

Dr. Erik Poppleton

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Higher Education & Academic Research

Max Planck Institute for Medical Research / Heidelberg University – Heidelberg, DE 2022-Present

Postdoctoral fellowship (DKFZ AI Health Innovation Cluster)
Research: Biophysical modeling of RNA-lipid interactions
Advisor: Dr. Kerstin Göpfrich

Heidelberg Institute for Theoretical Studies / Max Planck Institute for Polymer Research – Heidelberg, DE / Mainz, DE 2022-Present

Visiting Scholar
Research: Biophysical modeling of RNA-lipid interactions
Advisors: Dr. Frauke Gräter & Dr. Camillo Aponte-Santamaría

Arizona State University, Ira A. Fulton School of Engineering and Biodesign Center for Molecular Design and Biomimetics – Tempe, AZ, USA 2017-2022

Degree: PhD in Biological Design
Honors: Dean's Dissertation Award
Dissertation title: Software tools for design, simulation, and characterization of DNA and RNA nanostructures
Advisors: Dr. Petr Šulc & Dr. Hao Yan
GPA (4.0 scale): 4.00

Tufts University, School of Arts and Sciences – Medford, MA, USA 2013-2017

Degrees: BS in Biology, BS in Geology
Honors: Highest Thesis Honors in Biology
Thesis title: "Structural changes in phosphorylated triple helical collagen-like peptides and requirements for *in vitro* enzymatic phosphorylation"
Advisors: Dr. Barbara Brodsky, Dr. David Kaplan, Dr. Yu-Shan Lin
GPA (4.0 scale): 3.44

Lawrence Berkeley National Laboratory – Berkeley, CA, USA Summer 2016

Position - Summer Undergraduate Research Internship (SULI)
Research: Tracking organic matter decomposition and transport in deep soil horizons using ^{13}C -labeled roots
Advisors: Dr. Caitlin Hicks-Pries & Dr. Margaret Torn

Industry Consulting

Kano Therapeutics — Boston, MA, USA

Aug-Dec 2022

Responsibilities: Develop a computational pipeline to further the company's ability to produce CRISPR knock-in vectors

Team: Myself and two interns

Mentorship

Supervised 3 PhD students, 4 masters students, and 1 bachelor student and on RNA design and simulation projects during my postdoc.

Supervised 5 undergraduate lab interns from Computer Science, Biology and Civil Engineering at ASU on various projects in software tool development, molecular simulation and analytical chemistry of soils.

Oversaw a 6-member senior capstone team from Computer Science at ASU who designed and implemented a web server to facilitate use of the oxDNA modeling software by non-experts.

2 PhD students and 4 undergraduate interns have co-published publications with me.

I was the first PhD student in the Šulc lab, so have mentored and supported 5 subsequent masters/PhD students.

Technical Skills

Programming Languages: Python (including Numpy and Cython), JavaScript, TypeScript, Bash, HTML/CSS/Angular/Markdown, some C++

IT: Linux sysadmin, HPC hardware, Git version control

Dry Laboratory Skills: Molecular Simulation in oxDNA and GROMACS, RNA design with ROAD and PyFuRNace, nucleic acid structure analysis with ViennaRNA and DSSR

Wet Laboratory Skills: DNA/RNA extraction and purification, Peptide synthesis and conjugation to DNA, HPLC, CD Spectroscopy, Gel Electrophoresis, MALDI-TOF mass spectroscopy, Plasmid cloning, E. coli protein expression, Soil characterization, Hydrocarbon extraction from soil, Atomic Force Microscopy, GC-FID

Communication software proficiencies: Microsoft Office, Inkscape, LaTeX

Honors, Awards, Scholarships & Fellowships

<u>Year</u>	<u>Honor</u>	<u>Value</u>
2023-2025	DKFZ AI Health Innovation Postdoctoral Fellowship	155,200€
2022	Dean's Dissertation Award – Top 5% of PhD dissertations in the Fulton School of Engineering.	-
2022	DNA28 Best student poster award – 2nd place	-
2022	DNA28 NSF travel award	\$800
2022	FNANO Best student presentation award	-
2021	FNANO Best poster presentation award	-
2021	Phoenix ARCS Foundation Fellowship	\$8,500
2021	Engineering Graduate Fellowship	\$1,000
2020	Engineering Graduate Fellowship	\$1,000
2019	Harold & Lucille Dunn Memorial Engineering Scholarship	\$3,942
2019	Ferdinand A. Stanchi Fellowship	\$1,206
2019	Biodesign Travel Grant	\$500
2019	DNA25 NSF Travel Award	\$500
2019	National Science Foundation Graduate Research Fellowship Program (GRFP) – Honorable Mention	-
2018	Fulton Fellowship	\$1,875
2017	Highest Senior Thesis Honors in Biology	-
2013	GE STAR Scholarship	\$3,500

Software

Lead or co-lead developer:

[OxView](#) – A molecular visualizer and editor for DNA, RNA and protein structures for simulation in the oxDNA/RNA molecular simulation package.

[OxDNA Analysis Tools](#) – A Python library for analysis of oxDNA/RNA trajectories.

[OxDNA.org](#) – A public webserver with a GUI for setting up and running oxDNA/RNA simulations on a GPU cluster at ASU.

[Nanobase.org](#) – A repository of DNA, RNA and protein nanostructure designs.

Contributor:

[oxDNA](#) – A suite of molecular models for DNA, RNA and patchy particle simulations.

[TacoxDNA](#) – website with conversion tools into and out of the oxDNA format.

[ExpertRNA](#) – An RNA structure prediction tool combining prediction and evaluation functions from multiple folding tools using the Rollout reinforcement learning algorithm.

Future publications & Preprints

* First or co-first author papers

E. Poppleton*. 4c: Digital Description of Molecules. To appear in *The Art of Molecular Programming*, a community-driven textbook initiative which will likely be published in 2026.

E. Poppleton*, T. Karrasch, B. Freudenberg, C. Aponte-Santamaría, F. Gräter, K. Göpfrich. Molecular basis of RNA aptamers for DOPC membranes. *In preparation*

Y. Xu *et al.* High-affinity binding to the SARS-CoV-2 spike trimer by a nanostructured, trivalent protein-DNA synthetic antibody. (2023) *BioRxiv* preprint.

Publications

* – First or co-first author | Underline – Corresponding author

L. Monari, I. Braun, W. Verstraeten, **E. Poppleton**, K. Göpfrich. PyFuRNace: An integrated design engine for RNA origami. (2025). *Nature Communications* **16**(1):10815.

M. P. Tran, T. Chakraborty, **E. Poppleton**, L. Monari, M. Illig, F. Giessler, K. Göpfrich. Genetic encoding and expression of RNA origami cytoskeletons in synthetic cells. (2025) *Nature Nanotechnology* **20**:664-671.

C. Kriebsh *et al.* A roadmap towards the synthesis of life. (2025) *Chem* **11**(3):102399.

F. Tosti Guerra, **E. Poppleton**, P. Šulc, L. Rovigatti. ANNaMo: Coarse-grained modeling for folding and assembly of RNA and DNA systems. (2024) *Journal of Chemical Physics* **160**: 205102.

M. Centola, **E. Poppleton**, S. Ray, M. Centola, R. Welty, J. Valero, N.G Walter, P. Šulc, M. Famulok. A rhythmically pulsing leaf-spring DNA-origami nanoengine that drives a passive follower. (2024) *Nature Nanotechnology* **19**(2):226-236.

Q. Liu, Y. Xu, **E. Poppleton**, K. Zhou, P. Šulc, N. Stephanopoulos, Y. Ke. DNA Nanostructure-Guided Assembly of Proteins into Programmable Shapes. (2024) *Nano Letters* **24**(5)1703-1709.

E. Poppleton*, N. Urbanek, T. Chakraborty, A. Griffo, L. Monari, K. Göpfrich. RNA origami: design, simulation and application. (2023) *RNA Biology* **20**(1):510-524.

J. P. K. Doye *et al.* The oxDNA coarse-grained model as a tool to simulate DNA origami. (2023) *DNA and RNA Origami: Methods and Protocols*, Springer US, 93-112.

E. Poppleton*, M. Matthies, D. Mandal, F. Romano, P. Šulc, L. Rovigatti. oxDNA: coarse-grained simulations of nucleic acids made simple. (2023) *The Journal of Open Source Software*, **8**(81):4693.

R. P. Narayanan, J. Procyk, P. Nandi, **E. Poppleton**, Y. Xu, A. Prasad, F. Zhang, D. Williams, H. Yan, N. Stephanopoulos, P. Chiu, P. Šulc. Coarse-grained simulations for the

- characterization and optimization of hybrid protein-DNA nanostructures. (2022) *ACS Nano*, **16**(9):14086-14096.
- J. Bohlin*, M. Matthies*, **E. Poppleton***, J. Procyk, A. Mallya, H. Yan, P. Šulc. OxView: a system for online design, analysis, and interactive simulation of DNA, RNA, and hybrid protein-nucleic acid nanostructures. (2022) *Nature Protocols*, **17**:1762-1788.
- M. Liu, G. Pedrielli, **E. Poppleton**, P. Šulc, D. Bertsekas. ExpertRNA: A new framework for RNA structure prediction. (2022) *INFORMS Journal on Computing*, **34**(5):2464-2484
- E. Poppleton***, A. Mallya, S. Dey, J. Joseph, P. Šulc. Nanobase.org: a repository for DNA and RNA nanostructures. (2022) *Nucleic Acids Research*, **50**(D1):D246-D252.
- D. Kuťák, **E. Poppleton**, H. Miao, P. Šulc, I. Barišić. Unified Nanotechnology Format: One Way to Store Them All (2022) *Molecules*, **27**(1):63.
- E. Poppleton***, R. Romero, A. Mallya, L. Rovigatti, P. Šulc. OxDNA.org: A public webserver for coarse-grained simulations of DNA and RNA nanostructures. (2021) *Nucleic Acids Research*, **49**(W1): W491-W498.
- J. Procyk, **E. Poppleton**, P. Šulc. Coarse-grained nucleic acid-protein model for hybrid nanotechnology. (2021) *Soft Matter*, **17**(13):3586-3593.
- G. Yao, F. Zhang, F. Wang, T. Peng, H. Liu, **E. Poppleton**, P. Šulc, S. Jiang, L. Liu, C. Gong, X. Jing, X. Liu, L. Wang, Y. Liu, C. Fan, H. Yan. Meta-DNA Structures. (2020) *Nature Chemistry*, **12**(11):1067-1075.
- E. Poppleton***, J. Bohlin, M. Matthies, S. Sharma, F. Zhang, P. Šulc. Design, optimization and analysis of large DNA and RNA nanostructures through interactive visualization, editing, and molecular simulation. (2020) *Nucleic Acids Research*, **48**(12):e72.
- A. Suma, **E. Poppleton**, M. Matthies, P. Šulc, F. Romano, A. A. Louis, J. P. K. Doye, C. Micheletti, L. Rovigatti. Tacoxdna: a user-friendly web server for simulations of complex DNA structures, from single strands to origami. (2019) *Journal of Computational Chemistry*, **40**(29):2586-2595.
- M. Matthies, N. P. Agarwal, **E. Poppleton**, F. M. Joshi, P. Šulc, T. L. Schmidt. Triangulated wireframe structures assembled using single-stranded DNA tiles. (2019) *ACS Nano*, **13**(2):1839-1848.
- A. Mekkat*, **E. Poppleton***, B. An, R. Visse, H. Nagase, D. L. Kaplan, B. Brodsky, Y. Lin. Effects of flexibility of the $\alpha 2$ chain of type I collagen on collagenase cleavage. (2018) *Journal of Structural Biology*, **203**(3):247-254.
- C. H. Pries, B. N. Sulman, C. West, C. O'Neill, **E. Poppleton**, R. C. Porras, C. Castanha, B. Zhu, D. B. Wiedemeier, M. S. Torn. Root litter decomposition slows with soil depth. (2018) *Soil Biology and Biochemistry*, **125**:103-114.
- Y. Qiu*, **E. Poppleton***, A. Mekkat, H. Yu, S. Banerjee, S. E. Wiley, J. E. Dixon, D. L. Kaplan, Y-S. Lin, and B. Brodsky. Enzymatic phosphorylation of Ser in a type I collagen peptide. (2018) *Biophysical Journal*, **115**(12):2327-2335.

Patents

N. Stephanopoulos, K. S. Anderson, P. Šulc, S. J. W. Henry, L. Chen, **E. Poppleton**, H. Yan.
Folding mRNA into a nanoscale delivery vehicle. (2025). US Patent Application 18726078

Conference Talks

The wider world of nucleic acids simulations: Modelling (mostly) RNA beyond oxDNA.

OxDNA Users and Developers Workshop, February 2026, Tempe, AZ, USA

Biomimetic hardware for synthetic cells: Creating life from the simple stuff.

International Conference for the Ethics of Engineering Life, September 2024, Rome, Italy

Simulation analysis with oxDNA analysis tools.

OxDNA Users and Developers Workshop, September 2024, Oxford, UK

RNA nanopores without chemical functionalization.

Artificial Biology (ArtBio), August 2024, Aarhus, Denmark

RNA nanopores without chemical functionalization.

Foundations of Nanotechnology (FNANO), April 2024, Snowbird, UT, USA

Coarse-grained modelling of DNA origami structures with oxDNA.

Computer Simulation and Theory of Macromolecules, April 2023, Hünfeld, Germany

Building an integrated software environment for DNA/RNA design and simulation.

The Foresight Institute's Designing Molecular Machines Workshop, July 2022, San Francisco, CA.

Facilitating sharing, simulations, and design of DNA/RNA/protein nanostructures.

Foundations of Nanotechnology (FNANO), April 2022, online.

Using oxView for interactive simulation, visualization and analysis of coarse-grained DNA, RNA and protein simulations.

DNA Mechanics: From Base Pairs to Chromosomes, June 2021, online.

In-silico design, visualization, and analysis of large DNA and RNA nanostructures. Foundations of Nanotechnology (FNANO), April 2020, online.

Invited Seminars and Interviews

ExpertRNA: A new framework for RNA structure prediction.

Arizona RNA Salon: March 2021, online.

Lab Pigs: Erik Poppleton.

The Molpigs podcast, February 2021, available on all major podcast feeds.

Software tools for molecular simulation of DNA nanotechnology.

DNA Nanotechnology for Medicine and Biology: September 2020, University of Edinburgh, online.

Poster Presentations

MD simulations of RNA-membrane interactions.

31st International Conference on DNA Computing and Molecular Programming (DNA31),
August 2025, Lyon, France

MD simulations of RNA-membrane interactions.

Foundations of Nanotechnology (FNANO), April 2025, Snowbird, Utah, USA

RNA origami transmembrane pores.

Gordon Research Conference – RNA nanotechnology, January 2025, Ventura, CA, USA.

Characterization of lipid-binding RNA aptamers.

Swiss-UK SynBio Symposium, August 2023, Lausanne, Switzerland.

Using oxDNA simulations to characterize structural consequences of design modifications on a DNA origami leaf-spring engine.

28th International Conference on DNA Computing and Molecular Programming (DNA28),
August 2022, Albuquerque, NM, USA.

How to design free-form DNA nanostructures online.

Foundations of Nanotechnology (FNANO), April 2021, online.

General-purpose analysis package for coarse-grained simulations of DNA/RNA nanotechnology.

25th International Conference on DNA Computing and Molecular Programming (DNA28),
August 2019, Seattle, WA, USA.

Structural analysis of DNA/RNA nanostructures from coarse-grained simulations.

Gordon Research Conference – RNA nanotechnology, January 2019, Ventura, CA, USA.

Utilizing coarse-grained molecular models to iterate RNA-tile designs.

Statistical Physics in Biology: A workshop in honor of Ken Dill, October 2018, Tempe, AZ.

Effects of flexibility of the $\alpha 2$ chain of type I collagen on collagenase cleavage.

Gordon Research Conference – Collagen, July 2017, New London NH.

Outreach Projects & Scientific Community Engagement

President and podcast host for MOLPIGS (MOlecular Programming Interest Group) - A group of early career scientists from the molecular programming field. We organize communication events, reading groups, and host a long-form interview podcast aimed at building connections within the community (2021-Present).

Created and manage the Molecular Programming feed on Bluesky. A custom algorithmic feed which curates the latest posts from the community to facilitate sharing and discussions of the latest research (2024-Present).

Attended the 2023 Locarno Film Festival in an outreach initiative to build bridges between artists and scientists supported by the Swiss National Competence Center in Research: Molecular Systems Engineering. A group of young scientists joined the festival's 'Basecamp'

for emerging artists and contributed our own art installations and attended workshops and film screenings.

Led group discussions on the science behind the SARS-Cov2 pandemic (2021) and on the growth of Arizona's biotechnology industry (2021 & 2022) with legislators and students at Arizona Science Policy Network's 2021 and 2022 Science Day at the Arizona Capitol.

Led design on [Nano Building](#), a game designed to teach pre-college students the basics of designing self-assembled systems. This game is part of ASU's Ask a Biologist outreach program to K-12 schools in Arizona.

Extracurricular Activities

Arizona Science Policy Network - An advocacy group for science-based policy decisions at the state and local level (2018-2022).

Communications Director for the Jumbo Jugglers - a fire spinning, object manipulation, and flow arts club at Tufts University: Responsibilities included member recruitment, community outreach, and planning WOMBAT, a juggling/flow arts workshop, which attracts teachers, performers, and juggling enthusiasts from around the country (2015-2017).

When not working, I can generally be found wandering the hills around Heidelberg or cooking an enormous pot of soup.

Non-scientific work experience

Tufts University Cohen Auditorium — Medford, MA, USA 2013-2017

Theater technician with a specialty in lighting.

Responsibilities: Lighting design/board operation for dance performances and technical support for classes and guest speakers.

Zao Asian Cafe — Salt Lake City, UT, USA Summer 2014

Front-of-house & dishwashing for a fast casual Asian fusion restaurant.