Recognized for innovative and collaborative research. Richard & Eleanor Towner Prize for outstanding Graduate Student Instructor (GSI), 2016, University of Michigan. For exceptional & innovative teaching. Poster award, First Place, Material & Chemical Technology, Engineering Graduate Symposium, 2014, University of Michigan.	

College of Engineering fellowship, University of Michigan, September–December 2012.

Monali Dey Memorial Award, BITS Pilani, December 2008, alumni memorial award for the most outstanding chemical engineering undergraduate in a graduating class.

FUNDING

NIH NIBIB R21, \$ 403,000, Aug 2023-25

Diversity Supplement (Caitlyn Castellion) for above R21, \$ 50,000, Aug 2024-25

Children's Hospital of Colorado and School of Mines Pilot Award, \$ 10,000 per PI (w/ Dr. Sagel at CHCO) May 2024-25,

PUBLICATIONS

17. Lawson, J.L., Sekar, R.P., Wright, A.R.E., Wheeler, G., Yanes, J., Estridge, J., Johansen, C.G., Farnsworth, N.L., Kumar, P., Tay, J., **Kumar, R.** (2024) [The spatial distribution of lipophilic cations in gradient copolymers regulates pDNA binding interactions, polyplex aggregation, and transgene expression](#) *ChemRxiv*, doi:10.26434/chemrxiv-2024-tmtd-v2
16. Sekar, R.P., Lawson, J.L., Wright, A.R.E., McGrath, C., Schadeck, C., Kumar, P., Tay, J., Dragovan, J., **Kumar, R.** (2024) [Poly\(L-glutamic acid\) overcomes cationicity-dependent tradeoffs among cytotoxicity, pDNA delivery, and serum stability](#) *RSC Applied Polymers*, 2, 701-718
15. Cheng, L., Zhu, Y., Ma, J., Aggarwal, A., Toh, W.H., Shin, C., Sangpachatanaruk, W., Weng, G., **Kumar, R***, Mao, H-Q., *. *co-corresponding authors with equal contribution (2023) [Machine Learning Elucidates Design Features of Plasmid DNA Lipid Nanoparticles for Cell Type-Preferential Transfection](#) *bioRxiv*, 2023.12. 07.570602
14. **Kumar, R.** (2022) [Materiomically Designed Polymeric Vehicles for Nucleic Acids: Quo Vadis?](#) *ACS Applied biomaterials*, 5, 6, 2507–2535
13. **Kumar, R.**, Le, N., Oviedo, F., Brown, M.E., & Reineke, T.M. (2022) [Combinatorial Polycation Synthesis and Causal Machine Learning Reveal Divergent Polymer Design Rules for Effective pDNA and Ribonucleoprotein Delivery.](#) *JACS Au*, 2, 2, 428–442
12. Bockman, M.R., Dalal, R.J., **Kumar, R.**, & Reineke, T.M. (2021) [Facile synthesis of GalNAc monomers and block polycations for hepatocyte gene delivery.](#) *Polymer Chemistry*, 12, 4063-4071.
11. Dalal, R.J., **Kumar, R.**, Ohnsorg, M., Brown, M.E., & Reineke, T.M. (2021) [Cationic Bottlebrush Polymers Outperform Linear Polycation Analogues for pDNA Delivery and Gene Expression.](#) *ACS Macro Letters*, 10, 7, 886–893.
10. **Kumar, R***, Chalarca, C.F.S.*, Bockman, M.R.*, Van Bruggen, C., Grimme, C.J., Dalal, R.J., Hanson, M.G., Hexum, J.K., & Reineke, T.M. (2021) [Polymeric Delivery of Therapeutic Nucleic Acids](#) *Chemical Reviews*, 121, 18, 11527–11652. *equal contribution.
9. **Kumar, R.**, Le, N., Tan, Z., Brown, M.E., Jian, S., & Reineke, T.M. (2020) [Efficient polymer-mediated delivery of ribonucleoprotein payloads through combinatorial design & parallelized experimentation.](#) *ACS Nano*, 14, 12, 17626–17639.
8. Tan, Z., Jiang, Y., Ganewatta, M.S., **Kumar, R.**, Keith, A., Twaroski, K., Pengo, T., Tolar, J., Lodge, T.P., & Reineke, T.M. (2019). [Block Polymer Micelles Enable CRISPR/Cas9 Ribonucleoprotein Delivery: Physico-Chemical Properties Affect Packaging Mechanisms and Gene Editing Efficiency.](#) *Macromolecules*, 52, 21, 8197-8206 .
7. **Kumar, R.**, Kratzer, D., Cheng, K., Prisby, J., Sugai, J., Giannobile, W.V., & Lahann, J. (2019). [Carbohydrate-based Polymer Brushes Prevent Viral Adsorption on Electrostatically Heterogeneous Interfaces.](#) *Macromolecular Rapid Communications*, 1800530.

6. **Kumar, R.**, Welle, A., Becker, F., Kopyeva, I., & Lahann, J. (2018). [Substrate-Independent Micropatterning of Polymer Brushes based on Photolytic Deactivation of Chemical Vapor Deposition-based SI-ATRP Initiator Films](#). *ACS Applied Materials & Interfaces*, 10 (38), pp 31965–31976.
5. Bally-Le Gal, F., Hussal, C., Kramer, J.J.P., Cheng, K.C., **Kumar, R.**, Eyster, T., Trouillet, V., Nieger, M., Brase, S., & Lahann, J. (2017). [Polylutidines: Multifunctional surfaces via vapor-based polymerization of functional pyridinophanes](#). *Chemistry: A European Journal*, 23, 13342-13350.
4. **Kumar, R.**, Kopyeva, I., Cheng, K.C., Liu, K. & Lahann, J. (2017). [Examining Interfacial Kinetics on Electrostatically Heterogeneous Surfaces using \$\zeta\$ -potential Measurements](#). *Langmuir*, 33 (25), pp 6322-6332.
3. Konig, M., **Kumar, R.**, Hussal, C., Biscarat, J., Barner, L., Schafer, A. & Lahann, J. (2017). [pH-Responsive Aminomethyl Functionalized Poly\(p-xylylene\) Coatings by Chemical Vapor Deposition Polymerization](#) *Macromolecular Chemistry & Physics*, 218, 1600521.
2. **Kumar, R.** & Lahann, J. (2016). [Predictive Model for the Design of Zwitterionic Polymer Brushes: A Statistical Design of Experiments Approach](#). *ACS Applied Materials & Interfaces*, 8 (26), 16595-16603.
1. Qian, X., Villa-Diaz, L. G., **Kumar, R.**, Lahann, J., & Krebsbach, P. H. (2014). [Enhancement of the propagation of human embryonic stem cells by modifications in the gel architecture of PMEDSAH polymer coatings](#). *Biomaterials*, 35(36), 9581–90.

K-12 OUTREACH

High school I lead outreach activities at Arvada West High School throughout the academic year in partnership with 2 high school teachers. My lab members and I offer hands-on polymer chemistry lab experiences for 120 students across 5 sections. See lab website for more details.

Middle school I also judge pre-college science poster competitions (Rocky MESA) and participate in summer camps that engage middle school students.

RESEARCH HIGHLIGHTS

[Machine learning makes magnificent macromolecules for medicine](#), paper from postdoctoral training highlighted in *Matter*

[The Quest to Design Better Experiments](#), special feature on PhD work in *BioTechniques*.

[Why Viruses Stick: Sugar Coating the Answer](#), filmed as a part of RELATE 2016.

Selected to record a [short video](#) at the 2016 ACS national meeting (Spring).

PROPOSAL REVIEW

National Institutes of Health Ad hoc reviewer for NIH study sections, May 2023 (Anti-viral drugs), November 2023 (Biomaterials special emphasis panel), June 2024 (INN), October 2024 (INN)

National Science Foundation December 2022, December 2023

National Science Foundation CBET Interfacial Engineering, May 2022

Los Alamos National Labs, DOE CINT, May 2022-present

JOURNAL REVIEW

JACS, ACS Engineering Au, Acta Biomaterialia, Journal of Controlled Release, Biomacromolecules, Soft matter, ACS AMI, Polymer Chemistry, Journal of Materials Chemistry B, IEEE Transactions on NanoBioscience, ACS Macro Letters, Chemical Science.

SERVICE TO MINES	<p>Graduate affairs committee member, Department of Chemical and Biological Engineering</p> <p>PhD Thesis Committee Samantha Siska (Chemical Engineering), Zoe Taylor Adkins (Chemical Engineering), Zachary Sparks (Chemical Engineering), Salvatore Luciano (Chemistry), Lindsey Wadsworth (Chemical Engineering)</p> <p>Selection committee Goldwater scholarships, December 2023.</p> <p>Judge Graduate Research and Discovery Symposium, 2022, 2024,</p>
CONFERENCE ORGANIZATION	<p>Organizing Committee Member Society for Biomaterials, Western Conference, UC Denver, September 2024.</p> <p>Session Chair AIChE: Graduate student awards in Biomaterials (2022,2023), Biomimetic materials (2024)</p>
OTHER SERVICE	<p>Panelist Postdoc panel for faculty careers, University of Colorado, Boulder (July 2023)</p> <p>Diversity, Equity, & Inclusion committee member, Department of Chemistry, University of Minnesota, Twin Cities. Working group for training graduate students on inclusive teaching, cultural sensitivity, and DEI issues.</p> <p>Volunteer. Researchers Expanding Lay Audience Teaching & Engagement (RELATE), Ann Arbor. Underwent 3 month-long training and obtained certification in advanced oral communication. Recorded short videos and delivered interactive presentations for community engagement events. (May-October 2016)</p> <p>Mentor, Lunch & Lab with a grad student, College of Engineering, University of Michigan, Ann Arbor. Help sophomore/junior students to prepare for graduate school admissions. Lab tours and long conversations about life in grad school with three students. (May 2014 -August 2016)</p> <p>Selection Committee, Panel to evaluate nominations for biannual travel awards instituted by the Postdoctoral Association, University of Minnesota, Twin Cities. (2019–present)</p> <p>Selection Committee, Serving on the selection panel to evaluate nominations for teaching awards presented by the College of Engineering, University of Michigan, Ann Arbor. (2017–present)</p> <p>Volunteer, Xplore Engineering: Engineering a Cure for Cancer workshop. An annual outreach activity to help middle school students learn how my lab was using engineering to understand cancer and find treatments. (2014-2018)</p>
TEACHING AT MINES	<p>CBEN 310 Introduction to Biomedical Engineering, Fall 2024, Spring 2023, Fall 2023, Instructor rating of 4.0/5.0.</p> <p>CBEN 620 Engineering of Soft Matter, Spring 2022, Spring 2024, Instructor rating of 4.6/5.0.</p>
TEACHING	<p>Department of Chemical Engineering, Ann Arbor, Michigan USA</p> <p><i>Graduate Student Instructor, Chemical & Engineering Thermodynamics</i> Jan-May 2015</p> <p>Led two discussions of 30 students each, held office hours and delivered guest lectures. Developed course material, lessons, homework and exams.</p>

Instructor rating of 4.9/5.0.
Nominated by students for department teaching prize.
Awarded Richard & Eleanor Towner Prize by the College of Engineering.

Undergraduate Research Opportunity Program, Ann Arbor, Michigan USA

Mentor **August 2013-Present**
Trained 8 undergraduate students in experimental design, synthesis, analytical techniques and writing/presentation skills.
Undergraduate students contributed to three journal publications.

Center for Research on Learning & Teaching, Ann Arbor, Michigan USA

Engineering Teaching Consultant **August 2015 -17**
Observing classes and providing feedback to graduate student instructors.
Consulting with instructors, helping them learn and implement effective teaching practices.

Practice School Division, BITS Pilani, Pilani, Rajasthan, India

Co-instructor **May-July 2008**
Contributed towards summer school course development and coordinated internship experiences for undergraduate students.

MENTORING AT
MINES

PhD students: Jessica Lawson (NSF GRF award), Adam Humpal (NSF GRF HM)
Masters' thesis: Aryelle Wright (NSF GRF HM)
Undergraduate students: Claire Nelson, Shawn Muhr, Caleb McGrath, Wakana Kani, Jordan Estridge, Grant Wheeler, Alex Dhupar, Jilian Yanes, Caitlyn Castellion. High school students: Gabriella Loi, Kidnred Alvarado.

OTHER MENTORING

Shan Jian (2019-2020), B.S., ChE, University of Minnesota, Class of 2021, currently pursuing his PhD at Purdue University.

Irina Kopyeva (2015-2018), B.S., ChE, University of Michigan, Class of 2019, Received NSF-GRFP in her senior year, currently pursuing her PhD at the University of Washington, Seattle.

Salwan Butrus (2016-2018), B.S., ChE, University of Michigan, Class of 2019, Received NSF-GRFP in his senior year, currently pursuing his PhD at the University of California, Berkeley.

Julia Prisby (Summer 2015), B.S., BME, University of Michigan, Class of 2016, Engineer, Terumo Cardiovascular Group

Aymen Maktari (2014-2015), B.S., ChE & Mat.Sci.E, University of Michigan, Class of 2019, Manager, Nano Technology Solutions.

Robert Grant Spurney (2013-14), B.S., Mat.Sci.E, University of Michigan, Class of 2016, Completed his PhD at Georgia Institute of Technology (2019) and is now a researcher at Texas Instruments.

Tristan Brohm (2013-2014), B.S., ChE, University of Michigan, Class of 2017, Engineer, ZF Group.

Jay Antonishen (2012-2013), B.S., ChE, University of Michigan, Class of 2014, Data Scientist, Tik-Tok.

PATENTS Copolymers for Intracellular Therapeutic Nucleic Acid Payload Delivery. US Patent App. 18/000,258, 2023

Preparation Of Crystalline Bazedoxifene And Its Salts, United States Patent WO/2012/037187.

Crystalline form of Retigabine and processes for mixture of Retigabine crystalline modifications United States Patent WO/2013/008250 A2.

EMPLOYMENT *Process engineer, Dr. Reddy's Labs, India* **July 2009 - June 2012**
 Worked at the R&D center of a major pharmaceutical company. Contributed to product & process design, crystal polymorph screening & development, scale-up, and technology transfer.

Research Analyst, LatentView Analytics India **January-June 2009**
 Worked on competitive intelligence, market estimation and product analysis for a biomedical device client. Assessed viability of low-cost cardiovascular devices in rural India.

INVITED PRESENTATIONS **Keynote speaker** *Causal Machine Learning Reveals Payload-Specific Polymer Design Criteria for pDNA and RNP Delivery*, **Ramya Kumar**, Society for Biomaterials and Materials Research Society Workshop on Artificial Intelligence for Biomaterials Design.

Causal Machine Learning Reveals Payload-Specific Polymer Design Criteria for pDNA and RNP Delivery, **Ramya Kumar**, Dept. Seminar, Chemical Engineering, 2023, University of Arizona, Tucson, AZ

Invited speaker at Keystone Symposia *Causal Machine Learning Reveals Payload-Specific Polymer Design Criteria for pDNA and RNP Delivery*, **Ramya Kumar**, Ngoc Le, Felipe Oviedo, Mary E. Brown & Theresa M. Reineke, 2023, Keystone Symposia, Next-gen nanomedicine, Irvine, CA

Causal Machine Learning Reveals Payload-Specific Polymer Design Criteria for pDNA and RNP Delivery, **Ramya Kumar**, Ngoc Le, Felipe Oviedo, Mary E. Brown & Theresa M. Reineke, Dept. Seminar, Chemistry, 2023, Ohio State University, Columbus, OH

Causal Machine Learning Reveals Payload-Specific Polymer Design Criteria for pDNA and RNP Delivery, **Ramya Kumar**, Ngoc Le, Felipe Oviedo, Mary E. Brown & Theresa M. Reineke, ACS Polymers in Biology and Medicine, 2022, Napa Valley, CA.

Causal Machine Learning Reveals Payload-Specific Polymer Design Criteria for pDNA and RNP Delivery, **Ramya Kumar**, Ngoc Le, Felipe Oviedo, Mary E. Brown & Theresa M. Reineke, Dept. Seminar, Chemical Engineering, 2022, Colorado State University, Fort Collins, CO

Causal Machine Learning Reveals Payload-Specific Polymer Design Criteria for pDNA and RNP Delivery, **Ramya Kumar**, Ngoc Le, Felipe Oviedo, Mary E. Brown & Theresa M. Reineke, nanoDDS 2022, UNC Chapel Hill.

Translating Polymeric Vehicles Between Ribonucleoprotein and Plasmid Cargoes: Do the Same Design Rules Apply?, **Ramya Kumar**, Ngoc Le, Felipe Oviedo, Mary E. Brown & Theresa M. Reineke, Bioprocessing India Mini Symposium Series, 2021, Chennai, India (Virtual).

Translating Polymeric Vehicles Between Ribonucleoprotein and Plasmid DNA Cargoes: Do the Same Design Rules Apply?, **Ramya Kumar**, Ngoc Le, Felipe Oviedo, Mary E. Brown & Theresa M. Reineke, 2021 Genome Writers Guild, Minneapolis, MN.

Directed evolution of polymers through combinatorial design & statistical learning: Applications in gene editing, **Ramya Kumar**, Ngoc Le, Zhe Tan, Shan Jian, & Theresa M. Reineke, Department Seminar, Chemical Engineering, University of Michigan, 2021, Ann Arbor, MI.

Directed evolution of polymers through combinatorial design & statistical learning: Applications in gene editing, **Ramya Kumar**, Ngoc Le, Zhe Tan, Shan Jian, & Theresa M. Reineke, Department Seminar, Biotechnology, Indian Institute of Technology Madras 2021, Chennai, India.

Directed evolution of polymers through combinatorial design & statistical learning: Applications in gene editing, **Ramya Kumar**, Ngoc Le, Zhe Tan, Shan Jian, & Theresa M. Reineke, Department Seminar, Chemical and Biomolecular Engineering, University of Houston, 2021, Houston, TX.

Directed evolution of polymers through combinatorial design & statistical learning: Applications in gene editing, **Ramya Kumar**, Ngoc Le, Zhe Tan, Shan Jian, & Theresa M. Reineke, Department Seminar, Chemical Engineering, Texas A&M University, 2021, College Station, TX.

Directed evolution of polymers through combinatorial design & statistical learning: Applications in gene editing, **Ramya Kumar**, Ngoc Le, Zhe Tan, Shan Jian, & Theresa M. Reineke, Department Seminar, Chemical and Materials Engineering, New Jersey Institute of Technology, 2021, Newark, NJ.

Combinatorial design & high-throughput experimentation accelerate discovery of polymers for CRISPR delivery, **Ramya Kumar**, Ngoc Le, Zhe Tan, Shan Jian, & Theresa M. Reineke, Industrial Partnership in Interfacial and Materials Engineering, 2020, Minneapolis, MN.

Polymeric biomaterials via high-throughput experimentation & statistical learning, **Ramya Kumar**, Ngoc Le, Zhe Tan, & Theresa M. Reineke, 2019 ACS national meeting (Fall), PMSE Future Faculty Scholars, San Diego, CA.

Sugar-Coating the Answers to Virus Binding: Glycocalyx-Mimetic Interfaces, **Ramya Kumar**, Domenic Kratzer, Kenneth Cheng, Irina Kopyeva & Joerg Lahann, 2017 AIChE national meeting, Biomaterials Graduate Student Awards Session, Minneapolis, MN.

CONTRIBUTED
PRESENTATIONS

Are Structure-Function Relationships Governing Polymeric Gene Delivery Payload-Specific?, **Ramya Kumar**, Ngoc Le, Mary E. Brown, & Theresa M. Reineke, 2021 AIChE national meeting, Boston, MA.

Efficient Intracellular Delivery of CRISPR Payloads Mediated By a Polymeric Vehicle Discovered through Combinatorial Design and High-Throughput Experimentation, **Ramya Kumar**, Ngoc Le, Zhe Tan, & Theresa M. Reineke, 2020 Virtual AIChE national meeting.

Data-Driven Discovery of Polymeric Vehicles for Gene Editing: Serendipity-Inspired Design Directions., **Ramya Kumar**, Ngoc Le, Zhe Tan, & Theresa M. Reineke, 2020 Virtual AIChE national meeting.

Accelerating the Discovery of Polymeric Vehicles for Gene Editing through Combinatorial Synthesis and Statistical Learning, **Ramya Kumar**, Ngoc Le, Zhe Tan, & Theresa M. Reineke, 2020 Virtual AIChE national meeting.

Polymeric biomaterials via high-throughput experimentation & statistical learning, **Ramya Kumar**, Ngoc Le, Zhe Tan, & Theresa M. Reineke, 2019 AIChE national meeting, Orlando, FL.

Substrate-independent micropatterning of polymer brushes using chemical vapor deposition-based polymerization initiator films, **Ramya Kumar**, Alexander Welle, Fabian Becker, Irina Kopyeva & Joerg Lahann, 2019 ACS national meeting (Fall), San Diego, CA.

Glycocalyx-mimetic interfaces: Sugar-coating the answers to virus binding, **Ramya Kumar**, Domenic Kratzer, Kenneth Cheng, Irina Kopyeva & Joerg Lahann, 2017 ACS national meeting (Spring), San Francisco, CA.

Glycocalyx-mimetic interfaces: Sugar-coating the answers to virus binding, **Ramya Kumar**, Domenic Kratzer, Kenneth Cheng, Irina Kopyeva & Joerg Lahann, 2017 ACS national meeting (Spring), San Francisco, CA.

Glycocalyx-mimetic interfaces with tunable protein and virus adsorption characteristics, **Ramya Kumar**, Domenic Kratzer, Kenneth Cheng, Julia Prisby, Kai Liu & Joerg Lahann 2016 Chemical Engineering Graduate Symposium, University of Michigan, Ann Arbor, MI.

Glycocalyx-mimetic interfaces with tunable protein and particulate adsorption characteristics, **Ramya Kumar**, Kenneth Cheng, Julia Prisby, Kai Liu & Joerg Lahann, 2016 ACS national meeting (Spring), San Diego, CA.

Glycocalyx-Mimetic Surfaces with Tunable Surface Charge– Synthesis, Electrokinetic Investigation and Adsorption Studies, **Ramya Kumar**, Kenneth Cheng, Julia Prisby, Kai Liu & Joerg Lahann, 2015 MRS Fall meeting, Boston MA.

A Predictive Model for the Design of Polymer Brushes for hESC Culture: A Statistical Design of Experiments Approach, **Ramya Kumar**, Tristan Brohm & Joerg Lahann, 2015 AIChE annual meeting, Salt Lake City, UT.

Predicting the properties of stem cell culture coatings using a statistical model, **Ramya Kumar** & Joerg Lahann, BME student seminar, 2015, University of Michigan, Ann Arbor, MI.