

Miri Krupkin, PhD

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Education

Ph.D.	Structural Biology, Weizmann Institute of Science, direct track from MSc.	2016
B.Sc.	Chemistry, Bar-Ilan University, <i>magna cum laude</i> .	2008

Research Experience

Postdoc Researcher, Stanford University	2019- present
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Advisors: Joseph Puglisi and Elisabetta Viani Puglisi.

- Program Leadership: Investigate the dynamic multi-scale architecture of full-length HIV-1 genomic RNA (>9,000 nt) and associated viral ribonucleoprotein complexes.
- Platform Innovation for Large RNA: Engineered biochemical protocols eliminating irreversible solution precipitation of massive, structured RNA transcripts, enabling high-resolution Cryo-ET ultrastructure determination and single-molecule fluorescence tracking.
- Modular VLP Encapsulation Engine: Developed proof-of-concept for synthetic packaging of full-length viral RNA into Virus-Like Particles (VLPs) to characterize viral structural mechanics in situ.
- Resolving Genetic Code Bottlenecks: Solved high-resolution Cryo-EM structures of synthetic tRNA-ribosome complexes, diagnosing severe A-to-P translocation bottlenecks and executing structure-guided rational point mutations to restore kinetics (Nucleic Acids Res, Journal Cover).
- Automated Pipeline & Generative AI Architecture: Architected custom Python/MATLAB analytical pipelines that slashed data-processing latency across Cryo-EM/ET and single-molecule datasets. Conceived and launched [FoldCheck-RNA](#) and [FoldCheck-Pro](#) (GitHub/Colab suites) bridging AlphaFold 3 predictions with experimental ground truth via automated monomer isolation, scipy Hungarian matching, and Kabsch superposition, including GPCRs.
- Consortium Leadership (NIH CHEETAH): Serve as technical milestone lead and primary scientific speaker within the Capsid & Core Architecture subgroups of the NIH CHEETAH consortium, supervising 3 students, and yielding 3 papers.

Postdoc Researcher, Massachusetts Institute of Technology.	2017-2019
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Advisor: Katharina Ribbeck.

- Biomimetic Hydrogels & Microfluidics: Designed and fabricated microfluidic devices and biophysical assays to characterize selective permeability barriers and drug delivery across reconstituted mucin matrices (Bill & Melinda Gates Foundation Initiative), supervising 4 students and interns, and yielding 3 papers.
- Clinical Specimen Governance: Directed multi-site clinical biospecimen procurement and hospital biobanking logistics under strict IRB and HIPAA regulatory compliance.

Researcher, Weizmann Institute of Science.	2008-2017
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Advisor: Ada Yonath.

- Direct Ph.D. Thesis: The origin of the ribosome and its paralysis by antibiotics.
- M.Sc. Thesis: Towards the determination of the structure of *Mycobacterium smegmatis* ribosome.
- Ribosome-Antibiotic Structural Elucidation: Determined atomic-resolution crystal structures of bacterial ribosomes complexed with novel orthosomycin, pleuromutilin, and macrolide antibiotics; uncovered the allosteric resistance mechanism of avilamycin across 8 papers.

- Prebiotic Proto-ribosome Engineering: Directed cross-functional teams in synthesizing, modeling, and biochemically validating prebiotic dimeric RNA machines capable of uncatalyzed peptide bond formation, supervising 16 students and interns, yielding 4 papers.
- Synchrotron Campaign Operations: Directed continuous 24-hour synchrotron diffraction campaigns across European storage rings (ESRF France, SLS Switzerland, Diamond UK) with zero instrument downtime.

Publications ([PubMed link](#)).

First and *co-first author list:

1. **Krupkin M**, Puglisi JD, Puglisi EV. "Packaging A Synthetic Full-length HIV viral RNA into Functional HIV Virions". *In preparation, available upon request*.
2. Wagner CE*, **Krupkin M***, Smith-Dupont KB*, Wu CM, Bustos NA, Witten J, Ribbeck K. "Comparison of Physicochemical Properties of Native Mucus and Reconstituted Mucin Gels". **Biomacromolecules** (2023). [Link](#). [*co-first author].
3. **Krupkin M***, Jackson LN*, Ha B*, Puglisi EV. "Advances in understanding the initiation of HIV-1 reverse transcription". **Current Opinion in Structural Biology** (2020). [Link](#).
4. **Krupkin M***, Wekselman I*, Matzov D, Eyal Z, Diskin Posner Y, Rozenberg H, Zimmerman E, Bashan A, Yonath A. "Avilamycin and evernimicin induce structural changes in rProteins uL16 and CTC that enhance the inhibition of A-site tRNA binding". **Proc Natl Acad Sci USA** (2016). [Link](#).
5. **Krupkin M**, Bashan A, Yonath A. (2014) "Glimpse into the Origin of Life: What was First, the Genetic Code or its Products, the Proteins?" book chapter. In "Why does Evolution Matter? The Importance of Understanding Evolution", G. Trueba, ed. (Cambridge Scholars Publishing), p. 87-100. [Link](#).
6. **Krupkin M**, Matzov D, Tang H, Metz M, Kalaora R, Belousoff MJ, Zimmerman E, Bashan A, Yonath A. "A vestige of a prebiotic bonding machine is functioning within the contemporary ribosome". **Philos Trans R Soc Lond B Biol Sci** (2011). [Link](#).
Research highlight: [Link](#).

Contributing author list:

7. Dugan A, ... **Krupkin M**, Ribbeck K, Xavier R, Bevins C, and Kiessling L. "Intellectin-2 is a broad-spectrum antimicrobial lectin". *Submitted to Nature Communication*. [BioRxiv Link](#).
8. Yapici I, Dao H, Yokoi S, **Krupkin M**, ..., Puglisi EV, Puglisi JD, Wakatsuki S, and DeMirci H. "4D Crystallography Captures Transient IF1-Ribosome Dynamics in Translation Initiation". *Submitted to EMBOJ*.
9. Diehl RC, Chorghade JS, Keys AM, Alam MM, Early SA, Dugan AE, **Krupkin M**, Ribbeck K, Kulik HJ, and Kiessling LL. "A CH- π Interaction Is Required for Human Galectin-3 Function". **JACS Au** (2024). [Link](#).
10. Nouhin J, Tzou PL, Rhee SY, Sahoo MK, Pinsky BA, **Krupkin M**, Puglisi JD, Puglisi EV, Shafer RW. "Human immunodeficiency virus 1 5'-leader mutations in plasma viruses before and after the development of reverse transcriptase inhibitor-resistance mutations". **J Gen Virol** (2023). [Link](#).
11. Prabhakar A*, Krahn N*, Zhang J*, Vargas-Rodriguez O, **Krupkin M**, Fu Z, Acosta-Reyes FJ, Ge X, Choi J, Crnković A, Ehrenberg M, Puglisi EV, So'Il, and Puglisi J. "Uncovering translation roadblocks during the development of a synthetic tRNA". **Nucleic Acids Res** (2022). [Link](#). **Journal cover**.
12. Bose T, Fridkin G, Davidovich C, **Krupkin M**, Dinger N, Falkovich AH, Peleg Y, Agmon I, Bashan A, Yonath A. "Origin of life: proto ribosome forms peptide bonds and links RNA and protein dominated worlds". **Nucleic Acids Res** (2022). [Link](#).
Featured in Nature news: [Link](#).

13. Matzov D, Eyal Z, Benhamou RI, Shalev-Benami M, Halfon Y, **Krupkin M**, Zimmerman E, Rozenberg H, Bashan A, Fridman M, Yonath A. "Structural insights of lincosamides targeting the ribosome of *Staphylococcus aureus*". **Nucleic Acids Res** (2017). [Link](#).
14. Wekselman I, Zimmerman E, Davidovich C, Belousoff M, Matzov D, **Krupkin M**, Rozenberg H, Bashan A, Friedlander G, Kjeldgaard J, Ingmer H, Lindahl L, Zengel JM, Yonath A. "The Ribosomal Protein uL22 Modulates the Shape of the Protein Exit Tunnel". **Structure** (2017). [Link](#).
15. Eyal Z*, Matzov D*, **Krupkin M**, Paukner S, Riedl R, Rozenberg H, Zimmerman E, Bashan A, and Yonath A. "A novel pleuromutilin antibacterial compound, its binding mode and selectivity mechanism". **Scientific Reports** (2016). [Link](#).
16. Auerbach-Nevo T, Baram D, Bashan A, Belousoff M, Breiner E, Davidovich C, Cimicata G, Eyal Z, Halfon Y, **Krupkin M**, ... Yonath A. "Ribosomal antibiotics: Contemporary challenges". **Antibiotics** (2016). [Link](#).
17. Eyal Z*, Matzov D*, **Krupkin M**, Wekselman I, Paukner S, Zimmerman E, Rozenberg H, Bashan A, Yonath A. "Structural insights into species-specific features of the ribosome from the pathogen *staphylococcus aureus*". **Proc Natl Acad Sci USA** (2015). [Link](#).
18. Sun L, Xiong Y, Bashan A, Zimmerman E, Shulman Daube S, Peleg Y, Albeck S, Unger T, Yonath H, **Krupkin M**, Matzov D, Yonath A. "A recombinant collagen–mRNA platform for controllable protein synthesis". **Chembiochem** (2015). [Link](#).
19. Huang L, **Krupkin M**, Bashan A, Yonath A, Massa L. "Protoribosome by quantum kernel energy method". **Proc Natl Acad Sci USA** (2013). [Link](#).
20. Bashan A, Zimmerman E, Belousoff MJ, Rozenberg H, Davidovich C, Wekselman I, Shapira T, **Krupkin M**, Yonath A. "The ribosome as drug target: lessons from 3D structures". **Isr Chem Soc** (2010). [Link](#). **Journal cover**.
21. Davidovich C, Belousoff M, Wekselman I, Shapira T, **Krupkin M**, Zimmerman E, Bashan A, Yonath A. "The proto-ribosome : An ancient nano-machine for peptide bond formation". **Isr J Chem**. (2010). [Link](#). **Journal cover**.

Awards and Fellowships

Compass scholar, Washington University, USA	2025
New England future faculty, USA	2025
Leading edge fellow, USA.	2025
NSF award, RNA 2021, USA.	2021
Fellowship award, Cincinnati Children's Hospital Medical Center, USA.	2016
A competitive 2-weeks clinical research fellowship abroad.	
Best talk award. Genetics, Genomics and Evolution Conference. Tel Aviv University.	2015
Vallee Lindau Fellow.	2013
A competitive travel award, 63rd Lindau Nobel Laureate Meeting, Germany.	
Adams Ph.D. fellowship, The Israel Academy of Sciences and Humanities.	2012-2016
A competitive national fellowship in the sum of 100,000\$ plus tuition.	
Schächter summer scholarship for research, Bar-Ilan University.	2007
A competitive 2-months undergraduate research scholarship.	
Dean's honors list, Bar-Ilan University.	2006

Conferences and Presentations, Partial List

The Structure and Function of HIV Viral RNA

Bay Area RNA conference, UCSF. Talk.	2026
HIV Structural Biology Meeting, NIH. Talk.	2025
CHEETAH seminar series, NIH. Talk.	2024
HIV Structural Biology Meeting, NIH. Talk.	2022
Revolutionary 3-D Views of Viral RNA Using CryoEM, SLAC, USA. Invited panelist .	2022

Layers of Protections: Reconstituting the Mucus Layer

Frontiers of Biophysics 17th Course, Erice, Italy. Talk.	2019
Structural Biology Department, Stanford School of Medicine. Talk.	2019
Biochemistry and Biophysics Department, UCSF. Talk.	2019
Chemistry Department, University of Utah. Talk.	2019

The Structural Mechanism of Avilamycin Ribosomal Antibiotic

Simons Electron Microscopy Center, New York Structural Biology Center. Talk.	2017
Biological Engineering Department, MIT, USA. Talk.	2016
Cincinnati Children's Hospital Medical Center, USA. Talk.	2016
Ribosome Structure and Function EMBO conference, Strasbourg, France. Poster.	2016

The Origin of The Ribosome: The Proto-Ribosome

Genetics, Genomics and Evolution (GGE) conference, Israel. Talk. Best talk award.	2015
The RNA society 19 th annual meeting, Quebec, Canada. Poster.	2014
Society for Molecular Biology and Evolution meeting, Puerto Rico. Poster.	2014
Ribosomes meeting, CA, USA. Poster.	2013

Service and Leadership

I acquired considerable experience in planning and coordinating 4 professional conferences, contributing service as editor and reviewer for 6 journals, and taking on leadership roles in several organizations. I started taking on leadership roles during my graduate school, when I ran and was elected to serve as the student council chair, where I managed the budget (50,000\$), led negotiations with the administration, organized social and volunteering events, and led access expansion initiatives, planned meetings, and coordinated volunteers. During my postdoctoral training I joined the Bay Area RNA Club (2020-present), MIT Microbiome Club (2018-2019), and the MIT Postdoctoral Organization for Women Engaged in Research (2018-2019) leadership teams, where I helped organize their yearly symposium, scientific seminars, and career development events. Next, I joined Next, I co-organized 4 conferences, where I managed the budget (16,000\$), invited keynote speakers, poster judges, and moderators, organized poster competitions, led talk selection committees, recruited and coordinated volunteers, and moderated the conference sessions.

BMC Research Notes. Editorial board and editor.	2022- present
Antibiotics. Guest editor and reviewer board.	2020- present
Reviewer for 16 papers, published in Antibiotics, Viruses, IJMS, and more...	2021- present
BARC2020 and BARC2023 conference. Co-organizer and moderator.	2020- present
MIT-Harvard Microbiome symposium 2019. Co-organizer.	2018-2019
Frontiers in Chemical Sciences Symposium, Israel. Co-organizer and moderator.	2015
Student Council, Weizmann Institute of Science, Israel. Chair.	2013

Mentoring and Teaching

Mentoring: I have directly mentored 19 students throughout my graduate and postgraduate career and have co-authored publications with 5 of my mentees. I designed 10-36 weeks projects for undergraduate, post-graduate, and graduate students that I mentor. I mentor my students through hands on training in both lab work and data analysis, discussing current literature, and coaching each student in their science presentations.

2010	Gabriele Nübel (Universität Greifswald) biochemistry internship, WIS.
2010	Donna Matzov, research assistant, WIS.
2010	Zohar Eyal, biology MSc rotation student, WIS.
2010-2011	Hua Tang, research assistant, WIS.
2011	Jacques Rovetto, biology MSc rotation student, WIS.
2011-2012	Lisha Lim (University of Bath) pharmacology internship, WIS.
2011-2012	Hadar Israeli (BGU undergrad), WIS.

2012	Moshe Pargament research program, 3 high school students, WIS.
2012	Sapir Ofer (UCL undergrad) structural biology internship, WIS.
2012	Dror Oren, chemistry MSc rotation student, WIS.
2012	Anna-Skrollan Geiermann (Minerva Foundation Fellowship), WIS.
2017	Chloe Wu, BE PhD rotation student, MIT.
2017	Kathryn Yammine, chemistry PhD rotation student rotation, MIT.
2018	Heather Giblin (biology teacher), MRL summer internship program, MIT.
2018	Astatke Assaminew, MRL summer internship program, MIT.
2022	Meghan Nolan, Biology PhD rotation student, Stanford.
2025	Ajinkya Dhepe, Chemistry PhD student, Stanford.
2026	Helen Elmer, Biochemistry PhD student, Stanford.

Teaching: I have been teaching in the classroom and working to expand access to scientific education and scientific careers since 2009, through developing and instructing 2 scientific workshops, 2 career development workshops, and 1 journal club. I have sought out opportunities to teach throughout my graduate and postdoctoral training, as my training programs did not have teaching requirements. My experience with developing lesson plans and my strong academic background has prepared me to develop coursework across several disciplines.

Introduction to Medicine, Stanford University. Developer and instructor. **2026**

Designed and directed an intensive 10-module STEM curriculum introducing foundational biomedical sciences, translational medicine, and molecular mechanisms at Stanford University. Delivered core coursework spanning bacterial and viral pathogenesis, antibiotic pharmacology, genetics, and CRISPR gene editing; recruited and hosted 6 clinical and industry guest lecturers (MDs, research scientists, and a clinical pharmacist) to connect molecular biology to clinical therapeutics.

Atom Structure, Developer and instructor. **2026**

Architected and instructed a 10-module community outreach program translating fundamental chemistry into accessible STEM modules for young learners. Engineered tactile modeling workshops using structural clay media to teach 3D atomic geometry, periodic properties, and chemical bonding, driving engagement across diverse educational backgrounds.

MIT GlycoBioClub Journal Club. Co-founder and co-organizer. **2018-2019**

Invited speakers and moderated monthly meetings.

Polymer structure and function. Developer and instructor. **2017-2018**

Designed and instructed a science workshop that included a 1 hr lecture followed by a hands-on polymer making activity. Presented at the Boston Science Museum and on MIT Polymer Day.

The Ribosome Structure and Function. Developer and instructor. **2009-2017**

Designed and instructed a science workshop that included a 1 hr lecture followed by a 3D theater immersive experience. Presented regularly at Davidson Institute of Science Education and at WIS summer science camps.

Finding a postdoc, MIT. Invited panelist. **2018**

Gender balance in chemical sciences workshop, WIS. Developer and instructor. **2015**

Designed and instructed a workshop for the whole chemistry department. Invited panel speakers and moderated the panel.

Choosing a rotation lab workshop, WIS. Developer and instructor. **2013**

Designed and instructed a workshop to help graduate students choose rotations. Invited the panel speakers and moderated the panel.

Professional Training, Partial List

Microbiology and clinical samples. WIS, MIT, Stanford, CSHL.	2009-present
CryoEM training. Stanford University, SLAC, S2C2, NIH, EMBL.	2019-present
Microfluidics and single molecule microscopy. MIT, Stanford.	2017- present
X-ray crystallography training. WIS, Oxford university.	2009-2017
Synchrotrons: ESRF (France), SLS (Swiss), Diamond (UK).	

References

1. Elisabetta Viani Puglisi, Postdoc advisor. Department of Structural Biology, Stanford University, (650) 498-5420, epuglisi@stanford.edu
2. Joseph Puglisi, Postdoc advisor. Department of Structural Biology, Stanford University, (650) 498-4397, puglisi@stanford.edu
3. Peter Sarnow, collaborator. Department of Microbiology and Immunology, Stanford University, (650) 498-7076, psarnow@stanford.edu