Curriculum Vitae

Neha P. Kamat

Assistant Professor of Biomedical Engineering
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RESEARCH OBJECTIVES

Our interests lie in constructing minimal systems, or artificial cells, as a tool to understand and recreate certain cellular behaviors. We are specifically interested in designing environmentally responsive systems that can optically or enzymatically report physical forces or biological analytes in biological and aquatic environments. By using emerging engineering methods in material science and synthetic biology, we aim to construct macromolecular assemblies that can coordinate *both* membrane biophysical processes and RNA-regulated chemical processes in order to model cellular behaviors and design new biosensing materials.

EDUCATION

B.S., Bioengineering (Magna Cum Laude) (2008) Rice University, Houston, TX
Ph.D., Bioengineering (2012) University of Pennsylvania, Philadelphia, PA
Postdoctoral Fellow (2016) Harvard University and Massachusetts General Hospital, Boston, MA

PROFESSIONAL EXPERIENCE

Assistant Professor, Department of Biomedical Engineering Northwestern University (2017 – present)
Affiliations at Northwestern:
Member, Center of Synthetic Biology (2018 – present)
Member, Chemistry of Life Processes Institute (2017 – present)
Preceptor, Interdisciplinary Biological Sciences Graduate Program (2017- present)
Preceptor, Molecular Biophysics Training Program (2017- present)
Postdoctoral Fellow, Molecular Biology, Harvard University and Massachusetts General Hospital, (2012-2016)

HONORS AND AWARDS

2019	Rice Outstanding Young Engineering Alum Award
2018	Cornew Innovation Award, Chemistry of Life Processes, Northwestern University
2018	Air Force Young Investigator Research Program Recipient
2018	Selection for the National Academy of Engineering Frontiers of Engineering Symposium
2016	Rice Bioengineering Outstanding Undergraduate Alumna Award
2014-2016	NASA Postdoctoral Research Fellowship, Harvard University
2013	Solomon R. Pollack Award; thesis award in Bioengineering, University of Pennsylvania
2011	Nano/Bio Interface Center Graduate Research Award; best graduate research on Nanotechnology applied to Biology at the University of Pennsylvania
2009-2012	NSF Graduate Research Fellowship, University of Pennsylvania
2008-2009	GAANN Fellowship, University of Pennsylvania
2008	Student Association Outstanding Senior Award, Rice University
2008/2009	Outstanding Bioengineering Junior/Senior Award, Rice University
2005-2007	Beckman Scholars Award, Arnold and Mabel Beckman Foundation
2004-2008	Rice University Trustee Distinguished Scholarship, Louis J. Walsh Engineering Scholarship
2004-2006	Rice University Century Scholars Program
2004	Intel Science Talent Search Semifinalist

PUBLICATIONS

* = corresponding author; underline = student/member of Kamat group; # = equal contribution; IF=impact factor; † = highlighted

1. Hilburger, C. E.; Jacobs, M. L.; Lewis, K. R.; Peruzzi, J. A.; **Kamat, N. P.*** Controlling secretion in artificial cells with a membrane AND gate. *ACS Synthetic Biology* (IF: 5.571) **2019**, *8*, 1224-1230
2. Jacobs, M. J.; Boyd, M. A.; **Kamat, N. P.***; Diblock copolymers enhance folding of a mechanosensitive membrane protein during cell-free expression. *Proceedings of the National Academy of Sciences of the United States of America* (IF: 9.58) **2019,** *10*, 4031-4036 † Highlighted in Northwestern Engineering News
3. Boyd, M. A. and **Kamat, N. P.*** Visualizing tension and growth in model membranes using optical dyes. *Biophys J.* (IF: 3.495) **2018**, *115, 1307-1315*
4. O'Flaherty, D. K.[#]; **Kamat, N.P.**[#] *; Mirza, F. M.; Li, L.; Prywes, N.; Szostak, J. W▽. Copying of mixed sequence RNA templates inside model protocells. *Journal of the American Chemical Society* (IF: 14.695) **2018,** *140, 5171-5178* [#] authors contributed equally; * co-corresponding authors
5. Jin, L.[#]; **Kamat, N. P**.[#]; Jena, S.; Szostak, J. W. Fatty Acid/Phospholipid Blended Membranes: A Potential Intermediate State in Protocellular Evolution. *Small* (IF: 10.856) **2017,** 1704077. [#] authors contributed equally
6. Izgu, E. C.; Bjorkbom, A.; **Kamat, N. P.**; Lelyveld, V. S.; Zhang, W.; Jia, T. Z.; Szostak, J. W. NCarboxyanhydride-Mediated Fatty Acylation of Amino Acids and Peptides for Functionalization of Protocell Membranes. *Journal of the American Chemical Society* (IF: 14.695) **2016**, *138*, 16669-16676.
7. **Kamat, N. P**.; Tobe, S.; Hill, I. T.;Szostak, J. W. Electrostatic Localization of RNA to Protocell Membranes by Cationic Hydrophobic Peptides. (IF: 12.257) *Angewandte Chemie* **2015**. † Highlighted in The Science Times and designated as a "Hot Paper" by journal
8. Adamala, K.; Engelhart, A. E.; **Kamat, N. P.**; Jin, L.;Szostak, J. W. Construction of a Liposome Dialyzer for the Preparation of High-Value, Small-Volume Liposome Formulations. *Nature Protocols* (IF: 12.423) **2015,** *10,* 927-38.
9. Percec, V.; Leowanawat, P.; Sun, H.-J.; Kulikov, O.; Nusbaum, C. D.; Tran, T. M.; Bertin, A.; Wilson, D. A.; Peterca, M.; Zhang, S.; **Kamat, N. P.**; Vargo, K.; Moock, D.; Johnston, E. D.; Hammer, D. A.; Pochan, D. J.; Chen, Y.; Chabre, Y. M.; Shiao, T. C.; Bergeron-Brlek, M.; Andre, S.; Roy, R.; Gabius, H.-J.;Heiney, P. A. Modular Synthesis of Amphiphilic Janus Glycodendrimers and Their Self-Assembly into Glycodendrimersomes and Other Complex Architectures with Bioactivity to Biomedically Relevant Lectins. *Journal of the American Chemical Society* (IF: 14.695) **2013,** *135,* 9055-9077.
10. **Kamat, N. P.**; Henry, S. J.; Lee, D.;Hammer, D. A. Single-Vesicle Patterning of Uniform, Giant Polymersomes into Microarrays. *Small* (IF: 10.856) **2013,** *9,* 2272-2276.
11. Lee, M. H.; Hribar, K. C.; Brugarolas, T.; **Kamat, N. P.**; Burdick, J. A.;Lee, D. Harnessing Interfacial Phenomena to Program the Release Properties of Hollow Microcapsules. *Advanced Functional Materials* (IF: 15.621) **2012,** *22,* 131-138. † Featured on the cover
12. Katz, J. S.; Eisenbrown, K. A.; Johnston, E. D.; **Kamat, N. P.**; Rawson, J.; Therien, M. J.; Burdick, J. A.;Hammer, D. A. Soft Biodegradable Polymersomes from Caprolactone-Derived Polymers. *Soft Matter* (IF: 3.399) **2012,** *8,* 10853-10862.
13. Hammer, D. A.; **Kamat, N. P.** Towards an Artificial Cell. *Febs Letters* **2012,** *586,* 3766-3766.
14. **Kamat, N. P.**; Liao, Z.; Moses, L. E.; Rawson, J.; Therien, M. J.; Dmochowski, I. J.;Hammer, D. A. Sensing Membrane Stress with near Ir-Emissive Porphyrins. *Proceedings of the National Academy of Sciences of the United States of America* (IF: 9.58) **2011,** *108,* 13984-13989. † Highlighted in Penn Today, World of Chemicals, and NSF News from the Field
15. **Kamat, N. P.**; Lee, M. H.; Lee, D.;Hammer, D. A. Micropipette Aspiration of Double Emulsion-Templated Polymersomes. *Soft Matter* (IF: 3.399) **2011,** *7,* 9863-9866.
16. **Kamat, N. P.**; Katz, J. S.;Hammer, D. A. Engineering Polymersome Protocells. *Journal of Physical Chemistry Letters* (IF: 8.709) **2011,** *2,* 1612-1623. † Featured on the cover

17. Cheng, Z.; Elias, D. R.; **Kamat, N. P.**; Johnston, E. D.; Poloukhtine, A.; Popik, V.; Hammer, D. A.;Tsourkas, A. Improved Tumor Targeting of Polymer-Based Nanovesicles Using Polymer-Lipid Blends. *Bioconjugate Chemistry* (IF: 4.818) **2011,** *22,* 2021-2029.
18. **Kamat, N. P.**; Robbins, G. P.; Rawson, J.; Therien, M. J.; Dmochowski, I. J.;Hammer, D. A. A Generalized System for Photoresponsive Membrane Rupture in Polymersomes. *Advanced Functional Materials* (IF: 15.621) **2010,** *20,* 2588-2596.

MANUSCRIPTS UNDER REVIEW OR IN PREPARATION

1. Peruzzi, J. A.; Jacobs, M. L. ; Vu, T. Q. ; **Kamat, N. P.*** Barcoding biological reactions with DNA-functionalized vesicles. bioRxiv: 10.1101/672287 2019 (In Revision)

PATENTS

1. Daniel A Hammer, Ivan Julian Dmochowski, Gregory Patrick Robbins, Masaya S Jimbo, Michael J Therien, and Neha P Kamat. Polymer Vesicles for Selective Electromagnetic Energy-Induced Delivery. US Patent App. 12/548, 801.

INVITED SEMINARS

Kyoto University, Institute for Integrated Cell-Material Sciences (iCeMS) Retreat, Kyoto, Japan, 2019
Washington University in St. Louis, T32 Mechanobiology Retreat (keynote), Spring 2019
Northwestern University, Biotechnology Training Program, Seminar Series, Spring 2019
University of Illinois at Chicago, Department of Chemistry, Seminar Series, Spring 2019
Northwestern University Department of Pharmacology Retreat, Spring 2019
2019 ACS Great Lakes Regional Meeting (GLRM), Spring 2019
Northwestern University, Department of Chemical Engineering, Faculty Lunch Series, Fall 2017
Northwestern University Interdisciplinary Biosciences Retreat, Fall 2017
University of Nebraska-Lincoln, Big 10 BME Speaker Exchange, Spring 2017
Northwestern University, Department of Biomedical Engineering, Seminar Series, Spring 2016
Columbia University, Department of Biomedical Engineering, Seminar Series, Spring 2016
Stanford University, Department of Chemical Engineering, Seminar Series, Spring 2016
Boston University, Department of Biomedical Engineering, Seminar Series, Spring 2016
Columbia University, Department of Chemical Engineering, Seminar Series, Spring 2016
Duke University, Department of Biomedical Engineering, Seminar Series, Fall 2015
Northeastern University, College of Engineering, Seminar Series, 2014.
Earth-Life Science Institute Origins of Life Chemistry Workshop, Tokyo, Japan, 2014.

INVITED WORKSHOPS

NSF, Square-Table Workshop: Programmable Interfaces: Exploring the Intersection of Synthetic Biology, Biomaterials, and Soft Matter, Fall 2019 (declined due to maternity leave)
NSF, Understanding the Rules of Life: Building a Synthetic Cell Ideas Lab, Winter 2019
NSF, 2018 NSF EFRI Workshop: Convergence and Interdisciplinarity in Advancing Larger Scale Research, Summer 2018

CONTRIBUTED PRESENTATIONS AT TECHNICAL MEETINGS

underline = presenting author

1. Kamat, N. P. *A membrane logic gate to control secretion from vesicles*, Society of Biomaterials, Seattle, WA, 2019
2. Jacobs, M. L.; Kamat, N. P. *Investigating how Membrane Elasticity Impacts Membrane Protein Folding*, Annual Meeting of the Biophysical Society, Baltimore, MD, 2018
3. Boyd, M. A.; Kamat, N. P. *An Optical Approach to Monitor Membrane Dynamics in Response to Tension*, Biomedical Engineering Society Annual Meeting, Atlanta, GA, 2018

4. Kamat, N.P.; O'Flaherty, D.; Szostak, J. W. *Gating Protocell Permeability to RNA*, AIChE, Minneapolis, MN, 2017
5. Kamat, N. P.; Szostak, J. W. *Gating Protocell Permeability to RNA*, AIChE, Salt Lake City, UT, 2015
6. Kamat, N. P.; Szostak, J. W. *Peptide-Induced Localization of RNA to Protocell Membranes*, Biomedical Engineering Society Annual Meeting, Tampa, Florida, 2015.
7. Kamat, N. P.; Szostak, J. W. *Using Electrostatic Interactions to Localize RNA to Phospholipid Membranes*, 2015 Earth-Life Science Institute Origins of Life Chemistry Workshop, Cambridge, MA, 2015.
8. Kamat, N. P.; Szostak, J. W. *RNA Localization to Phospholipid Membranes with Nucleolipids*, Biomedical Engineering Society 2014 Annual Meeting, San Antonio, Texas, 2014.
9. Kamat, N. P.; Tobe, S.;Szostak, J. W. *Non-Enzymatic Primer Extension with Nucleolipids*, Gordon Research Conference on Origins of Life, Galveston, TX, 2014.
10. Kamat, N. P.; Szostak, J. W. *RNA Localization to Phospholipid Membranes with Nucleolipids*, Gordon Research Conference on Bioinspired Materials, Newry, ME, 2014.
11. Kamat, N. P.; Szostak, J. W. *Inducing RNA Localization to Protocell Membranes*, 2014 Simons Collaboration on the Origins of Life Annual Symposium, New York, NY, 2014.
12. Kamat, N. P.; Szostak, J. W. *Inducing RNA Localization to Protocell Membranes with Lipophilically-Modified Nucleotides*, Harvard Molecular Biology Friday Seminar Series, Boston, MA, 2013.
13. Kamat, N. P.; Liao, Z.; Dmochowski, I. J.;Hammer, D. A. *Using Porphyrin Emission to Monitor Stress in Synthetic Membranes*, Biomedical Engineering Society Annual Meeting, Atlanta, Georgia, 2012.
14. Kamat, N. P.; Lee, D.; Henry, S. J.;Hammer, D. A. *Characterizing and Functionalizing Double-Emulsion Templated Polymersomes*, Biomedical Engineering Society Annual Meeting, Atlanta, Georgia, 2012.
15. Kamat, N. P.; Vargo, K. B.; Therien, M. J.; Lee, D.; Dmochowski, I. J.;Hammer, D. A. *Sensing Stress and Blending Proteins in Polymer Membranes*, Gordon Research Conference on Bioinspired Materials, Davidson, NC, 2012.
16. Kamat, N. P.; Liao, Z.; Therien, M. J.; Dmochowski, I. J.;Hammer, D. A. *Sensing Membrane Stress with near Ir-Emissive Porphyrins*, Biophysical Society, San Diego, CA, 2012.
17. Kamat, N. P.; Liao, Z.; Dmochowski, I. J.;Hammer, D. A. *Optical Polymer Vesicles for Nanoparticle Release and Stress Sensing*, Bioengineering Graduate Research Symposium, Philadelphia, PA, 2012.
18. Kamat, N. P.; Hammer, D. A. *Photoresponsive, Nir-Emissive Polymersomes*, Radiobiology & Imaging Program Annual Retreat, Philadelphia, PA, 2011.
19. Kamat, N. P.; Hammer, D. A. *Engineering and Sensing Instability in Synthetic Vesicle Membranes*, Nano/Bio Interface Center Symposium, Philadelphia, PA, 2011.
20. Kamat, N. P.; Liao, Z.; Dmochowski, I. J.;Hammer, D. A. *Sensing Instability: Using Porphyrin Fluorescence to Detect Membrane Stress*, Materials Research Society Annual Meeting, Boston, MA, 2010.
21. Kamat, N. P.; Robbins, G. P.; Therien, M. J.; Dmochowski, I. J.;Hammer, D. A. *Photo-Induced Release from Porphyrin-Dextran Composite Polymersomes*, Materials Research Society Annual Meeting, Boston, MA, 2009.
22. Kamat, N. P.; West, J. L. *Nanoshell Transport through the Blood-Brain Barrier*, Fall Meeting of the Biomedical Engineering Society, Los Angeles, CA, 2007.

PHD DISSERTATIONS DIRECTED

Timothy Vu, Ph.D. Biomedical Engineering, Northwestern University (2018-present)
Justin Peruzzi, Ph.D. Chemical Engineering, Northwestern University (2017-present)
Margrethe Boyd, Ph.D. Biomedical Engineering, Northwestern University (2017-present)
Miranda Jacobs, Ph.D. Molecular Biosciences, Northwestern University (2017-present)

UNDERGRADUATE STUDENTS SUPERVISED

* = publication in Kamat Lab

Summer Duffy, Undergraduate Student Researcher, Northwestern University (2019-present)
Nora Chambers, Undergraduate Student Researcher, Northwestern University (2019-present)
Kenneth Wang, Undergraduate Student Researcher, Northwestern University (2019-present)
*Claire Hilburger, Undergraduate Student Researcher, Northwestern University (2017-present)
*Kamryn Lewis, Undergraduate Student Researcher, Northwestern University (2017-2018)
David Alexander Fong, Undergraduate Student Researcher, Northwestern University (2017-2019)

ACHIEVEMENTS BY GROUP MEMBERS

NDSEG Graduate Fellowships: 2019 (Boyd)
NSF Graduate Fellowships: 2018 (Peruzzi)
Biomedical Engineering Research Award, Northwestern University: 2019 (Boyd)
Molecular Biophysics Training Program NIH: 2017-18 (Jacobs), 2018 (Boyd)

TEACHING ACTIVITIES

BME 250 – Thermodynamics (Winter 2017 – present)
BME 446 - Synthetic Biology in Biomaterials (Spring 2018 – present
BME 403 – Quantitative Systems Physiology (Spring 2019 – present)

SERVICE- CONFERENCE/ SYMPOSIUM/ COLLOQUIUM ORGANIZATION

1. **Biomedical Engineering Society Annual Meeting, 2017-present**
   - Co-chair, “Applications of nanopores and Nanoparticles,” October 2017, Phoenix, AZ
   - Co-chair, “Nanotechnologies for Nucleic Acid Detection and Exosome Analysis,” Oct 2018, Atlanta, GA
2. **American Institute of Chemical Engineers, 2017-present**
   - Co-chair, “Biomaterials,” Nov 2017, San Francisco, CA
   - Co-chair, “Biomimetic Materials,” Nov 2019, Orlando, FL
3. **Central US Synthetic Biology Workshop**
   - Organizing Committee, Sept 2018, Evanston, IL
4. **Synthetic Biology: Engineering, Evolution & Design (SEED), 2019-present**
   - Chair: Session 2: The Materials Science/ Synthetic Biology Interface, June 2019, NY, NY
5. **Cell-Free Systems Conference**
   - Organizing Committee, Dec 2019, Boston, MA
6. **American Chemical Society Annual Symposium**
   - Co-Chair, “Bio-Inspired Macromolecular Materials,” Spring 2020, Philadelphia, PA
7. **New York Academy of Sciences, Synthetic Biology Conference**
   - Organizing Committee, Fall 2020, NY, NY

SERVICE- PROPOSAL AND MANUSCRIPT REVIEW

1. **National Institute of Health**
   - Gene and Drug Delivery (GDD) Study Section Ad Hoc Reviewer 2019
2. **European Research Council**
   - Advanced Grants Reviewer 2017
3. **Journal Reviews**
   - Langmuir, Nature Nanotechnology, ACS Synthetic Biology, ACS Nano, Science Advances

SERVICE- PROFESSIONAL

1. **Engineering Biology Research Consortium (EBRC),** Member, 2019- present

SERVICE- UNIVERSITY

Northwestern BME Undergraduate Academic Advisor, 2017 - present
Northwestern BME Graduate Recruitment Committee, 2017- present
Northwestern BME Undergraduate Club Faculty Advisor, 2017- present
Northwestern Undergraduate Research Assistant Program (URAP) Committee (2018- present)

MEDIA COVERAGE AND RESEARCH HIGHLIGHTS

Media Coverage

Darlene Tverdohleb (2015) Study Reveals New Insights on Origin of Life, The Science Times

Research and Award Highlights

Glenn Jeffers (2019) Cell Maker, Northwestern Research News
Lisa Valee (2019) 2019 CLP Cornew Awards Kick-Start Three Blue Sky Team Science Projects, CLP Frontpage
Emily Ashford (2019) New Technique Improves Folding of Membrane Proteins, Northwestern Engineering News
Alexandra Jacobson (2018) Northwestern Engineering Faculty Teams Receive NSF Big Ideas for the Future Grants, Northwestern Engineering News
Evan Lerner (2011) Penn Moleclar Scientists Deveop Color Changing Stress Sensor, Penn Today