

## Michael G. Mohsen

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### Education & Training

**Yale University**, Dept. of Molecular, Cellular and Developmental Biology (MCDB) New Haven, CT  
Postdoctoral Fellow Jul 2020-Present

- Research topics: chemical biology, synthetic biology

**Stanford University**, School of Humanities and Sciences Stanford, CA  
PhD in Chemistry Jun 2015-Jun 2020

- Research topics: chemical biology, organic chemistry
- Thesis: "Chimeric Dinucleotides: Expanding the DNA Polymerase Toolkit"

**New York University (NYU)**, College of Arts and Sciences New York, NY  
B.S. in Chemistry with High Honors, *cum laude* Sep 2011-May 2015

- Phi Lambda Upsilon National Honorary Chemical Society
- Senior Honors Thesis: "Helicity Estimation of 2'-O-Methyl DNA/DNA Hybrids Using Two-Dimensional Arrays"
- Minors: Physics, Mathematics

### Awards

Oral Presentation Award – 6 <sup>th</sup> Annual Yale Postdoctoral Association Symposium	May 2023
Life Sciences Research Foundation Postdoctoral Fellowship	Aug 2022
Poster Award – NYAS Chemical Biology Discussion Group Year-End Symposium	May 2022
PhRMA Foundation Postdoctoral Fellowship in Drug Discovery	Mar 2022
VPGE Academic Achievement Award for the Markaz (Stanford University)	Jun 2020
Edward Curtis Franklin Award (Stanford Dept. of Chemistry)	Dec 2019
Founder's Day Award (NYU)	Apr 2015
Finish Line Grant (NYU)	Jan 2015
Dean's List for Academic Year (NYU)	2012, 2013, 2014, 2015
Dean's Undergraduate Research Fund Grant (NYU)	Nov 2012, Apr 2014
Departmental Scholar Award (NYU Dept. of Chemistry)	Mar 2014
Julius Silver Scholarship (NYU)	Sep 2013, Sep 2014

### Research Experience

**Yale Dept. of MCDB** Jul 2020-Present

Postdoctoral training with Prof. Ronald R. Breaker. Initial postdoctoral work showed that bacterial ligand-sensing RNA gene regulatory elements, known as riboswitches, could be exploited to develop aptamers that bind drug compounds, such as quinine or caffeine. Current research efforts involve employing directed evolution methods to engineer RNA constructs that sense additional target compounds and regulate the expression of therapeutic genes in eukaryotic and bacterial species.

**Stanford Dept. of Chemistry** Jun 2015-Jun 2020

Graduate work with Prof. Eric T. Kool focused on the synthesis of novel modified nucleotides employed as sensors of biochemical processes. Specific projects included using ATP-releasing nucleotides (ARNs) as sensors for DNA synthesis and as luminescence-based reporters for single-nucleotide polymorphism discrimination. Additionally, novel dimeric nucleotides (dicaptides) were shown to outperform canonical dNTPs under extended amplification conditions.

## NYU Dept. of Chemistry

May 2012-May 2015

Undergraduate research with Prof. Nadrian C. Seeman involved the design and analysis of novel DNA nanostructures that self-assemble to form two- and three-dimensional crystals. Specific projects included assembly of a symmetric 2-turn tensegrity square comprised of DNA, determining the helical repeat of a 2'-O-methyl RNA and unmodified DNA hybrid duplex using atomic force microscopy, and exploring the effects of microgravity on self-assembled DNA crystals grown via liquid bridge diffusion.

## Teaching Experience

### Graduate Student Educator, Stanford Markaz Resource Center

May 2018-Jun 2020

- Developed and presented workshops aimed at combating Islamophobia and anti-Muslim bias in a university setting. [Featured in \*The Stanford Daily\*](#)

### Graduate Teaching Assistant, Stanford Dept. of Chemistry

Sep 2015-Jul 2016

- CHEM 1: Introduction to Organic Chemistry, Summer 2016
- CHEM 2: Organic Chemistry of Carbonyl Containing Molecules, Summer 2016
- CHEM 130: Organic Chemistry Laboratory, Fall 2015 and Winter 2016

### Learning Assistant, NYU University Learning Center (ULC)

Sep 2013-May 2015

- Provided free tutoring to peers on a walk-in basis in general, organic, and physical chemistry. Led peer tutoring sessions in a classroom setting that met weekly.

## Presentations

- Exploiting Natural Riboswitches for Aptamer Engineering and Validation. Chemical Biology Symposium 2023. NYU, New York, NY. Aug 11, 2023. Poster.
- Exploiting Natural RNA Switches to Engineer and Validate Synthetic RNA Sensors. 6<sup>th</sup> Annual Yale Postdoctoral Association Symposium. Yale University, New Haven, CT. May 25, 2023. Talk. **Awarded prize for best oral presentation.**
- Exploiting Natural Riboswitches for Aptamer Engineering and Validation. Yale RNA Club. Yale University, New Haven, CT. Nov 8, 2022. Talk.
- Exploiting Natural Riboswitches as Platforms for Evolution and Validation of Synthetic Aptamers. New York Academy of Sciences Chemical Biology Discussion Group Year-End Symposium 2022. Columbia University, New York, NY. May 26, 2022. Poster. **Awarded prize for best poster presentation.**
- Chimeric Dinucleotides: Expanding the DNA Polymerase Toolkit. Candidate Seminar. Yale University, New Haven, CT. Feb 26, 2020. Talk.
- Helicity Estimation of 2'-O-Methyl DNA/DNA Hybrid Duplex Using Two-Dimensional Arrays. American Chemical Society Undergraduate Research Symposium. St. John's University, Jamaica, NY. May 3, 2014. Talk.
- Helicity Estimation of 2'-O-Methyl DNA/DNA Hybrid Duplex Using Two-Dimensional Arrays. Dean's Undergraduate Research Conference. NYU, New York, NY. Apr 25, 2014. Poster.
- A New Motif in Structural DNA Nanotechnology: The DNA Tensegrity Square. Dean's Undergraduate Research Conference. NYU, New York, NY. Apr 12, 2013. Poster.

## Articles

- 13 MG Mohsen, MK Midy, A Balaji, RR Breaker\*. **Engineered branaplam aptamers that exploit structural elements from natural riboswitches.** *Manuscript in preparation.*
- 12 MG Mohsen, RR Breaker\*. **Prospects for Riboswitches in Drug Development.** *Methods and Principles in Medicinal Chemistry* 2024, *in press.*
- 11 L Fang, WA Velema, Y Lee, L Xiao, MG Mohsen, AM Kietrys, ET Kool\*. **Pervasive Transcriptome Interactions of Protein-Targeted Drugs.** *Nat. Chem.* 2023, 15, 1374-1383. DOI: [10.1038/s41557-023-01309-8](https://doi.org/10.1038/s41557-023-01309-8)
- 10 MG Mohsen, RR Breaker\*. **In vitro Selection and in vivo Testing of Riboswitch-inspired Aptamers.** *Bio-protocol* 2023, 13. DOI: [10.21769/BioProtoc.4775](https://doi.org/10.21769/BioProtoc.4775)
- 9 MG Mohsen, MK Midy, A Balaji, RR Breaker\*. **Exploiting natural riboswitches for aptamer engineering and validation.** *Nucleic Acids Res.* 2023, 51, 966-981. DOI: [10.1093/nar/gkac1218](https://doi.org/10.1093/nar/gkac1218)
- 8 Y Lee, Y Onishi, LA McPherson, AM Kietrys, M Hebenbrock, YW Jun, I Das, S Adimoolam, D Ji, MG Mohsen, JM Ford, ET Kool\*. **Enhancing Repair of Oxidative DNA Damage with Small Molecule Activators of MTH1.** *ACS Chem. Biol.* 2022, 17, 2074-2087. DOI: [10.1021/acschembio.2c00038](https://doi.org/10.1021/acschembio.2c00038)
- 7 LA McPherson, CI Troccoli, D Ji, AE Bowles, ML Gardiner, MG Mohsen, NS Nagathihalli, DM Nguyen, DJ Robbins, NB Merchant, ET Kool, P Rai\*, JM Ford\*. **Increased MTH1-specific 8-oxodGTPase activity is a hallmark of cancer in colon, lung and pancreatic tissue.** *DNA Repair (Amst).* 2019, 83, 102644. DOI: [10.1016/j.dnarep.2019.102644](https://doi.org/10.1016/j.dnarep.2019.102644)
- 6 MG Mohsen, D Ji, ET Kool\*. **Polymerase synthesis of four-base DNA from two stable dimeric nucleotides.** *Nucleic Acids Res.* 2019, 47, 9495-9501. DOI: [10.1093/nar/gkz741](https://doi.org/10.1093/nar/gkz741)
- 5 YP Ohayon, C Hernandez, AR Chandrasekaran, X Wang, HO Abdallah, MA Jong, MG Mohsen, R Sha, JJ Birktoft, PS Lukeman, PM Chaikin, SL Ginell, C Mao, NC Seeman\*. **Designing Higher Resolution Self-Assembled 3D DNA Crystals via Strand Terminus Modifications.** *ACS Nano* 2019, 13, 7957-7965. DOI: [10.1021/acsnano.9b02430](https://doi.org/10.1021/acsnano.9b02430)
- 4 MG Mohsen, D Ji, ET Kool\*. **Polymerase-amplified release of ATP (POLARA) for detecting single nucleotide variants in RNA and DNA.** *Chem. Sci.* 2019, 10, 3264-3270. DOI: [10.1039/C8SC03901A](https://doi.org/10.1039/C8SC03901A)
- 3 MG Mohsen, ET Kool\*. **The Discovery of Rolling Circle Amplification and Rolling Circle Transcription.** *Acc. Chem. Res.* 2016, 49, 2540-2550. DOI: [10.1021/acs.accounts.6b00417](https://doi.org/10.1021/acs.accounts.6b00417)
- 2 K Oertell, EM Harcourt, MG Mohsen, J Petruska, ET Kool, MF Goodman\*. **Kinetic selection vs. free energy of DNA base pairing in control of polymerase fidelity.** *Proc. Natl. Acad. Sci. U. S. A.* 2016, 113, E2277-E2285. DOI: [10.1073/pnas.1600279113](https://doi.org/10.1073/pnas.1600279113)
- 1 D Ji, MG Mohsen, EM Harcourt, ET Kool\*. **ATP-Releasing Nucleotides: Linking DNA Synthesis to Luciferase Signaling.** *Angew. Chem. Intl. Ed. Engl.* 2016, 55, 2087-2091. DOI: [10.1002/anie.201509131](https://doi.org/10.1002/anie.201509131)

\*corresponding author

## Patents

- ET Kool, MG Mohsen. **Methods for Detecting Viral RNA Using ATP-Releasing Nucleotides**. 2022, publication number: WO 2022/115435
- ET Kool, D Ji, MG Mohsen. **Amplified Isothermal Detection of Polynucleotides with ATP Release**. 2017, publication number: 20170159112

## Grants

Award	Amount	Dates
Howard Hughes Medical Institute (HHMI) Life Sciences Research Foundation Postdoctoral Fellowship	\$201,000 (\$67,000/year)	Aug 2022-Jul 2025
PhRMA Foundation Postdoctoral Fellowship in Drug Discovery	\$100,000 (\$50,000/year) accepted: \$20,833.33 declined: \$79,166.67	Mar 2022-Jul 2022
Dean's Undergraduate Research Fund (DURF)	\$500	Apr 2014
Dean's Undergraduate Research Fund (DURF)	\$1,000	Nov 2012

## Activities

- Judge for ENVISION by Women in STEM (WiSTEM) Research Competition 2020-2023
- Member of MCDB Faculty Search Committee 2022

## Mentorship

- Pedro Madalozzo (graduate rotation student) Jan 2024-Mar 2024
- Cynthia Megyola (research assistant) Sep 2022-Mar 2023
- Kyrillos Abdallah (graduate rotation student) Sep 2021-Oct 2021
- Matthew Midy (undergraduate) Jun 2021-Present
- Aparajita Balaji (graduate student) Jun 2021-Feb 2023
- Mala Puri (graduate student) Feb 2021-May 2021

## References

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- Prof. Ronald R. Breaker  
Sterling Professor of Molecular, Cellular and Developmental Biology  
and of Molecular Biophysics and Biochemistry  
Investigator, Howard Hughes Medical Institute  
Yale University  
ronald.breaker@yale.edu
- Prof. Eric T. Kool  
George A. and Hilda M. Daubert Professor of Chemistry  
Stanford University  
kool@stanford.edu
- Prof. Roger D. Kornberg  
Professor of Structural Biology  
Stanford University School of Medicine  
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