

MEGAN E. KIZER, PhD

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RESEARCH INTERESTS

My research is focused on the development of chemical biology tools that enable investigation of complex biopolymers in critical biological processes. This has resulted in the development of a nanostructured nucleic acid binder and sensor against Dengue virus, RNA aptamers that target specific glycosaminoglycans, microfluidic delivery of DNA nanostructures, and tip-enhanced Raman scattering based DNA/RNA detection. More recently, I am interested in improving glycan (complex carbohydrates) detection by developing sequence-specific glycan binding probes. Such previous research experiences have informed my lab's research goals to develop glycan reading libraries, create novel nucleic acid nanostructured glycoconjugates as investigative tools, and recreate biosynthetic pathways for sequence-defined glycan synthesis.

APPOINTMENTS

Brown University <i>Assistant Professor of Chemistry</i>	Jan 2023 – Present
Massachusetts Institute of Technology <i>Postdoctoral Training</i> <i>Advisor: Barbara Imperiali</i>	June 2019 – Dec 2022

EDUCATION

Rensselaer Polytechnic Institute (RPI) <i>PhD, Chemistry and Chemical Biology</i> <i>Advisors: Robert Linhardt and Xing Wang</i>	May 2019
Binghamton University <i>Bachelor of Science, Biochemistry</i> <i>Advisor: Sozanne Solmaz</i>	May 2015

RESEARCH EXPERIENCE

Dr. Barbara Imperiali Lab, MIT – Cambridge, MA <i>NIH Ruth L. Kirschstein Postdoctoral Fellow</i> Engineering protein-based probes against glycan motifs implicated in bacterial pathogenesis and tumor progression. <ul style="list-style-type: none">- Chemical synthesis of defined glycoconjugates; characterization with HPLC and mass spectrometry (MALDI-TOF, ESI-MS).- Yeast surface display for selection of protein binders against glycan targets.- Random and site-directed mutagenesis of elicited protein binders to increase specificity and avidity.	June 2019 – Dec 2022
Dr. Xing Wang and Dr. Robert Linhardt Labs, RPI – Troy, NY <i>PhD; Slezak Fellow</i> Development of nucleic acid nanostructures and nanomaterials for biotechnological applications. <ul style="list-style-type: none">- DNA sequence design for nanostructure development.- Production of viral phage DNA scaffold for DNA origami structures and novel sequencing method.- Utilization of gel electrophoresis, AFM and TEM to characterize DNA nanostructures and their derivatives. Generation of nucleic acid biosensors for easy and rapid detection of biological entities. <ul style="list-style-type: none">- Toehold DNA sensor for Zika Virus detection.	Sept. 2015 – May 2019

- Tile-based DNA sensor for Dengue and Zika Virus detection and inhibition.
- Generation and characterization of RNA aptamers against glycosaminoglycans, 5'-end modifications for biosensor applications.

Delivery of DNA nanostructures to mammalian cells and investigation of stability.

- Delivery of nanostructures via microfluidic devices.
- Maintenance of mammalian cell lines for DNA nanostructure delivery.
- Determination of nanostructure stability inside K562 cells.

Bioconjugation of DNA and glycosaminoglycans.

- Strain promoted 'click chemistry' for end-to-end conjugation of DNA and heparin oligosaccharides.
- Characterization of conjugates by Denaturing-PAGE, purification by HPLC and size exclusion.

Dr. Sozanne Solmaz Lab, Binghamton University – Binghamton, NY

Sept. 2014 – Aug. 2015

Starzak Fellow, Undergraduate Research Assistant

Investigation into the dilation mechanism of the Nuclear Pore Complex, and its role in mitotic cell division.

- Mapped and characterized an interacting domain between nuclear pore protein RanBP2 and dynein adaptor protein BicD2 through site directed mutagenesis of potential requisite interacting residues.

PUBLICATIONS

[◊] *Equal contribution.*

* *Corresponding author.*

18. Ward, E.M., Zamora, C.Z., Schocker, N., Ghosh, S., Kizer, M.E. and Imperiali, B. Engineered Glycan-Binding Proteins for Recognition of the Thomsen-Friedenreich Antigen and Structurally Related Disaccharides. **ACS Chemical Biology**. 2023, 18 (1), 70-80. ([Link](#))
17. Chakraborty, B., Das, S., Gupta, A., Xiong, Y., TV, V., **Kizer, M.**, Duan, J., Chandrasekaran, A.R., Wang, X. Aptamers for viral detection and inhibition. **ACS Infectious Disease**. 2022, 18 (4), 667-692. ([Link](#))
16. Ward, E. M., **Kizer, M.E.**, and Imperiali, B. Strategies and Tactics for the Development of Selective Glycan-Binding Proteins. **ACS Chemical Biology**. 2021, 16 (10), 1795-1813. ([Link](#))
15. He, Z., Qiu, W., **Kizer, M.E.**, Wang, J., Sokolov, A. V., Wang, X., Hu, J., and Scully, M.O. Gap Mode Tip-Enhanced Raman and AFM Imaging of RNA Strands. **Conference on Lasers and Electro-Optics**. 2021, AM1R.3. ([Link](#))
14. He, Z., Qiu, W., **Kizer, M.E.**, Wang, J., Chen, W., Sokolov, A., Wang, X., Hu, J., and Scully, M. O. Resolving the Sequence of RNA Strands by Tip-Enhanced Raman Spectroscopy. **ACS Photonics**. 2021, 8 (2), 424-430. ([Link](#))
13. Duan, J.* , Wang, X., and **Kizer, M.E.*** Biotechnological and therapeutic applications of natural nucleic acid structural motifs. **Topics in Current Chemistry**. 2020, 378, 26. ([Link](#))
12. Kwon, P.S.[◊], Ren, S.[◊], S-J. Kwon, S-J.[◊], **Kizer, M.E.[◊]**, Kuo, L.[◊], Zhou, F., Zhang, F., Kim, D., Fraser, K., Kramer, L.D., Seeman, N.C, Dordick, J.S., Linhardt, R.J., Chao, J. and Wang, X. Designer DNA architecture offers precise and multivalent spatial pattern-recognition for viral sensing and inhibition. **Nature Chemistry**. 2020, 12, 26-35. ([Link](#))
Nature Biotechnology [Press Article](#)
Nature Materials [Editorial](#)
11. Wang, X., Chandrasekaran, A.R., Shen, Z., Ohayon, Y., Wang, T., **Kizer, M.**, Sha, R., Mao, C., Zhang, X., Liao, S., Ding, B., Chakraborty, B., Niu, D., Gu, H., Chao, J., Gao, X., Tangmatitham, T.C., and Seeman, N.C. Paranemic Crossover DNA: There and Back Again. **Chemical Reviews**. 2019, 119 (10), 6273-6289. ([Link](#))
10. **Kizer, M.E.***, Linhardt, R. J., Chandrasekaran, A. R., and Wang, X. The Iron Man suit for in vitro and in vivo DNA Nanostructures. **Small**. 2019, 15, 1805386. ([Link](#))
9. **Kizer, M.E.[◊]**, Deng, Y.[◊], Kang, G-Y., Mikael, P.E., Zhu, K., Wang, X., Chung, A.J. Hydroporator: A hydrodynamic cell membrane perforator for the high-throughput vector-free intracellular delivery of nanomaterials and an

evaluation of DNA nanostructure biostability in living cells. *Lab on a Chip*. 2019, 19, 1747-1754. ([Link](#))

8. **Kizer, M.**, Jing, T.J., Huntress, I.D., Walcott, B.D., Bromley, J.P., Fraser, K., Bystrhoff, C., and Wang, X. The complex between a multi-junction DNA motif, PX-DNA, and T7 endonuclease I. *Biochemistry*. 2019, 58 (10), 1332-1342. ([Link](#))
7. Cheng, A., Zhang, X., **Kizer, M.**, Wang, R., Middleton, D., Li, M., Wang, X., Li, X., Avci, F.Y., Zhang, F., and Linhardt, R.J. Glycoconjugate synthesis using chemoselective ligation. *Organic & Biomolecular Chemistry*. 2019, 17, 2646-2650. ([Link](#))
6. Zhe, H., Zehua, H., **Kizer, M.**, Linhardt, R. J., Wang, X., Sinyukov, A. M., Wang, J., Deckert, V., Sokolov, A. V., Hu, J., and Scully, M. O. Tip-Enhanced Raman Imaging of Single-Stranded DNA with Single Base Resolution. *Journal of the American Chemical Society*. 2019, 141 (2), 753-757. ([Link](#))
5. Noell, C. R., Loftus, K. M., Heying, C., Grewer, C., **Kizer, M.**, Debler, E., and Solmaz, S. A quantitative model for BicD2/cargo interactions. *Biochemistry*. 2018. 57 (46), 6538-6550. ([Link](#))
4. **Kizer, M.**, Li, P., Cress, B.F., Lin, L., Jing, T.J., Zhang, X., Xia, K., Linhardt, R.J., and Wang, X. RNA aptamers with specificity for heparosan and chondroitin glycosaminoglycans. *ACS Omega*. 2018. 3 (10), 13667-13675. ([Link](#))
3. Deng, Y., **Kizer, M.**, Rada, M., Sage, J., Wang, X., Cheon, D.J., and Chung, A. J. Intracellular Delivery of Nanomaterials via an Inertial Microfluidic Cell Hydroporator. *Nano Letters*. 2018, 18 (4), 2705-2710. ([Link](#))
2. Halvorsen, K., **Kizer, M.E.**, Wang, X. Chandrasekaran, A.R., Basanta-Sanchez, M. Shear Dependent LC Purification of an Engineered DNA Nanoswitch and Implications for DNA Origami. *Analytical Chemistry*. 2017, 89 (11), 5673-5677. ([Link](#))
1. Chandrasekaran, A.R., Anderson, N., **Kizer, M.**, Halvorsen, K. and Wang, X. Beyond the fold: Emerging Biological Applications of DNA Origami. *ChemBioChem*. 2016, 17, 1081-1089. ([Link](#))

FELLOWSHIPS AND AWARDS

NIH Ruth L. Kirschstein Postdoctoral Fellowship	April 2020
Walter H. Bauer Doctoral Prize in Chemistry	May 2019
RPI Founder's Award of Excellence	Oct. 2018
Slezak Memorial Fellowship	Oct. 2018
Maas Teaching Prize	June 2017
Dale B. Terry Memorial Award	May 2015
Mike Starzak Summer Research Fellowship	May 2015

PRESENTATIONS

UMass Dartmouth Chemistry Department Seminar – Dartmouth, MA	Nov. 2023
Presentation: Engineered Biomolecules to Mitigate Viral Pathogenesis and Cancer Progression (<i>Invited – Dr. Siva Rasapalli</i>)	
Brown Center for Biomedical Engineering Seminar – Providence, RI	Mar. 2023
Presentation: Glycan-focused Tools and Technologies to Understand Complex Carbohydrates in Human Health and Disease (<i>Invited – Dr. Ian Wong</i>)	
University of Rhode Island Chemistry Department Seminar – South Kingston, RI	Mar. 2023
Presentation: Engineered Biomolecules to Mitigate Viral Pathogenesis and Cancer Progression (<i>Invited – Dr. Jason Dwyer</i>)	
Brown Department of Chemistry Colloquium – Providence, RI	Mar. 2023
Presentation: Engineered Biomolecules to Mitigate Viral Pathogenesis and Cancer Progression	

WIC+/CADI Symposium (MIT) – Cambridge, MA	Nov. 2022
Poster: Kizer, M. E., and Imperiali, B. Chemically-Defined Glycopeptides Enable Expansion of Sso7d-Based Glycan Reading Library	
New England Glyco-Chemistry Meeting (Brandeis) – Waltham, MA	June 2022
Poster: Kizer, M. E., and Imperiali, B. Chemically-Defined Glycopeptides Enable Expansion of Sso7d-Based Glycan Reading Library	
Department of Biology Retreat (MIT) – Cambridge, MA	June 2022
Poster: Kizer, M. E., and Imperiali, B. Chemically-Defined Glycopeptides Enable Expansion of Sso7d-Based Glycan Reading Library	
RPI Chemistry and Chemical Biology Graduate Symposium – Troy, NY	Nov. 2018
Best Oral Presentation: Microfluidic Delivery of DNA Nanostructures and Investigation of <i>In Vitro</i> and <i>In Vivo</i> Stability	
Foundations of Nanoscience (FNANO18) – Snowbird, UT	Apr. 2018
Poster: Kizer, M. E., Li, P., Cress, B.F., Lin, L., Jing, T.J., Zhang, X., Linhardt, R.J., and Wang, X. RNA aptamers with specificity for heparosan and chondroitin glycosaminoglycans.	
cMDIS Fall Symposium (RPI) – Troy, NY	Nov. 2017
Poster: Kizer, M., Li, P., Cress, B.F., Lin, L., Jing, T.J., Zhang, X., Linhardt, R.J., and Wang, X. RNA aptamers with specificity for heparosan and chondroitin glycosaminoglycans.	
Binghamton University Chemistry Department Summer Research Symposium – Binghamton, NY	Aug. 2015
Poster: Kizer, M., Loftus, K., Debler, E., and Solmaz, S. Insights into cargo selectivity of BicD2.	

COURSES

Chemistry of Glycobiology	Fall 2023
Chem 1560H, Department of Chemistry, Brown University – Providence, RI	
Turning Evolutionary Dials: Biomolecular Design Strategies from Therapeutics to Climate Change	Spring 2022
Course 7.341, Department of Biology, MIT – Cambridge, MA	
<i>Instructors: Megan E. Kizer and Robbie Wilson</i>	

PROFESSIONAL & HONOR SOCIETIES

Phi Lambda Upsilon Chemistry Honor Society, RPI	Jan. 2019 – Present
International Society for Nanoscale Science, Computation and Engineering	Apr. 2018 – Present
American Chemical Society	Jan. 2016 – Present
Phi Sigma Iota, International Foreign Language Honor Society	Jan. 2013 – Present

LEADERSHIP, OUTREACH & PROFESSIONAL DEVELOPMENT

Diversity and Inclusion Action Committee, Brown University – Providence, RI	Jan 2023 – Present
<i>Faculty Member</i>	
Women+ in Chemistry, MIT – Cambridge, MA	Sept 2019 – Dec 2022
<i>Member, Graduate Student Mentor</i>	
Department of Biology Postdoctoral Association	Sept 2019 – Dec 2022
<i>Committee Member</i>	
Graduate Student Council, RPI – Troy, NY	Sept. 2016 – April 2019
<i>Committee Member, Student Outreach Task Force Chair</i>	

American Cancer Society – Binghamton & Troy, NY <i>Relay for Life Committee Member</i>	Sept. 2011 – May 2019
Professional Leadership Series, RPI – Troy, NY <i>Participant</i>	Jan. 2016 – May 2016
Girls Inc. – Albany, NY <i>STEM Educator Volunteer</i>	Sept. 2015 – May 2016
Phi Sigma Iota, International Foreign Language Honor Society – Binghamton, NY <i>Executive Vice President</i>	May 2013 – May 2015
Binghamton University Biochemistry Club – Binghamton, NY <i>Underclassmen Mentor</i>	Sept. 2012 – May 2013