

Michael J. Flynn

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Focus Areas: Synthetic Biology and Systems Biology

Professional Summary

I am an Applied Physics Ph.D. specializing in Bioengineering. I have a multidisciplinary background in Physics, Computer Science, and Synthetic Biology. My most recent work is in miRNA circuits, where my collaborators and I developed a **toolkit of tunable, orthogonal synthetic miRNA incoherent feedforward loops**. We also **applied synthetic miRNA circuits to reduce MeCP2 overexpression** in Rett Syndrome gene therapy.

Education

2017-2025 Ph.D. in Applied Physics, Elowitz Lab, Caltech

2011-2015 B.A. Physics with Highest Honors; B.A. in Computer Science, Williams College

Professional Experience

Caltech

2018-2025

Graduate Student, Advisor: Michael Elowitz

- molecular cloning, flow cytometry, in-situ hybridization, computational image analysis in C++, data analysis in Python.
- Designed and engineered synthetic miRNA circuits
- Designed and engineered protease circuits, optimizing ability of such circuits to amplify signals.

Caltech

2017-2018

Graduate Student, Rotation Advisor: Paul Bellan

- Engineered x-ray spectrometer from digital camera to measure x-rays in magnetic reconnection experiment, which contributed to Marshall, Flynn, and Bellan (*Physics of Plasmas* 2018).

Hutchin Hill Capital

2015-2017

Analyst

- Daily rebalancing of portfolio with up to \$2 billion in assets.
- Wrote portfolio optimization code, including linear programming using R. Developed R Shiny dashboard for global portfolio.

Williams College

2014-2015

Undergraduate Research Assistant. Advisor: Daniel Aalberts

- Optimized algorithms to compute the partition function of RNA (secondary structure), and compute RNA secondary structure from this data.

Peer Reviewed Publications

Marshall, R. S., **M. J. Flynn**, and P. M. Bellan. "[Hard x-ray bursts observed in association with Rayleigh-Taylor instigated current disruption in a solar-relevant lab experiment.](#)" *Physics of Plasmas* 25, no. 11 (2018).

Active Preprints

Flynn, Michael J.*, Acacia MH Mayfield*, Rongrong Du, Viviana Gradinaru, and Michael B. Elowitz. "[Synthetic dosage-compensating miRNA circuits allow precision gene therapy for Rett syndrome.](#)" *BioRxiv* (2024). (in submission at *Cell Reports*)

Du, Rongrong*, **Michael J. Flynn***, Monique Honsa, Ralf Jungmann, and Michael B. Elowitz. "[miRNA circuit modules for precise, tunable control of gene expression.](#)" *BioRxiv* (2024). (in submission at *Molecular Cell*)

Lu, Andrew, Lukas Moeller, Stephen Moore, Shiyu Xia, Kevin Ho, Evan Zhang, Mark W. Budde, Haley Larson, Ali Ahmed Diaz, Bo Gu, James M. Linton, Leslie Klock, **Michael J. Flynn**, Xiaojing J. Gao, Daniel J. Siegwart, Hao Zhu, Michael B. Elowitz. "[Engineered protein circuits for cancer therapy](#)" *BioRxiv* (2025). (in submission at *Nature*)

* These authors contributed equally to the work

Preprint-only (not submitted for review)

Flynn, Michael J., Olga Snitser, James Flynn, Samantha Green, Idan Yelin, Moran Szwarcwort-Cohen, Roy Kishony, and Michael B. Elowitz. "[A simple direct RT-LAMP SARS-CoV-2 saliva diagnostic.](#)" *medRxiv* (2020): 2020-11.

Flynn, Michael J. "[RNA Macrostates and Computational Tools](#)". Williams College 2015.

Patents

Flynn, Michael J., Michael B. Elowitz, Acacia Hori, Viviana Gradinaru. "[Method of Robust Control of Gene Expression](#)". USA Patent US20210171582A1. Provisional filed Nov. 22, 2019. Granted 2023-11-21.

Lu, Andrew C., **Michael J. Flynn**, Lucy S. Chong, Ronghui Zhu, Michael B. Elowitz. "[Protein-based signal amplification](#)". USA Patent US20240124913A1. Provisional Filed Oct. 14, 2022. Pending.

Presentations

Flynn, Michael J. "A Synthetic miRNA IFFL Circuit Module for Rett Syndrome Gene Therapy".
Powerpoint presentation. ASGCT Gene Targeting & Gene Correction: CNS, Los Angeles, 2023.

Trainees

Guided Rongrong Du in rotation through to Elowitz lab membership. Resulted in her co-first authorship in Du et al.

Grants Awarded

Rosen Bioengineering Center Pilot Grant Award 2019
Rett Syndrome Research Trust Private Grant
Merkin Translational Research Grant
Protein-level circuits RO1