

Ramya Kumar

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RESEARCH INTERESTS Biomaterials for gene delivery and stem cell engineering, polymer brushes, surface engineering, statistical modeling in materials discovery and optimization.

POST-DOCTORAL EXPERIENCE **University of Minnesota**, Twin Cities Campus, Minneapolis, USA
Post-doctoral Associate, Department of Chemistry, July 2018 - Present

- Project: Data-driven discovery of polymeric gene delivery vehicles using high-throughput experimentation and statistical learning.
- Advisor: Prof. Theresa M. Reineke

EDUCATION **University of Michigan**, Ann Arbor, Michigan, USA
Ph.D., Chemical Engineering, September 2012-April 2018

- Dissertation Title: Directing Interfacial Events using Bioinspired Polymer Brushes.
- 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.

PUBLICATIONS

10. **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*, 10.1021/acsnano.0c08549.
9. **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. (2020) Polymeric Delivery of Therapeutic Nucleic Acids. Minor Revision. *Chemical Reviews*. *equal contribution.
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.

WORKING PAPERS

2. **Kumar, R.**, Le, N., & Reineke, T.M. [Translating Polymeric Vehicles Between Ribonucleoprotein and Plasmid DNA Cargoes: Do the Same Design Rules Apply?](#)
1. Bockman, M.R., Dalal, R.J., **Kumar, R.**, & Reineke, T.M. [Improved Synthetic Route to GalNAc Monomers Allow for Exploration of N-Acetylgalactosamine Block Lengths as Nonviral Hepatocyte-Targeted Gene Delivery Vehicles.](#)

RESEARCH
HIGHLIGHTS

The Quest to Design Better Experiments, *BioTechniques*, Vol. 61, No. 1, July 2016, pp. 9–14, special feature on statistical design of experiments.

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) by the ACS Scientific Video Lab.

PROFESSIONAL
DEVELOPMENT

NextProf - Michigan Engineering Future Faculty Workshop, 2018

Future Faculty Workshop, *Grooming Diverse Leaders for the Future*, 2017, Case Western Reserve University, Cleveland.

Preparing Future Faculty Conference: 'Getting Ready for an Academic Career', Rackham Graduate School, 2014, University of Michigan, Ann Arbor.

SERVICE

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.

Reviewer. Soft matter, ACS AMI, Polymer Chemistry, Journal of Materials Chemistry B, IEEE Transactions on NanoBioscience, ACS Macro Letters.

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)

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)

Selection Committee, Panel to evaluate nominations for biannual travel awards instituted by the Postdoctoral Association, University of Minnesota, Twin Cities. (2019–present)

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)

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)

TEACHING

Department of Chemical Engineering, Ann Arbor, Michigan USA

Graduate Student Instructor, Chemical & Engineering Thermodynamics

Jan-May 2015

Led two discussions of 30 students each, held office hours and delivered guest lectures.

Developed course material, lessons, homework and exams.

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

Shan Jian (2019-2020), B.S., ChE, University of Minnesota, Class of 2021.

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.

GRANT WRITING

Rackham Predoctoral Fellowship

March 2017

Authored research proposal that was among 80 successful applications in a university-wide competition.

Virtual Materials Design Initiative, Karlsruhe Institute of Technology, Germany

Aug 2017

Primary author, "Unbiased Modeling of Bioadhesion on Complex Materials", granted €170,000 after peer review. PI: Prof. Joerg Lahann

National Science Foundation, RAPID proposals for COVID-19

March 2020

Author, "Modeling the Spread of COVID-19 through Attachment and Persistence on Surfaces via

SARS-CoV-2-Mimetic Polymeric Architectures (COMPARs) Containing 3D Multivalent Display of the Spike Glycoprotein Receptor Binding Domain”, declined. PI: Prof. Theresa M. Reineke

PATENTS

Copolymers for Intracellular Therapeutic Nucleic Acid Payload Delivery. Provisional patent application 63/031,996.

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

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

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.

HOBBIES

Classic literature, long-distance running, writing poetry.