MATTHEW LAKIN

Associate Professor
Department of Computer Science
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Research Interests

Computational biodesign, domain-specific languages for biological modeling, DNA nanotechnology, synthetic biology.

Education

- Ph.D. in Computer Science, University of Cambridge, UK, 2010.
  - Thesis title: *"An executable meta-language for inductive definitions with binders."*
  - Advisor: Prof. Andrew M. Pitts.
- M.A. (Cantab), University of Cambridge, UK, 2009.
- B.A. (Hons) in Computer Science, University of Cambridge, UK, 2005.

Positions

- 2024–current. Associate Professor, Department of Computer Science, University of New Mexico.
- 2024–current. Associate Professor (by courtesy), Department of Chemical & Biological Engineering, University of New Mexico.
- 2020–2024. Assistant Professor (by courtesy), Department of Chemical & Biological Engineering, University of New Mexico.
- 2017–2024. Assistant Professor, Department of Computer Science, University of New Mexico.
- 2014–2024. Member, Center for Biomedical Engineering, University of New Mexico.
- 2015–2017. Research Assistant Professor, Department of Chemical & Biological Engineering, University of New Mexico.
- 2015–2017. Research Assistant Professor, Department of Computer Science, University of New Mexico.
- 2011–2015. Postdoctoral Scholar, Department of Computer Science, University of New Mexico. Advisor: Prof. Darko Stefanovic.

- 2009–2011. Postdoctoral Researcher, Biological Computation Group, Microsoft Research, Cambridge, UK. Advisor: Dr. Andrew Phillips.

Awards (9 total)

- 2025–present. NSF EPSCoR Research Fellowship.
- **2025. Presidential Early Career Award for Scientists and Engineers (PECASE).**
- **2021–present. NSF CAREER award. Project title: *"Robust heterochiral molecular computing in mammalian cells."* Total award amount: $650,000.**
- 2021. UNM School of Engineering Junior Faculty Research Excellence Award.
- 2020. STC.UNM Innovation Award.
- 2013–2015. Postdoctoral Training Fellowship, New Mexico Cancer Nanotechnology Training Center.
- 2007–2008. Queens' College Munro Studentship. (Awarded for teaching excellence.)
- 2004. Queens' College Foundation Scholarship. (Awarded for first class honors in Tripos examinations.)
- 2003. Queens' College Exhibition. (Awarded for first class honors in Tripos examinations.)

Awards To My Students (3 total)

- 2023. UNM School of Engineering Outstanding Graduate Student Award for the combined Interdisciplinary Programs (Biomedical Engineering, Nanoscience & Microsystems Engineering, and Optical Science & Engineering) awarded to my graduate student, **Tracy L. Mallette** (Ph.D. in Biomedical Engineering).
- 2023. NSF Graduate Research Fellowship awarded to my graduate student, **Andrew Gutierrez** (Ph.D. in Biology).
- 2022. Poster Award at the 18th Annual Meeting of the Oligonucleotide Therapeutics Society awarded to my graduate student, **Tracy L. Mallette** (Ph.D. in Biomedical Engineering).

Grants (17 total)

Active Grants (7 total)

‡ = postdoctoral researcher advised by Lakin.

- Principal Investigator, National Science Foundation award 2614686, *"EAGER: Probing the interactions of mirror DNA with cellular machinery using cell-free systems."*
  - Total award amount: $400,000.
  - UNM portion: $400,000.

- Project period: 07/01/2026–06/30/2028.
- PI: Matthew R. Lakin (sole investigator).

- Principal Investigator, National Science Foundation award 2429343, *"EPSCoR Research Fellows: NSF: Computational design and experimental validation of DNA nanodevices."*
  - Total award amount: $300,000.
  - UNM portion: $300,000.
  - Project period: 02/01/2025–01/31/2027.
  - PI: Matthew R. Lakin (sole investigator).

- Principal Investigator, National Science Foundation award 2312215, *"FET: Small: Simulation-guided design of heterochiral DNA nanostructures for biomaterials applications."*
  - Total award amount: $500,000.
  - UNM portion: $500,000.
  - Project period: 10/01/2023–09/30/2027.
  - PI: Matthew R. Lakin; Co-PI: William P. Bricker (UNM).

- Co-Principal Investigator, National Science Foundation award 2318897, *"URoL:ASC: Biosensors for field detection of aqueous heavy metals: a collaboration with Native American communities."*
  - Total award amount: $3,000,000.
  - UNM portion: $2,500,500.
  - Award period: 08/15/2023–07/31/2028.
  - PI: Gabriel P. López (UNM); Co-PIs: Matthew R. Lakin, Nick J. Carroll (UNM), José Cerrato (UNM), Abraham Meles (Navajo Technical University).

- Co-Principal Investigator, National Science Foundation award 2124308, *"Collaborative Research: Toward lifelike synthetic cells via engineered control of DNA replication."*
  - Total award amount: $1,095,798.
  - UNM portion: $414,071.
  - Award period: 08/15/2021–07/31/2027.
  - PI: James E. Chappell (Rice University); Co-PIs: Matthew R. Lakin, **Peter W. Davenport‡** (UNM), Emma K. Frow (Arizona State University).

- Co-Principal Investigator, National Science Foundation award 2123465, *"Synthetic P-bodies: Coupling gene expression and ribonucleoprotein granules in synthetic cell vesicles for sensing and response."*
  - Total award amount: $992,280.
  - UNM portion: $704,216.
  - Award period: 08/01/2021–07/31/2027.
  - PI: Gabriel P. López (UNM); Co-PIs: Matthew R. Lakin, Katarzyna P. Adamala (University of Minnesota), William Gannon (UNM).

- **Principal Investigator, National Science Foundation award 2044838, *"CAREER: Robust heterochiral molecular computing in mammalian cells."***

- **Total award amount: $650,000.**
- **UNM portion: $650,000.**
- **Award period: 04/01/2021–03/31/2027.**
- **PI: Matthew R. Lakin (sole investigator).**

Completed Grants (10 total)

- Principal Investigator, UNM Rainforest Innovations pilot project award, *"Controlling cellular behavior using heterochiral DNAzymes."*
  - Total award amount: $25,000.
  - UNM portion: $25,000.
  - Project period: 08/01/2024–07/31/2025.
  - PI: Matthew R. Lakin; Co-PI: Diane P. Lidke (UNM Health Sciences Center).
- Co-Principal Investigator, National Science Foundation award 1935087, *"Synthetic cells that can learn without evolution."*
  - Total award amount: $1,000,000.
  - UNM portion: $203,171.
  - Award period: 09/15/2019–08/31/2024.
  - PI: James M. Carothers (University of Washington); Co-PIs: Matthew R. Lakin, Irene Chen (University of California Los Angeles), Pamela Peralta-Yahya (Georgia Tech), Emma K. Frow (Arizona State University).
- Principal Investigator, National Science Foundation award 1814906, *"SHF: Small: Models and design tools for tethered molecular circuits."*
  - Total award amount: $450,000.
  - UNM portion: $450,000.
  - Award period: 06/15/2018–05/31/2024.
  - PI: Matthew R. Lakin (sole investigator).
- Project Investigator, National Institutes of Health NIGMS grant P20GM103451 via NM-INBRE, *"Cell-free design and implementation of CRISPR guide RNA switches."*
  - Total award amount: $109,237.
  - UNM portion: $109,237.
  - Award period: 05/01/2019–03/31/2024.
  - PI: Matthew R. Lakin (sole investigator).
- Co-Principal Investigator, National Science Foundation award 2031774, *"EAGER: Engineered, Smart, Nucleic Acid-Binding, Intrinsically Disordered Proteins to Enable Ubiquitous Detection of Viral Pathogens and Diagnosis."*
  - Total award amount: $300,000.
  - UNM portion: $300,000.
  - Award period: 07/01/2020–06/30/2023.

- PI: Gabriel P. López (UNM); Co-PIs: Matthew R. Lakin, Nick J. Carroll (UNM), David S. Peabody (UNM).

- Co-Principal Investigator, National Science Foundation award 2202396, *"Student and Postdoc Travel Support for DNA28."*
  - Total award amount: $20,000.
  - UNM portion: $20,000.
  - Award period: 03/01/2022–02/28/2023.
  - PI: Darko Stefanovic (UNM); Co-PIs: Matthew R. Lakin.

- Co-Principal Investigator, National Science Foundation award 1763718, *"SHF: Collaborative Research: Biocompatible I/O interfaces for robust bioorthogonal molecular computing."*
  - Total award amount: $300,000.
  - UNM portion: $200,000.
  - Award period: 10/01/2018–09/30/2022.
  - PI: Darko Stefanovic (UNM); Co-PIs: Matthew R. Lakin, Milan Stojanovic (Columbia University).

- Co-Principal Investigator, National Science Foundation award 1518861, *"AF: Large: Collaborative Research: Molecular computing for the real world."*
  - Total award amount: $2,000,000.
  - UNM portion: $934,358.
  - Award period: 09/01/2015–08/31/2022.
  - PI: Darko Stefanovic (UNM); Co-PIs: Matthew R. Lakin, Steven Graves (UNM), Lydia Tapia (UNM), Milan Stojanovic (Columbia University), Sergei Rudchenko (Hospital for Special Surgery), Christof Teuscher (Portland State University).

- Co-Principal Investigator, National Science Foundation award 1843958, *"RoL: EAGER: DESYN-C^3: Programmable control of metabolism in synthetic cells using intrinsically disordered proteins."*
  - Total award amount: $299,986.
  - UNM portion: $299,986.
  - Award period: 10/01/2018–09/30/2021.
  - PI: Nick J. Carroll (UNM); Co-PI: Matthew R. Lakin.

- Principal Investigator, National Science Foundation award 1525553, *"AF: SHF: Small: Adaptive molecular computation using buffered strand displacement networks."*
  - Total award amount: $449,999.
  - UNM portion: $449,999.
  - Award period: 09/01/2015–08/31/2020.
  - PI: Matthew R. Lakin; Co-PIs: Darko Stefanovic (UNM), Steven Graves (UNM).

Patents (6 total)

‡ = postdoctoral scholar advised by Lakin; † = graduate student advised by Lakin.

- M. R. Lakin, **Anshika Mishra**†, and **Andrew Lezia**‡, *DNA strand displacement reactions and methods*, US provisional patent application, 2026
- Matthew R. Lakin, **Tracy L. Mallette**†, Darko Stefanovic, and Milan N. Stojanovic, *Heterochiral translators and molecular circuits*, US patent number 12,529,103, 2026
- Matthew R. Lakin, Carl W. Brown, III, Darko Stefanovic, and Steven W. Graves, *Signal propagation biomolecules, devices and methods*, US patent number 10,221,446, 2019
- Matthew R. Lakin and Nick J. Carroll, *Programmable control of metabolism in synthetic cells using intrinsically disordered proteins*, US provisional patent application, 2018
- Matthew R. Lakin and **Peter W. Davenport**‡, *Engineering stimulus-responsive effectors for cell-specific control of gene expression*, US provisional patent application, 2018
- Matthew R. Lakin and Andrew Phillips, *Stochastic simulation of multi-language concurrent systems*, US patent application number 13/091,950, patent pending, 2011

Publications (64 total)

‡ = postdoctoral scholar advised by Lakin; † = graduate student advised by Lakin; ⋆ = undergraduate student advised by Lakin.

Edited Volumes (2 total)

- Matthew R. Lakin and Petr Šulc, "Preface for Special Issue: Selected papers from the 27th International Conference on DNA Computing and Molecular Programming," *Natural Computing*, vol. 23, no. 3, p. 453, 2024. DOI: 10.1007/s11047-024-09988-z
- Matthew R. Lakin and Petr Šulc, Eds., *27th International Conference on DNA Computing and Molecular Programming (DNA 27)*, vol. 205, Leibniz International Proceedings in Informatics (LIPIcs), Schloss Dagstuhl – Leibniz-Zentrum für Informatik, 2021, ISBN: 978-3-95977-205-1. DOI: 10.4230/LIPIcs.DNA.27

Book Chapters (4 total)

- Matthew R. Lakin, Carlo Spaccasassi, and Andrew Phillips, "Computational design of nucleic acid circuits: Past, present, and future," in *Visions of DNA Nanotechnology at 40 for the Next 40*, ser. Natural Computing Series, N. Jonoska and E. Winfree, Eds., Springer, 2023, ch. 18, pp. 311–346. DOI: 10.1007/978-981-19-9891-1_18
- Matthew R. Lakin, Darko Stefanovic, and Milan N. Stojanovic, "Diverse applications of DNAzymes in computing and nanotechnology," in *Ribozymes*, S. Müller, B. Masquida, and W. Winkler, Eds., Wiley, 2021, ch. 25, pp. 633–660. DOI: 10.1002/9783527814527.ch25

- **David Arredondo**[†], Matthew R. Lakin, Darko Stefanovic, and Milan N. Stojanovic, "Development and application of catalytic DNA in nanoscale robotics," in *DNA- and RNA-Based Computing Systems*, E. Katz, Ed., Wiley, 2021, ch. 15, pp. 293–306. DOI: 10.1002/9783527825424.ch15

- Matthew R. Lakin, Milan N. Stojanovic, and Darko Stefanovic, "Implementing molecular logic gates, circuits, and cascades using DNAzymes," in *Advances in Unconventional Computing Volume 2: Prototypes, Models and Algorithms*, ser. Emergence, Complexity, and Computation, A. Adamatzky, Ed., vol. 23, Springer International Publishing, 2017, ch. 1, pp. 1–28. DOI: 10.1007/978-3-319-33921-4_1

Journal Publications (39 total)

- Baiyang Liu, Xiao Peng, Matthew Bennett, Matthew R. Lakin, and James Chappell, "Engineering plasmids with synthetic origins of replication," *Nature Communications*, vol. 17, p. 2255, 2026. DOI: 10.1038/s41467-026-68907-1

- **Tracy L. Mallette**[†], **Anshika Mishra**[†], and Matthew R. Lakin, "On degradation-induced leak in heterochiral DNA strand displacement cascades," *ACS Synthetic Biology*, vol. 15, no. 2, pp. 599–609, 2026. DOI: 10.1021/acssynbio.5c00680

- Telmo Díez Pérez, Ashley N. Tafoya, David S. Peabody, Carina N. Anastasio, Andrew P. Shreve, Matthew R. Lakin, Nick J. Carroll, and Gabriel P. López, "Smart nucleic acid chaperones: Phase-separating intrinsically disordered proteins for accelerating DNA hybridization reactions," *ACS Synthetic Biology*, vol. 15, no. 1, pp. 114–126, 2026. DOI: 10.1021/acssynbio.5c00511

- **Randi L. Smith**[†], **Peter W. Davenport**[‡], and Matthew R. Lakin, "A study of CRISPR ribonucleoprotein displacement in cell-free systems," *ACS Omega*, vol. 10, no. 9, pp. 9154–9164, 2025. DOI: 10.1021/acsomega.4c09275

- Telmo Díez Pérez, Ashley N. Tafoya, David S. Peabody, Matthew R. Lakin, Ivy Hurwitz, Nick J. Carroll, and Gabriel P. López, "Isolation of nucleic acids using liquid-liquid phase separation of pH-sensitive elastin-like polypeptides," *Scientific Reports*, vol. 14, p. 10 157, 2024. DOI: 10.1038/s41598-024-60648-9

- **Tracy L. Mallette**[†], Diane S. Lidke, and Matthew R. Lakin, "Heterochiral modifications enhance robustness and function of DNA in living human cells," *ChemBioChem*, vol. 25, no. 5, e202300755, 2024. DOI: 10.1002/cbic.202300755

- Dalton R. George, Mark Danciu, **Peter W. Davenport**[‡], Matthew R. Lakin, James Chappell, and Emma K. Frow, "A bumpy road ahead for genetic biocontainment," *Nature Communications*, vol. 15, p. 650, 2024. DOI: 10.1038/s41467-023-44531-1

- **Sarika Kumar**[†] and Matthew R. Lakin, "A geometric framework for reaction enumeration in computational nucleic acid devices," *Journal of the Royal Society Interface*, vol. 20, no. 208, p. 20 230 259, 2023. DOI: 10.1098/rsif.2023.0259

- **David Arredondo**[†] and Matthew R. Lakin, "Supervised learning in a multilayer, nonlinear chemical neural network," *IEEE Transactions on Neural Networks and Learning Systems*, vol. 34, no. 10, pp. 7734–7745, 2023. DOI: 10.1109/TNNLS.2022.3146057

- Matthew R. Lakin, "Design and simulation of a multilayer chemical neural network that learns via backpropagation," *Artificial Life*, vol. 29, no. 3, pp. 308–335, 2023. DOI: 10.1162/artl_a_00405
- **David Arredondo**[†] and Matthew R. Lakin, "Operant conditioning of stochastic chemical reaction networks," *PLOS Computational Biology*, vol. 18, no. 11, e1010676, 2022. DOI: 10.1371/journal.pcbi.1010676
- **Tracy L. Mallette**[†] and Matthew R. Lakin, "Protecting heterochiral DNA nanostructures against exonuclease-mediated degradation," *ACS Synthetic Biology*, vol. 11, no. 7, pp. 2222–2228, 2022. DOI: 10.1021/acssynbio.2c00105
- **David Arredondo**[†] and Matthew R. Lakin, "Robust finite automata in stochastic chemical reaction networks," *Royal Society Open Science*, vol. 8, no. 12, p. 211 310, 2021. DOI: 10.1098/rsos.211310
- Oskar Staufer, Jacqueline A. De Lora, Eleonora Bailoni, Alisina Bazrafshan, Amelie S. Benk, Kevin Jahnke, Zachary A. Manzer, Lado Otrin, Telmo Díez Pérez, Judee Sharon, Jan Steinkühler, Katarzyna P. Adamala, Bruna Jacobson, Marileen Dogterom, Kerstin Göpfrich, Darko Stefanovic, Susan R. Atlas, Michael Grunze, Matthew R. Lakin, Andrew P. Shreve, Joachim P. Spatz, and Gabriel P. López, "Building a community to engineer synthetic cells and organelles from the bottom-up," *eLife*, vol. 10, e73556, 2021. DOI: 10.7554/eLife.73556
- **Sarika Kumar**[†], **Julian M. Weisburd**[⋆], and Matthew R. Lakin, "Structure sampling for computational estimation of localized DNA interaction rates," *Scientific Reports*, vol. 11, p. 12 730, 2021. DOI: 10.1038/s41598-021-92145-8
- Matthew R. Lakin and Andrew Phillips, "Domain-specific programming languages for computational nucleic acid systems," *ACS Synthetic Biology*, vol. 9, no. 7, pp. 1499–1513, 2020. DOI: 10.1021/acssynbio.0c00050
- **Tracy L. Mallette**[†], Milan N. Stojanovic, Darko Stefanovic, and Matthew R. Lakin, "Robust heterochiral strand displacement using leakless translators," *ACS Synthetic Biology*, vol. 9, no. 7, pp. 1907–1910, 2020. DOI: 10.1021/acssynbio.0c00131
- Carlo Spaccasassi, Matthew R. Lakin, and Andrew Phillips, "A logic programming language for computational nucleic acid devices," *ACS Synthetic Biology*, vol. 8, no. 7, pp. 1530–1547, 2019. DOI: 10.1021/acssynbio.8b00229
- Aurora Fabry-Wood, Madalyn Elise Fetrow, Ayomide Oloyede, Kyung-Ae Yang, Milan N. Stojanovic, Darko Stefanovic, Steven W. Graves, Nick J. Carroll, and Matthew R. Lakin, "Microcompartments for protection and isolation of nanoscale DNA computing elements," *ACS Applied Materials and Interfaces*, vol. 11, no. 12, pp. 11 262–11 269, 2019. DOI: 10.1021/acsami.9b03143
- Matthew R. Lakin and Andrew Phillips, "Automated analysis of tethered DNA nanostructures using constraint solving," *Natural Computing*, vol. 17, no. 4, pp. 709–722, 2018. DOI: 10.1007/s11047-018-9693-y
- Sandeep Pallikkuth, Cheyenne Martin, Farzin Farzam, Jeremy S. Edwards, Matthew R. Lakin, Diane S. Lidke, and Keith A. Lidke, "Sequential super-resolution imaging using DNA strand displacement," *PLOS ONE*, vol. 13, no. 8, e0203291, 2018. DOI: 10.1371/journal.pone.0203291

- Aurora Fabry-Wood, Madalyn Elise Fetrow, Carl W. Brown, III, Nicholas A. Baker, Nadiezda Fernandez Oropeza, Andrew P. Shreve, Gabriel A. Montaño, Darko Stefanovic, Matthew R. Lakin, and Steven W. Graves, "A microsphere-supported lipid bilayer platform for DNA reactions on a fluid surface," *ACS Applied Materials and Interfaces*, vol. 9, no. 35, pp. 30 185–30 195, 2017. DOI: 10.1021/acsami.7b11046

- Matthew R. Lakin and Darko Stefanovic, "Supervised learning in adaptive DNA strand displacement networks," *ACS Synthetic Biology*, vol. 5, no. 8, pp. 885–897, 2016. DOI: 10.1021/acssynbio.6b00009

- Dandan Mo, Matthew R. Lakin, and Darko Stefanovic, "Logic circuits based on molecular spider systems," *BioSystems*, vol. 146, pp. 10–25, 2016. DOI: 10.1016/j.biosystems.2016.03.008

- Matthew R. Lakin, Darko Stefanovic, and Andrew Phillips, "Modular verification of chemical reaction network encodings via serializability analysis," *Theoretical Computer Science*, vol. 632, pp. 21–42, 2016. DOI: 10.1016/j.tcs.2015.06.033

- Rasmus L. Petersen, Matthew R. Lakin, and Andrew Phillips, "A strand graph semantics for DNA-based computation," *Theoretical Computer Science*, vol. 632, pp. 43–73, 2016. DOI: 10.1016/j.tcs.2015.07.041

- Carl W. Brown, III, Matthew R. Lakin, Aurora Fabry-Wood, Eli K. Horwitz, Nicholas A. Baker, Darko Stefanovic, and Steven W. Graves, "A unified sensor architecture for isothermal detection of double-stranded DNA, oligonucleotides, and small molecules," *ChemBioChem*, vol. 16, no. 5, pp. 725–730, 2015. DOI: 10.1002/cbic.201402615

- Matthew R. Lakin, Carl W. Brown, III, Eli K. Horwitz, M. Leigh Fanning, Hannah E. West, Darko Stefanovic, and Steven W. Graves, "Biophysically inspired rational design of structured chimeric substrates for DNAzyme cascade engineering," *PLOS ONE*, vol. 9, no. 10, e110986, 2014. DOI: 10.1371/journal.pone.0110986

- Carl W. Brown, III, Matthew R. Lakin, Eli K. Horwitz, M. Leigh Fanning, Hannah E. West, Darko Stefanovic, and Steven W. Graves, "Signal propagation in multi-layer DNAzyme cascades using structured chimeric substrates," *Angewandte Chemie International Edition*, vol. 53, no. 28, pp. 7183–7187, 2014. DOI: 10.1002/anie.201402691

- Matthew R. Lakin, Amanda Minnich, Terran Lane, and Darko Stefanovic, "Design of a biochemical circuit motif for learning linear functions," *Journal of the Royal Society Interface*, vol. 11, no. 101, p. 20 140 902, 2014. DOI: 10.1098/rsif.2014.0902

- Carl W. Brown, III, Matthew R. Lakin, Darko Stefanovic, and Steven W. Graves, "Catalytic molecular logic devices by DNAzyme displacement," *ChemBioChem*, vol. 15, no. 7, pp. 950–954, 2014. DOI: 10.1002/cbic.201400047

- Matthew R. Lakin and Andrew M. Pitts, "Contextual equivalence for inductive definitions with binders in higher-order typed functional programming," *Journal of Functional Programming*, vol. 23, no. 6, pp. 658–700, 2013. DOI: 10.1017/S0956796813000245

- Peter Banda, Christof Teuscher, and Matthew R. Lakin, "Online learning in a chemical perceptron," *Artificial Life*, vol. 19, no. 2, pp. 195–219, 2013. DOI: 10.1162/ARTL_a_00105

- Matthew R. Lakin, David Parker, Luca Cardelli, Marta Kwiatkowska, and Andrew Phillips, "Design and analysis of DNA strand displacement devices using probabilistic model checking," *Journal of the Royal Society Interface*, vol. 9, no. 72, pp. 1470–1485, 2012. DOI: 10.1098/rsif.2011.0800

- Matthew R. Lakin, Loïc Paulevé, and Andrew Phillips, "Stochastic simulation of multiple process calculi for biology," *Theoretical Computer Science*, vol. 431, pp. 181–206, 2012. DOI: 10.1016/j.tcs.2011.12.057

- Matthew R. Lakin, Simon Youssef, Luca Cardelli, and Andrew Phillips, "Abstractions for DNA circuit design," *Journal of the Royal Society Interface*, vol. 9, no. 68, pp. 460–486, 2012. DOI: 10.1098/rsif.2011.0343

- Matthew R. Lakin, Simon Youssef, Filippo Polo, Stephen Emmott, and Andrew Phillips, "Visual DSD: A design and analysis tool for DNA strand displacement systems," *Bioinformatics*, vol. 27, no. 22, pp. 3211–3213, 2011. DOI: 10.1093/bioinformatics/btr543

- Matthew R. Lakin and Andrew M. Pitts, "Encoding abstract syntax without fresh names," *Journal of Automated Reasoning*, vol. 49, no. 2, pp. 115–140, 2012. DOI: 10.1007/s10817-011-9220-7

- Matthew R. Lakin, "Constraint solving in non-permutative nominal abstract syntax," *Logical Methods in Computer Science*, vol. 7, no. 3:06, pp. 1–31, 2011. DOI: 10.2168/LMCS-7(3:6)2011

Peer-Reviewed Conference Publications (19 total)

- Matthew R. Lakin, "Geometric constraint optimization for localized strand displacement reactions," in *32nd International Conference on DNA Computing and Molecular Programming (DNA 32)*, D. Scalise and R. Schweller, Eds., ser. Leibniz International Proceedings in Informatics (LIPIcs), vol. 387, Dagstuhl, Germany: Schloss Dagstuhl–Leibniz-Zentrum für Informatik, 2026, 5:1–5:23. DOI: 10.4230/LIPIcs.DNA.32.5

- Matthew R. Lakin and **Sarika Kumar**[†], "Geometric enumeration of localized DNA strand displacement reaction networks," in *30th International Conference on DNA Computing and Molecular Programming (DNA 30)*, S. Seki and J. M. Stewart, Eds., ser. Leibniz International Proceedings in Informatics (LIPIcs), vol. 314, Dagstuhl, Germany: Schloss Dagstuhl–Leibniz-Zentrum für Informatik, 2024, 1:1–1:24. DOI: 10.4230/LIPIcs.DNA.30.1

- Matthew R. Lakin and Andrew Phillips, "Automated, constraint-based analysis of tethered DNA nanostructures," in *Proceedings of the 23rd International Conference on DNA Computing and Molecular Programming*, R. Brijder and L. Qian, Eds., ser. Lecture Notes in Computer Science, vol. 10467, Springer, Cham, 2017, pp. 1–16. DOI: 10.1007/978-3-319-66799-7_1

- Matthew R. Lakin and Darko Stefanovic, "Towards temporal logic computation using DNA strand displacement reactions," in *Unconventional Computation and Natural Computation 2017*, M. J. Patitz and M. Stannett, Eds., ser. Lecture Notes in Computer Science, vol. 10240, Springer, Cham, 2017, pp. 41–55. DOI: 10.1007/978-3-319-58187-3_4

- Matthew R. Lakin and Darko Stefanovic, "Supervised learning in an adaptive DNA strand displacement circuit," in *Proceedings of the 21st International Conference on DNA Computing and Molecular Programming*, A. Phillips and P. Yin, Eds., ser. Lecture Notes in Computer Science,

vol. 9211, Springer International Publishing, 2015, pp. 154–167. DOI: 10.1007/978-3-319-21999-8_10

- Dandan Mo, Matthew R. Lakin, and Darko Stefanovic, "Scalable design of logic circuits using an active molecular spider system," in *Proceedings of the 10th International Conference on Information Processing in Cells and Tissues*, M. Lones, A. Tyrrell, S. Smith, and G. Fogel, Eds., ser. Lecture Notes in Computer Science, vol. 9303, Springer International Publishing, 2015, pp. 13–28. DOI: 10.1007/978-3-319-23108-2_2

- Matthew R. Lakin, Rasmus Petersen, Kathryn E. Gray, and Andrew Phillips, "Abstract modelling of tethered DNA circuits," in *Proceedings of the 20th International Conference on DNA Computing and Molecular Programming*, S. Murata and S. Kobayashi, Eds., ser. Lecture Notes in Computer Science, vol. 8727, Springer International Publishing, 2014, pp. 132–147. DOI: 10.1007/978-3-319-11295-4_9

- Matthew R. Lakin and Darko Stefanovic, "Pattern formation by spatially organized approximate majority reactions," in *Unconventional Computation and Natural Computation 2014*, O. H. Ibarra, L. Kari, and S. Kopecki, Eds., ser. Lecture Notes in Computer Science, vol. 8553, Springer International Publishing, 2014, pp. 254–266. DOI: 10.1007/978-3-319-08123-6_21

- Matthew R. Lakin and Andrew Phillips, "Compiling DNA strand displacement reactions using a functional programming language," in *Proceedings of Practical Aspects of Declarative Languages 2014*, M. Flatt and H.-F. Guo, Eds., ser. Lecture Notes in Computer Science, vol. 8324, Springer International Publishing Switzerland, 2014, pp. 81–86. DOI: 10.1007/978-3-319-04132-2_6

- Alireza Goudarzi, Matthew R. Lakin, Darko Stefanovic, and Christof Teuscher, "A model for variation- and fault-tolerant digital logic using self-assembled nanowire architectures," in *Proceedings of the 2014 IEEE/ACM International Symposium on Nanoscale Architectures (NANOARCH)*, IEEE Press, 2014, pp. 116–121. DOI: 10.1109/NANOARCH.2014.6880504

- Alireza Goudarzi, Matthew R. Lakin, and Darko Stefanovic, "Reservoir computing approach to robust computation using unreliable nanoscale networks," in *Unconventional Computation and Natural Computation 2014*, O. H. Ibarra, L. Kari, and S. Kopecki, Eds., ser. Lecture Notes in Computer Science, vol. 8553, Springer International Publishing, 2014, pp. 164–176. DOI: 10.1007/978-3-319-08123-6_14

- Matthew R. Lakin, Andrew Phillips, and Darko Stefanovic, "Modular verification of DNA strand displacement networks via serializability analysis," in *Proceedings of the 19th International Conference on DNA Computing and Molecular Programming*, D. Soloveichik and B. Yurke, Eds., ser. Lecture Notes in Computer Science, vol. 8141, Springer-Verlag, 2013, pp. 133–146. DOI: 10.1007/978-3-319-01928-4_10

- Alireza Goudarzi, Matthew R. Lakin, and Darko Stefanovic, "DNA reservoir computing: A novel molecular computing approach," in *Proceedings of the 19th International Conference on DNA Computing and Molecular Programming*, D. Soloveichik and B. Yurke, Eds., ser. Lecture Notes in Computer Science, vol. 8141, Springer-Verlag, 2013, pp. 76–89. DOI: 10.1007/978-3-319-01928-4_6

- Matthew R. Lakin, Amanda Minnich, Terran Lane, and Darko Stefanovic, "Towards a biomolecular learning machine," in *Unconventional Computation and Natural Computation 2012*, J. Durand-

Lose and N. Jonoska, Eds., ser. Lecture Notes in Computer Science, vol. 7445, Springer-Verlag, 2012, pp. 152–163. DOI: 10.1007/978-3-642-32894-7_15

- Matthew R. Lakin and Andrew Phillips, "Modelling, simulating and verifying Turing-powerful strand displacement systems," in *Proceedings of the 17th International Conference on DNA Computing and Molecular Programming*, L. Cardelli and W. Shih, Eds., ser. Lecture Notes in Computer Science, vol. 6937, Springer-Verlag, 2011, pp. 130–144. DOI: 10.1007/978-3-642-23638-9_12

- Andrew Phillips, Matthew R. Lakin, and Loïc Paulevé, "Stochastic simulation of process calculi for biology," in *Membrane Computing and Biologically Inspired Process Calculi 2010*, G. Ciobanu and M. Koutny, Eds., ser. Electronic Proceedings in Theoretical Computer Science, vol. 40, 2010, pp. 1–5. DOI: 10.4204/EPTCS.40.1

- Loïc Paulevé, Simon Youssef, Matthew R. Lakin, and Andrew Phillips, "A generic abstract machine for stochastic process calculi," in *CMSB 2010: Proceedings of the 8th International Conference on Computational Methods in Systems Biology, Trento, Italy*, ACM, 2010, pp. 43–54. DOI: 10.1145/1839764.1839771

- Matthew R. Lakin and Andrew M. Pitts, "Resolving inductive definitions with binders in higher-order typed functional programming," in *18th European Symposium on Programming (ESOP '09)*, G. Castagna, Ed., ser. Lecture Notes in Computer Science, vol. 5502, Springer, 2009, pp. 47–61. DOI: 10.1007/978-3-642-00590-9_4

- Matthew R. Lakin and Andrew M. Pitts, "A metalanguage for structural operational semantics," in *Trends in Functional Programming, Volume 8*, M. T. Morazán, Ed., Intellect, 2008, pp. 19–35

Ph.D. Students Advised And Graduated (3 total)

- Dr. Sarika Kumar (Computer Science Ph.D. student, 2018–2023).
  - Ph.D. thesis committee chair.
  - Graduated with a Ph.D. in Computer Science in Fall 2023.
  - Thesis title: *"Computational Study of the Effect of Geometry on Molecular Interactions."*
- Dr. Tracy Mallette (Biomedical Engineering Ph.D. student, 2017–2023).
  - Ph.D. thesis committee chair.
  - Graduated with a Ph.D. in Biomedical Engineering with Distinction in Summer 2023.
  - Thesis title: *"Heterochiral DNA Nanotechnology for Biomedical Applications."*
  - Nominated for the UNM Tom L. Popejoy Dissertation Prize in 2024.
  - Won the UNM School of Engineering Outstanding Graduate Student Award for the combined Interdisciplinary Programs (Biomedical Engineering, Nanoscience & Microsystems Engineering, and Optical Science & Engineering) in 2023.
  - Won a Poster Award at the 18th Annual Meeting of the Oligonucleotide Therapeutics Society in 2022.
  - Voted 1st runner-up for the DNA28 Best Student Presentation Award in 2022.

- Also received an M.S. in Biomedical Engineering.
- Subsequently a postdoctoral researcher at the University of Washington.

- Dr. David Arredondo (Nanoscience and Microsystems Engineering Ph.D. student, 2017–2022).
  - Ph.D. thesis committee chair.
  - Graduated with a Ph.D. in Nanoscience and Microsystems Engineering with Distinction in Fall 2022.
  - Thesis title: *"Control Mechanisms for Adaptive Nanoscale Devices."*
  - Also received an M.S. in Computer Science as a dual status student.
  - Currently a postdoctoral researcher at the University of New Mexico Health Sciences Center.
  - Mentored as a post-baccalaureate student, 2016–2017.

M.S. Students Advised And Graduated (3 total)

- Kaitlin Eversole (Biomedical Engineering M.S. student, 2020–2023).
  - Graduated with an M.S. in Biomedical Engineering in Spring 2023.
  - Carried out research on CRISPR transcriptional circuits in *E. coli*.
  - Currently a metabolic engineer at Trait Biosciences.
- Randi Smith (Biomedical Engineering / Computer Science M.S. student, 2019–2022).
  - Graduated with an M.S. in Computer Science in Fall 2022.
  - Carried out research on controlling CRISPR systems in cell-free TXTL.
- James C. Boney (Biomedical Engineering M.S. student, 2018).
  - Graduated with an M.S. in Biomedical Engineering in 2018.
  - Carried out research on controlling CRISPR systems in cell-free TXTL.
  - Currently a lab scientist at New Mexico Department of Health.

Current Graduate Students (3 total)

- David Timothy (Biomedical Engineering Ph.D. student, 2025–present).
  - Ph.D. thesis committee chair.
- Anshika Mishra (Biomedical Engineering Ph.D. student, 2024–present).
  - Ph.D. thesis committee chair.
- Andrew Gutierrez (Biology Ph.D. student, 2023–present).
  - Ph.D. thesis committee co-chair.
  - Awarded an NSF Graduate Research Fellowship.

Undergraduate Students Advised (8 total)

- Abigail Carlson (Computer Science undergraduate student, 2024–2025).
- Sameen Jawadi (Biology undergraduate student, 2021–2022).
- Jacob McCullough (Computer Science undergraduate student, 2020–2021).
- Luis Paez Beltran (Biochemistry undergraduate student, 2019–2021).
  - Currently a lab scientist at the UNM Health Sciences Center.
- Kelsie Herzer (Chemical Engineering undergraduate student, 2018–2020).
  - Currently in the Civil, Environmental and Sustainable Engineering Ph.D. program at Arizona State University.
  - Received an NSF Graduate Research Fellowship.
- Christopher Fetrow (Chemistry / Physics undergraduate student, 2016–2020).
  - Currently in the Nanoscience and Microsystems Engineering Ph.D. program at UNM, working with Prof. Shuya Wei.
- Danielsen Moreno (General Engineering undergraduate student, Central New Mexico Community College, 2018).
- Julian Weisburd (Computer Science undergraduate student, 2017).

Other Advisees (5 total)

- Research faculty advisor, University of New Mexico. Research professors mentored (1 total):
  - Dr. Peter W. Davenport (2020–2023).
    - Currently a systems integration and testing engineer at Sceye, Inc.
    - Previously a postdoctoral scholar in my group (2018–2020).
- Postdoctoral scholar advisor, University of New Mexico. Postdocs mentored (3 total):
  - Dr. Tracy Mallette (2026–present).
  - Dr. Andrew Lezia (2025–2026).
  - Dr. Peter W. Davenport (2018–2020).
- Technical staff advisor, University of New Mexico. Technical staff members mentored (1 total):
  - Dr. Caroline Rempe (part-time faculty member, Central New Mexico Community College, 2021–present).

Other Mentees (40 total)

- Graduate student mentor, University of New Mexico. Students mentored (18 total):
  - Alexander Baten (Chemical Engineering Ph.D. student, 2026–present).
    — Ph.D. research proposal committee member.
  - Essolakina Haliba (Chemical Engineering Ph.D. student, 2026–present).
    — Ph.D. research proposal committee member.
  - Jasmine Charley (Biomedical Engineering Ph.D. student, 2024–2026).
    — Ph.D. research advisor.
  - Emmanuel Ogbuewu (Chemistry Ph.D. student, 2024).
    — Ph.D. research proposal committee member.
  - Md Rafiqul Islam Rupam (Chemistry Ph.D. student, 2023).
    — Ph.D. research proposal committee member.
  - Sajjad Khan (Nanoscience and Microsystems Engineering Ph.D. student, 2021–2025).
    — Candidacy exam committee member.
  - Andisheh Dadashi (Computer Science Ph.D. student, 2021–2024).
    — Ph.D. dissertation committee member.
  - Tongtong Li (Chemistry Ph.D. student, 2020–2024).
    — Ph.D. dissertation committee member.
  - Amy Stevens (Chemistry Ph.D. student, 2020–2024).
    — Ph.D. dissertation committee member.
  - Adán Myers y Gutiérrez (Nanoscience and Microsystems Engineering Ph.D. student, 2013–2019).
    — Ph.D. dissertation committee member.
    — Thesis title: *"Diagnostic Sequence Detection Against a Complex Background using a DNA Molecular Computation Framework."*
    — Subsequently a postdoctoral researcher at Los Alamos National Laboratory.
  - Aurora Fabry-Wood (Biomedical Engineering Ph.D. student, 2013–2018).
    — Co-advisor, Ph.D. thesis committee member.
    — Thesis title: *"Compartmentalization of DNA-Based Molecular Computing Elements Using Lipid Bilayers."*
    — M.S. committee member.
    — Subsequently a field application scientist at Berkeley Lights.
  - Qing Sun (Biomedical Engineering M.S. student, 2018).
    — M.S. committee member.
  - Dandan Mo (Computer Science Ph.D. student, 2013–2016).
    — Ph.D. dissertation committee member.
    — Thesis title: *"Molecular Circuits based on Molecular Spider System."*
  - Alireza Goudarzi (Computer Science Ph.D. student, 2013–2016).
    — Subsequently a postdoctoral researcher at the RIKEN Brain Science Institute, Wakō, Japan.

- Carl W. Brown, III (Biomedical Sciences Ph.D. student, 2011–2015).
  - Graduated with a Ph.D. with Distinction in June 2014.
  - Subsequently a postdoctoral researcher at the Naval Research Laboratory, Washington, DC, a staff scientist at the Wyss Institute, Harvard Medical School, Boston, MA, and at Sherlock Biosciences.
- David Mohr (Computer Science Ph.D. student, 2013–2015).
  - Ph.D. thesis committee member.
  - Thesis title: *"Stella: A Python-based Domain-Specific Language for Simulations."*
  - Subsequently at Google, Boulder, CO.
- Amanda Minnich (Computer Science Ph.D. student, 2011–2014).
  - Now at Lawrence Livermore National Laboratory, Livermore, CA.
- Geoffrey Reedy (Computer Science M.S. student, 2013).
  - M.S. thesis committee member.
  - Thesis title: *"Design and Implementation of a Scala Compiler Backend Targeting the Low Level Virtual Machine."*

- Undergraduate student mentor, University of New Mexico. Students mentored (8 total):
  - Madalyn Fetrow (Chemistry undergraduate student, summer 2014–2018).
  - Mische Hubbard (Chemical Engineering undergraduate student, 2016–2017).
  - Nicholas A. Baker (Chemical Engineering undergraduate student, 2014–2016).
  - Dominic Medina (Biochemistry undergraduate student, summer 2015).
  - Cameron Degani (Chemical Engineering undergraduate student, summer 2015).
  - Erin Sosebee (Computer Science undergraduate student, summer 2013).
  - Eli K. Horwitz (Chemical Engineering undergraduate student, 2012–2014).
  - Hannah E. West (Chemical Engineering undergraduate student, 2011).

- High school intern mentor, University of New Mexico. Students mentored (7 total):
  - Christian Poncho (Fall 2018–Spring 2019) Adittyo Paul (Summer 2018), Priyanka Jain (Summer 2015), Holly Liu (Summer 2015), Rebecca DeLand (Summer 2014), Katherine Jordan (Summer 2013), Megan Willams (Summer 2013).

- Mentor for student team in graduate course BME 598: "Biodesign", University of New Mexico. Students mentored (7 total):
  - Fall 2018: Amanda Sanchez, Neema Naeemi, Rohan Choraghe, Christopher Buksa, Marshall Klee, Daniel Sikora, Ushnik Ghosh. My team won $50,000 in funding from the UNM School of Engineering and the UNM Clinical & Translational Science Center to develop their invention, a wheelchair attachment for stroke patients.

Courses Taught (21 total)

- 2016–present. Instructor, University of New Mexico. Multiple courses (21 total):
  - Spring 2026: Computer Science undergraduate course CS 251: "Intermediate Programming."

- Fall 2025: Computer Science graduate course CS 558: "Software Foundations."
- Spring 2024: Computer Science undergraduate / graduate course CS 468 / CS 568: "Computational Modeling for Bioengineering."
  — This course was cross-listed as CS 468, CS 568, and BME 568.
- Fall 2023: Computer Science graduate course CS 558: "Software Foundations."
- Spring 2023: Biomedical Engineering graduate course BME 556: "Protein and Nucleic Acid Engineering."
  — This course was cross-listed as BME 556, CBE 499, CBE 515, CS 491, and CS 591.
- Fall 2022: Computer Science graduate course CS 558: "Software Foundations."
- Spring 2022: Computer Science undergraduate / graduate course CS 468 / CS 568: "Computational Modeling for Bioengineering."
  — This course was cross-listed as CS 468, CS 568, and BME 568.
- Fall 2021: Computer Science graduate course CS 558: "Software Foundations."
- Spring 2021: Biomedical Engineering graduate course BME 556: "Protein and Nucleic Acid Engineering."
  — This course was cross-listed as BME 556, CBE 499, CBE 515, CS 491, and CS 591.
- Fall 2020: Computer Science graduate course CS 558: "Software Foundations."
- Spring 2020: Computer Science undergraduate / graduate course CS 365: "Introduction to Scientific Modeling."
  — This course was cross-listed as CS 365, CS 491, CS 591, and BME 598.
- Spring 2020: Computer Science graduate course CS 592: "Colloquium."
- Fall 2019: Computer Science graduate course CS 558: "Software Foundations."
- Fall 2019: Computer Science graduate course CS 592: "Colloquium."
- Spring 2019: Computer Science undergraduate course CS 251: "Intermediate Programming."
- Spring 2019: Biomedical Engineering graduate course BME 556: "Protein and Nucleic Acid Engineering."
  — This course was cross-listed as BME 556, CBE 499, CBE 515, and CS 591.
- Fall 2018: Computer Science graduate course CS 558: "Software Foundations."
- Spring 2018: Computer Science undergraduate course CS 365: "Introduction to Scientific Modeling."
- Fall 2017: Computer Science graduate course CS 558: "Software Foundations."
- Spring 2017: Computer Science undergraduate course CS 293: "Social and Ethical Issues in Computing."
- Fall 2016: Computer Science graduate course CS 558: "Software Foundations."

Other Teaching

- 2012–2015. Guest lecturer, University of New Mexico. Multiple courses (5 total):
  - Computer Science graduate course CS 558: "Software Foundations."

- Biomedical Engineering graduate course BME 556: "Protein and Nucleic Acid Engineering."
- Nanoscience and Microsystems Engineering graduate course NSMS 518: "Synthesis of Nanostructures."
- Chemical Engineering undergraduate course CHNE 361: "Biomolecular Engineering."
- Chemical Engineering undergraduate CBE 417 / Biomedical Engineering graduate course BME 517: "Applied Biology for Biomedical Engineers."

- 2005–2011. Computer Science supervisor, University of Cambridge. Served as teaching assistant for multiple undergraduate courses (10 total):
  - Programming in Java, Databases, Discrete Mathematics, Specification and Verification, Logic and Proof, Semantics of Programming Languages, Computation Theory, Types, Topics in Concurrency, Natural Language Processing.
- 2007–2009. Computer Science introductory undergraduate programming laboratory supervisor, University of Cambridge.

Media Coverage

- **2025. "Two UNM professors awarded presidential award for their efforts in STEM field" on KRQE News 13 website:**
  - `https://www.krqe.com/news/two-unm-professors-awarded-presidential-award-for-their-efforts-in-stem-field/`
- **2025. "Two School of Engineering faculty receive Presidential Early Career Awards" on UNM Newsroom website:**
  - `https://news.unm.edu/news/two-unm-faculty-receive-presidential-early-career-awards`
- **2025. "Two School of Engineering faculty receive Presidential Early Career Awards" on UNM School of Engineering website:**
  - `https://engineering.unm.edu/news/2025/01/two-school-of-engineering-faculty-receive-presidential-early-career-awards.html`
- **2025. "Two School of Engineering faculty receive Presidential Early Career Awards" on UNM Computer Science Department website:**
  - `https://cs.unm.edu/news/2025/01/two-school-of-engineering-faculty-receive-presidential-early-career-awards.html`
- 2023. "UNM project brings together diverse team to develop solutions to uranium waste in Native communities" on UNM Newsroom website:
  - `https://news.unm.edu/news/unm-project-brings-together-diverse-team-to-develop-solutions-to-uranium-waste-in-native-communities`
- 2022. "Faculty highlight" on UNM School of Engineering website:
  - `https://ess.unm.edu/resources/highlights/index.html`

- **2021. "Computer science professor offers a new twist on DNA in NSF CAREER project" article on UNM Newsroom website:**
  - `https://news.unm.edu/news/computer-science-professor-offers-a-new-twist-on-dna-in-nsf-career-project`
- 2019. "Research team receives NSF award to develop 'smart' synthetic cell systems" article on University of Washington Molecular Engineering & Sciences Institute website:
  - `https://www.moles.washington.edu/research-team-receives-nsf-award-to-develop-smart-synthetic-cell-systems/`
- 2015. "Molecular computing at UNM" article on UNM Newsroom website:
  - `http://news.unm.edu/news/molecular-computing-at-unm`
- 2014. "Computational chemicals" article on Royal Society of Chemistry's Chemistry World website:
  - `http://www.rsc.org/chemistryworld/2014/02/computational-chemicals-learning-network-turing`

External Service

- 2025–present. Steering committee vice-chair, International Conference on DNA Computing and Molecular Programming (DNAX).
- 2022–present. Steering committee member, International Conference on DNA Computing and Molecular Programming (DNAX).
- 2026. Reviewer for the Dutch Research Council Open Competition Domain Science program.
- 2026. Reviewer for the Alfred P. Sloan Foundation.
- 2025. Reviewer for the National Science Foundation: panel member for ENG directorate.
- 2021, 2024, 2025. Reviewer for the Natural Sciences and Engineering Research Council of Canada (NSERC) Discovery Grant program.
- 2018–2024. Program committee member, International Conference on DNA Computing and Molecular Programming (DNAX).
- 2024. Reviewer for the National Science Foundation: ad hoc reviewer for ENG directorate.
- 2023. Reviewer for the Human Frontier Science Program research grant program, administered by the International Human Frontier Science Program Organization.
- 2023. Reviewer for the National Science Foundation: panel member for CISE directorate.
- 2021–2022. Organizing committee co-chair, 27th International Conference on DNA Computing and Molecular Programming (DNA28), Albuquerque, NM, August 2022.
- 2022. Reviewer for the National Science Foundation: panel member for CISE directorate.
- 2020–2021. Program committee co-chair, 27th International Conference on DNA Computing and Molecular Programming (DNA27), Oxford, UK, September 2021.

- 2018–2021. Organizing committee member, program committee member, and virtual technology committee member, International Conference on Engineering Synthetic Cells and Organelles, held virtually, May 2020 and 2021.
- 2021. Reviewer for the National Science Foundation: ad hoc reviewer for CISE directorate, ad hoc reviewer for BIO directorate.
- 2020. Reviewer for the National Science Foundation: panel member for GRF program, panel member and ad hoc reviewer for CISE directorate, panel member for cross-cutting interdisciplinary programs.
- 2019. Reviewer for the National Science Foundation: panel member for ENG directorate.
- 2018. Reviewer for the National Science Foundation: panel member for BIO directorate, ad hoc reviewer for CISE directorate, panel member for cross-cutting interdisciplinary programs.
- 2017–2018. Program committee member, 9th and 10th International Workshops on Biodesign Automation (IWBDA 2017, 2018).
- 2017. Reviewer, British Computer Society Distinguished Dissertation award.
- 2017. Poster and oral presentation judge, UNM STEM Research Symposium.
- 2014–2021. Review editorial board member, Frontiers in Computational Intelligence (a specialty of Frontiers in Robotics and AI).
- 2014. Session chair, Workshop on Computing with Biomolecules: From Network Motifs to Complex and Adaptive Systems (satellite workshop of ALife 2014 conference).
- 2014–2015. Program committee member, 1st and 2nd International Workshops on Verification of Engineered Molecular Devices and Programs (VEMDP 2014, 2015).
- 2008–present. Invited peer reviewer for multiple journals (54 total):
  - *Nature Publishing Group journals:* Nature, Nature Nanotechnology, Nature Microbiology, Nature Communications.
  - *National Academy of Sciences journals:* Proceedings of the National Academy of Sciences of the USA.
  - *Americal Chemical Society journals:* Journal of the American Chemical Society, ACS Applied Materials & Interfaces, ACS Synthetic Biology, ACS Nano, ACS Sensors, Nano Letters.
  - *Royal Society journals:* Journal of the Royal Society Interface, Proceedings of the Royal Society A, Interface Focus, Royal Society Open Science, RSC Advances.
  - *Royal Society of Chemistry journals:* Chemical Science, Nanoscale, Nanoscale Horizons, Analytical Methods.
  - *IEEE journals:* IEEE Transactions on Neural Networks and Learning Systems, IEEE/ACM Transactions on Computational Biology and Bioinformatics, IEEE Transactions on Molecular, Biological, and Multi-Scale Communications, IEEE Access, IEEE Design & Test, IEEE Life Sciences Letters, IEEE Transactions on NanoBioscience, IEEE Transactions on Nanotechnology, IEEE Transactions on Emerging Topics in Computational Intelligence.
  - *Oxford University Press journals:* Bioinformatics, Nucleic Acids Research, Synthetic Biology.

- *Wiley journals:* Advanced Biology, Advanced Functional Materials, Angewandte Chemie International Edition, ChemBioChem, WIREs Nanomedicine & Nanobiotechnology.
- *Other journals:* Theoretical Computer Science, Science Advances, APL Machine Learning, Artificial Intelligence in Medicine, BioSystems, BMC Bioinformatics, Computational and Structural Biotechnology Journal, Information & Computation, Systems & Control Letters, Interdiscplinary Sciences—Computational Life Sciences, International Journal of Molecular Sciences, International Journal of Parallel, Emergent, and Distributed Systems, Journal of Nanobiotechnology, Journal of Symbolic Computation, Natural Computing, Molecules, Theory of Computing Systems.

- 2008–present. Invited peer reviewer for multiple conferences (7 total):
  - International Conference on DNA Computing and Molecular Programming (DNA), International Conference on Unconventional Computation and Natural Computation (UCNC), International Conference on Functional Programming (ICFP), International Colloquium on Automata, Languages, and Programming (ICALP), European Symposium on Programming (ESOP), IEEE International Symposium on Logic in Computer Science (LICS), International Workshop on Biodesign Automation (IWBDA).

University Service

- 2018–present. Member, Graduate committee, Department of Computer Science, University of New Mexico.
- 2025–2026. Member, Department chair search committee, Department of Computer Science, University of New Mexico.
- 2023, 2025. Member, Faculty annual awards selection committee, School of Engineering, University of New Mexico.
- 2021–2024. Chair, Graduate admissions and recruitment committee, Department of Computer Science, University of New Mexico.
- 2018–2021. Member, Graduate admissions and recruitment committee, Department of Computer Science, University of New Mexico.
- 2018–2020. Member, Faculty search committee, Department of Computer Science, University of New Mexico.

Professional Society Memberships

- 2018–present. Member, American Association for the Advancement of Science (AAAS).
- 2018–present. Member, American Chemical Society (ACS).
- 2016–present. Member, Institute of Electrical and Electronics Engineers (IEEE).
- 2014–present. Member, Association for Computing Machinery (ACM).
- 2011–present. Member, International Society for Nanoscale Science, Computation and Engineering (ISNSCE).

Selected Invited Talks

- *"Heterochiral DNA for intracellular computing."* Invited speaker as part of the "Molecular Computing: Theory and Implementations minisymposium," part of the 14th European Conference on Mathematical & Theoretical Biology, University of Graz, Graz, Austria, July 2026.
- *"Heterochiral DNA for intracellular computing."* Invited speaker in the Computer Science colloquium series, University of New Mexico, Albuquerque, New Mexico, February 2026.
- *"Through the looking glass: mirror DNA for biomedicine."* Invited speaker in the UNM Honors College Faculty Lightning Lounge talks series, University of New Mexico, Albuquerque, New Mexico, November 2025.
- *"Learning in molecular computing systems."* Invited speaker as part of the "Recent Advances in Chemical Artificial Intelligence by Exploring Molecular Systems" webinar, September 2025.
- *"Heterochiral DNA for intracellular computing."* Invited seminar in the Hamilton Institute seminar series, Maynooth University, Maynooth, Ireland, March 2025.
- *"Heterochiral DNA for intracellular computing."* Invited seminar in the Biological Division seminar series, Department of Chemistry, Texas A&M University, College Station, Texas, September 2024.
- *"Declarative programming languages for molecular computing."* Invited speaker as part of the Pittsposium workshop in honor of the retirement of Prof. Andrew Pitts, held at the University of Cambridge, Cambridge, UK, August 2023.
- *"Engineering molecules and cells for programmable biology."* Invited speaker as part of University of Minnesota Electrical and Computer Engineering colloquium talk series, February 2022.
- *"Information processing in synthetic cells."* Invited speaker as part of the Build-A-Cell virtual seminar series, August 2021.
- *"Information processing in synthetic cells."* Invited speaker at the Synthetic Approaches to Biology and Artificial Intelligence (SB-AI) workshop, a satellite workshop of the 2021 ALIFE conference, held virtually, July 2021.
- *"Information processing in synthetic cells."* Invited speaker at the 2021 International Conference on Engineering Synthetic Cells and Organelles (SynCell 2021), held virtually, May 2021.
- *"Programming life using cell-free synthetic beiology."* Invited speaker at Biology Seminar, Northern New Mexico College, Española, New Mexico, September 2019.
- *"Modular verification of chemical reaction networks via serializability analysis."* Invited keynote speaker, 2nd International Workshop on Verification of Engineered Molecular Devices and Programs (VEMDP 2015), San Francisco, California, July 2015.
- *"Theory and practice of molecular computing."* Invited speaker at Biochemistry & Molecular Biology Seminar, University of New Mexico School of Medicine, Albuquerque, New Mexico, March 2015.

Selected Contributed Talks

† = graduate student advised by Lakin.

- *"Geometric constraint optimization for localized strand displacement reactions."* 32nd International Conference on DNA Computing and Molecular Programming (DNA32), Fayetteville, Arkansas, August 2026.
- *"Geometric enumeration of localized DNA strand displacement reaction networks."* 30th International Conference on DNA Computing and Molecular Programming (DNA30), Baltimore, Maryland, September 2024.
- *"Heterochiral DNA for information processing in synthetic cells."* International Conference on Engineering Synthetic Cells and Organelles (SynCell 2023), Minneapolis, Minnesota, May 2023.
- *"Protecting heterochiral DNA nanostructures against exonuclease-mediated degradation."* Presented by graduate student **Tracy Mallette†** at the 28th International Conference on DNA Computing and Molecular Programming (DNA28), Albuquerque, New Mexico, August 2022.
  - This presentation was voted 1st runner-up for the DNA28 Best Student Presentation Award.
- *"Robust heterochiral strand displacement using leakless translators."* Presented by graduate student **Tracy L. Mallette†** at the 26th International Conference on DNA Computing and Molecular Programming (DNA26), held virtually, September 2020.
- *"Supervised learning in a multi-layer, non-linear chemical neural network."* Presented by graduate student **David Arredondo†** at the 26th International Conference on DNA Computing and Molecular Programming (DNA26), held virtually, September 2020.
- *"Automated, constraint-based analysis of tethered DNA nanostructures."* 23rd International Conference on DNA Computing and Molecular Programming (DNA23), Austin, Texas, September 2017.
- *"Towards temporal logic computation using DNA strand displacement reactions."* International Conference on Unconventional Computation and Natural Computation, Fayetteville, Arkansas, June 2017.
- *"Supervised learning in an adaptive DNA strand displacement circuit."* 21st International Conference on DNA Computing and Molecular Programming (DNA21), Boston, Massachusetts, August 2015.
- *"Abstract modelling of tethered DNA circuits."* 20th International Conference on DNA Computing and Molecular Programming (DNA20), Kyoto, Japan, September 2014.
- *"Pattern formation by spatially organized approximate majority reactions."* International Conference on Unconventional Computation and Natural Computation, London, Ontario, July 2014.
- *"Compiling DNA strand displacement reactions using a functional programming language."* International Symposium on Practical Aspects of Declarative Languages, San Diego, California, January 2014.
- *"Modular verification of DNA strand displacement networks via serializability analysis."* 19th International Conference on DNA Computing and Molecular Programming (DNA19), Tempe, Arizona, September 2013.

- *"Towards a biomolecular learning machine."* International Conference on Unconventional Computation and Natural Computation, Orléans, France, September 2012.
- *"Modelling, simulating and verifying Turing-powerful strand displacement systems."* 17th International Conference on DNA Computing and Molecular Programming (DNA17), Pasadena, California, September 2011.
- *"Resolving inductive definitions with binders in higher-order typed functional programming."* European Symposium on Programming, York, United Kingdom, March 2009.

Selected Poster Presentations

‡ = postdoctoral scholar advised by Lakin; † = graduate student advised by Lakin; ⋆ = undergraduate student advised by Lakin.

- **Anshika Mishra**† and Matthew R. Lakin. *"Chirally mismatched DNA strand displacement."* 31st International Conference on DNA Computing and Molecular Programming (DNA31), Lyon, France, August 2025.
- **Tracy L. Mallette**†, **Anshika Mishra**†, and Matthew R. Lakin. *"On degradation-induced leak in heterochiral DNA strand displacement cascades."* 31st International Conference on DNA Computing and Molecular Programming (DNA31), Lyon, France, August 2025.
- **Andrew A. Gutierrez**†, **Peter W. Davenport**‡, James E. Chappell, and Matthew R. Lakin. *"Recombinase-switchable synthetic plasmid origins of replication."* 2025 Synthetic Biology: Engineering, Evolution, & Design (SEED) Conference, Houston, Texas, June 2025.
- **Andrew A. Gutierrez**†, **Kaitlin Eversole**†, **Peter W. Davenport**‡, and Matthew R. Lakin. *"Programmable transcriptional networks with recombination and CRISPR activation."* 2025 Synthetic Biology: Engineering, Evolution, & Design (SEED) Conference, Houston, Texas, June 2025.
- **Andrew A. Gutierrez**†, Ashley N. Tafoya, David S. Peabody, Gabriel P. López, and Matthew R. Lakin. *"RNA-binding protein condensates for regulation of CRISPR-based transcriptional networks."* 2025 Synthetic Biology: Engineering, Evolution, & Design (SEED) Conference, Houston, Texas, June 2025.
- **Tracy L. Mallette**†, Diane S. Lidke, and Matthew R. Lakin. *"Heterochiral modifications enhance robustness and function of DNA in living human cells."* 29th International Conference on DNA Computing and Molecular Programming (DNA29), Sendai, Japan, September 2023.
- **Kaitlin M. Eversole**†, **Peter W. Davenport**‡, and Matthew R. Lakin. *"Programmable genetic networks for synthetic cell engineering."* International Conference on Engineering Synthetic Cells and Organelles (SynCell 2023), Minneapolis, Minnesota, May 2023.
- **Tracy L. Mallette**† and Matthew R. Lakin. *"Triblock heterochiral oligonucleotide nanotechnology for protection against exonuclease-mediated degradation."* 18th Annual Meeting of the Oligonucleotide Therapeutics Society (OTS22), Phoenix, Arizona, October 2022.
  - This presentation won a Poster Award.

- **David Arredondo**[†] and Matthew R. Lakin. *"Operant conditioning of stochastic chemical reaction networks."* 28th International Conference on DNA Computing and Molecular Programming (DNA28), Albuquerque, New Mexico, August 2022.
- **Sarika Kumar**[†] and Matthew R. Lakin. *"A geometric framework for reaction enumeration in computational nucleic acid devices."* 28th International Conference on DNA Computing and Molecular Programming (DNA28), Albuquerque, New Mexico, August 2022.
- **David Arredondo**[†] and Matthew R. Lakin. *"Supervised learning in a multi-layer, non-linear chemical neural network."* 26th International Conference on DNA Computing and Molecular Programming (DNA26), held virtually, September 2020. This poster was also nominated for a short oral presentation.
- Matthew R. Lakin, **Julian M. Weisburd**[⋆], and **Sarika Kumar**[†]. *"Structure sampling for rate estimation in tethered molecular circuits."* 25th International Conference on DNA Computing and Molecular Programming (DNA25), Seattle, Washington, August 2019.
- Carlo Spaccasassi, Matthew R. Lakin, and Andrew Phillips. *"A logic programming language for computational nucleic acid devices."* International Workshop on Biodesign Automation, Cambridge, UK, July 2019.
- Aurora Fabry-Wood, Madalyn E. Fetrow, Carl W. Brown, III, Nicholas A. Baker, Nadia Fernandez Oropeza, Andrew P. Shreve, Gabriel A. Montaño, Darko Stefanovic, Matthew R. Lakin, and Steven W. Graves. *"Monitoring DNA Reactions on a Fluid Microsphere Supported Lipid Bilayer Surface with Flow Cytometry."* 23rd International Conference on DNA Computing and Molecular Programming (DNA23), Austin, Texas, September 2017.
- Keith Lidke, Diane Lidke, Cheyenne Martin, Farzin Farzam, Jeremy Edwards, Matthew R. Lakin. *"Multi-structure super-resolution imaging using sequential imaging and DNA strand displacement."* 2018 Conference on Quantitative BioImaging in Göttingen, Germany, January 2018.