

Email: [isaac.vock@yale.edu](mailto:isaac.vock@yale.edu)  
Office: MIC 214B (West Campus)

# Isaac Vock

Email: [isaac.vock@yale.edu](mailto:isaac.vock@yale.edu) | Website: <https://isaacvock.github.io/>

## Education

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### PhD in Molecular Biophysics and Biochemistry

*August 2019 - Present*

Yale University, New Haven, CT

### Bachelor of Science in Physics; Minor in Mathematics

*August 2015 – May 2019*

Centre College, Danville KY

*Summa Cum Laude (4.0 GPA)*

## Publications

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**Vock, I. W.**, Mabin J., Zhang A., Machyna M., Hogg R.J., Simon M.D. Expanding and improving analyses of all nucleotide recoding RNA-seq experiments with the EZbakR-suite. *bioRxiv*. **2024**.

Scharfen, L., **Vock I. W.**, Simon M. D., Neguebauer K. M. Regulation of immediate RNA base pairing upon exit from eukaryotic RNA polymerases. *In Revisions at Mol. Cell*.

Moon, M. H., **Vock I. W.**, Streit A. D., Connor L. J., Senkina J., Ellman J. A., Simon M. D. Disulfide tethering to map small molecule binding sites transcriptome-wide *ACS Chem Bio*. **2024**.

Lu-Culligan, W. J., Connor L. J., Xie Y., Ekundayo B. E., Rose, B. T., Machyna, M., Zimmer, J. T., **Vock, I. W.**, Bhanu, N. V., King, M. C., Garcia, B. A., Bleichert, F., Simon, M. D. Acetyl-methyllysine marks histone H4 in regulated chromatin. *Nature*. **2023**.

Zimmer, J. T., **Vock, I. W.**, Schofield, J. A., Kiefer, L., Moon, M. H., Simon, M. D. Improving the study of RNA dynamics through advances in RNA-seq with metabolic labeling and nucleotide-recoding chemistry. *bioRxiv*. **2023**.

**Vock, I. W.**, Simon, M. D. bakR: Uncovering differential RNA synthesis and degradation kinetics transcriptome-wide with Bayesian hierarchical modeling. *RNA*. **2023**.

Sullivan, M. C., Niederer, R. O., **Vock, I. W.**, Kiefer, L., Gilbert, W. V., Simon, M. D. An internally normalized approach to comparing RNA levels between samples using nucleoside recoding chemistry. *NAR*, **2022**.

Joy, S. T., Henley, M. J., De Salle, S. N., Beyersdorf, M. S., **Vock, I. W.**, Huldin, A. J. L., Mapp, A. K. A Dual-Site Inhibitor of CBP/p300 KIX is a Selective and Effective Modulator of Myb. *JACS*. **2021**.

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## Research Experience

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### PhD Student

*August 2019 – Present*

Yale University

Advisor: Matthew Simon, PhD

- Developed computational tools to process and analyze nucleotide recoding RNA-seq (NR-seq; e.g., SLAM-seq, TimeLapse-seq, TUC-seq, etc.) data. Culminated in the EZbakR suite, an R package (EZbakR) and Snakemake pipeline (fastq2EZbakR).
- Developed statistical methods for performing well powered comparative analyses of kinetic parameters estimated from NR-seq data, fitting linear dynamical systems models to subcellular fractionation NR-seq data, etc.

### Research Internship

*Summer 2019*

Xavier University

Advisor: Justin Link, PhD

- Gained experience using and studied the underlying theory of circular dichroism spectropolarimetry, optical tweezers, and atomic force microscopy.
- Aided in Dr. Link's NSF funded research of cryptochromes in plants.

### NSF REU

*Summer 2017*

University of Michigan

Advisor: Anna Mapp, PhD

Mentors: Omari Baruti, PhD and Stephen Joy, PhD

- Designed and synthesized peptides with the goal of achieving differential binding affinities for two structurally similar proteins, p300 and CREB Binding Protein (CBP).
- Expressed and purified a domain of p300 (KIX domain) used for binding affinity analysis.
- Determined peptide binding affinity with a fluorescent polarization (FP) assay.

### Undergraduate Research Assistant

*May 2016 – August 2016 and January 2017*

Centre College

Advisor: Bruce Rodenborn, PhD

- Constructed two systems of stepper motors and aluminum structures to macroscopically model bacteria that locomote with a rotating helical flagellum.
- Used Matlab scripts to control several stepper motors as well as the DC motor of the robotic bacterial analog.
- Characterized flagellar propulsion with torque sensors and Fourier analysis.

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## Teaching Experience

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### **Statistical Intuition for Modern RNA Biologists (MB&B 374/574)**

*January 2025 – May 2025*

Yale University

Role: Instructor on Record

- Course that Matt Simon and I developed and are co-teaching in the Spring of 2025.
- Introduces Yale undergraduates and first year graduate students to core concepts in statistics and how they can be applied to the analyses of modern high throughput biochemical datasets.
- Selected to run as a part of Yale's [Associates in Teaching](#) program.

### **Introduction to Physics in Living Systems I (MB&B 121L)**

*January 2024 – March 2024*

Yale University

Role: Teaching Fellow

- Half-semester course introducing biophysics majors at Yale to basic concepts in experimental physics.
- Ran discussion sections, helped students design and execute experiments in class, and answered questions about Jupyter notebooks, which students used to record results.

### **Advanced Eukaryotic Molecular Biology (MB&B 443b/743b)**

*January 2021 – May 2022*

Yale University

Role: Teaching Fellow

- Course on eukaryotic gene expression regulation for junior/senior undergraduates and 1<sup>st</sup> year graduate students.
- Ran discussion sections (weekly; discussed assigned paper) and graded assignments.

### **Physics Tutor**

*September 2016 – May 2019*

Centre College

- Provided homework help and explained difficult concepts to those in introductory physics classes.
- Helped students develop useful problem-solving techniques and skills.

## Presentations

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### **Oral Presentations:**

“Improved analyses of transcript isoform regulation and NMD”. C-Wing Hall Seminar, Yale University. November 2024.

“The joy of bioinformatics”. YBDIC computational biology lecture series, Yale University. November 2023.

“Extending and improving the study of transcript isoform dynamics”. C-Wing Hall Seminar, Yale University. October 2023.

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“Dissecting gene expression regulation mechanisms with bakR”. RNA Club, Yale University. July 2023; Steitz lab joint lab meeting, Yale University. October 2023.

“Enhanced exploration of chemical probing RNA-seq data with HDProbe”. C-Wing Hall Seminar, Yale University. September 2022

“Improved Statistical Modeling for Differential RNA Kinetics Analysis”. IBDD RIP talk, Yale University. December 2021; C-Wing Hall Seminar, Yale University. December 2021

“Modeling Bacterial Swimming”. Kentucky Academy of Science (KAS) Undergraduate Research Presentation, University of Louisville. November 2016

### Poster Presentations:

“Uncovering transcript isoform regulatory dynamics with metabolic labeling and EZbakR”. CSHL Systems Biology: Global Regulation of Gene Expression. March 2024.

“bakR: uncovering differential RNA synthesis and degradation kinetics transcriptome-wide”. Cold Spring Harbor Laboratory Biological Data Science Conference, CSHL. November 2022; RNA Society Annual Meeting, Suntec Center, Singapore. June 2023

“Uncovering Differential RNA Metabolic Kinetics with Improved Statistical Modeling”. MB&B departmental retreat. March 2022

“Differential Binding of c-Myb Mutants to CBP and p300-KIX”. Undergraduate Research Symposium in the Chemical and Biological Sciences, University of Maryland Baltimore County. October 2017

## Programming Languages

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Github profile: [isaacvock](#)

Daily use:

- R (Example project: [EZbakR](#))
- Snakemake (Example project: [fastq2EZbakR](#))
- Bash

Intermediate use:

- Python (Example project: fastq2EZbakR scripts)
- Stan (Example project: [bakR](#))

Occasional use:

- C ([Example repo](#))
- Pytorch ([Example repo](#))

## Other Experience

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**PEB Discussion Group Coordinator and Moderator**

*September 2021 – May 2022*

- Invited speakers (mainly graduate students and postdoctoral associates; all at Yale) to present at monthly RIP talks associated with Yale’s Integrated Graduate Program in Physical and Engineering Biology.
- Organized, advertised, and moderated the talks.

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### **New Haven Science Fair (NHSF) Mentor**

*March 2020 – May 2021*

- Developed online science content for a second-grade class at Conte West Hills Magnet School, a local public elementary school.
- Worked with a 5<sup>th</sup>/6<sup>th</sup> grade enrichment class at FAME, a local multilingual elementary school, to develop and conduct a science fair project presented at the NHSF.

### **Physics Program Student Representative**

*August 2017 – May 2019*

- Attended meetings to discuss the Centre College physics program and offer student perspective about curriculum, budget, social events, etc.
- Answered questions from prospective physics majors about the program.

## **Honors and Awards**

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|---|------------------|
| Yale Associates in Teaching   | <b>2024</b>      |
| Yale RNA Center Travel Award  | <b>2023</b>      |
| MB&B's Excellence in Teaching Award   | <b>2022</b>      |
| NIH Chemical Biology Training Grant   | <b>2020-2022</b> |
| Centre College Class of 2019 Valedictorian Prize  | <b>2019</b>      |
| T. Hunton Rogers Memorial Scholarship Prize for a Junior Excelling in the Physical Sciences | <b>2018</b>      |
| Marshall Wilt Physics Prize for an Outstanding Physics Major                                | <b>2018</b>      |
| Induction into Phi Beta Kappa General Honor Society   | <b>2018</b>      |
| Induction into Sigma Pi Sigma Physics Honor Society   | <b>2017</b>      |
| Max P. Canves Award for Highest GPA Freshman Year   | <b>2017</b>      |
| 1 <sup>st</sup> prize Physics and Astronomy Oral Presentation KAS                           | <b>2016</b>      |