**SAM BERRY**

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**EDUCATION**

**PhD student in Biophysics,** Harvard University (began August 2019).

* Expected degree completion: 2026
* Honors: NSF Graduate Research Fellowship Honorable Mention (2021)
* NSF-Simons Fellow in Quantitative Biology, 2020-2023

**B.S., Molecular Biophysics and Biochemistry,** Yale University (2015-2019)

* Honors: *Cum laude*, distinction in the major
* Cumulative GPA: 3.83
* Major GPA: 3.89

**Hopkins School,** New Haven, CT (2009-2015)

**RESEARCH INTERESTS**

I am interested in questions at the interface of molecular biophysics and evolutionary biology. How do the particular three-dimensional structures of proteins shape their trajectories through sequence space, and how does the requirement of biological evolution shape the proteins that we see today? In my PhD work, I plan to investigate these questions through a combination of computational and experimental studies on structure and evolution in large membrane protein families. I hope to connect the large-scale evolutionary patterns that we see in alignments and phylogenies to the physical and chemical principles that drive protein biochemistry.

**RESEARCH EXPERIENCE**

**Gaudet Laboratory**, Graduate student (June 2020 - present)\*

* *Principle Investigator****:* Rachelle Gaudet**, Professor of Molecular and Cellular Biology, Harvard University.
* I have performed both computational experimental studies of Nramp metal ion transporters, seeking to relate the structure and dynamics of these proteins to their evolution. In the process, I have developed familiarity the following techniques:
	+ *Computational*: alignment generation and analysis, building and rooting large phylogenies, developing methods to analyze molecular dynamics data in Python, comparison of published structures, evolutionary tests of selection (dN/dS), and statistical coupling analysis (SCA).
	+ *Experimental*: I have performed molecular cloning, assayed purified proteins in liposomes for metal and proton uptake, expressed unusual bacterial Nramp homologs, and performed cysteine labeling assays. I am currently working to set up a system to perform double electron electron resonance (DEER) spectroscopy in collaboration with the Griffin Lab at MIT.

**Marks Laboratory**, Graduate student (June 2020 - present)\*

* *Principle Investigator****:* Debora Marks**, Associate Professor in Systems Biology, Harvard Medical School.
* Have worked to develop new computational approaches to relate sequence variation in large families of membrane proteins to functional features. This has largely involved applications of direct coupling analysis (EVCouplings) but has also included data curation, construction of alignments and phylogenies, structure comparison, and working on algorithms to distinguish separate coupling signals from within large alignments and discriminate between signals of specificity.

**Schepartz Laboratory of Chemical Biology**, Undergraduate Researcher (May 2016 – December 2017)

* *Principle Investigator****:* Alanna Schepartz**, Sterling Professor of Chemistry and Professor of Molecular, Cellular and Developmental Biology, Yale University
* Cloned, expressed and purified novel cell-penetrating peptide-protein conjugates for testing via fluorescence correlation spectroscopy (FCS) and flow cytometry. Acquired familiarity with a wide variety of techniques including cloning, protein expression and purification, human cell culture, and data analysis in MATLAB and PRISM.
* Awards: Yale College Dean’s Research Fellowship (Summer 2017)

**Gerstein Bioinformatics Laboratory**, Undergraduate Researcher (May 2018 – May 2019)

* *Principle Investigator:* **Mark Gerstein**, Albert L. Williams Professor of Biomedical Informatics and Professor of Molecular Biophysics and Biochemistry, and of Computer Science, Yale University
* Analyzed large Hi-C and ChIP-Seq datasets in order to find trends and then created predictive models of genome architecture from epigenetic information. Acquired familiarity with large-scale data analysis in Python and basic machine learning algorithms.

*\* Jointly supervised*

**PUBLICATIONS**

*Academic:*

1. A. Steinauer, J.R. LaRochelle, S.L. Knox, R. Wissner, **S. Berry**, and A. Schepartz. (2019) HOPS-dependent endosomal fusion required for efficient cytosolic delivery of therapeutic peptides and small proteins. *Proc. Natl. Acad. Sci. U.S.A.* 116(2): 512-521

*General audience:*

1. **S. Berry** (2020) What can evolution teach us about the viruses of the future? *Science in the News*, <http://sitn.hms.harvard.edu/flash/2020/what-can-evolution-teach-us-about-the-viruses-of-the-future/>
2. **S. Berry** (2018) Putting a patch on resistance: a total synthesis of pleuromutilin opens the door to new long-lasting antibiotics. *Yale Scientific Magazine* (cover article), [http://www.yalescientific.org/2018/01/putting-a-patch-on-resistance-a-total-synthesis-of-pleuromutilin-opens-the-door-to-new-long-lasting-antibiotics/](http://www.yalescientific.org/2018/01/putting-a-patch-on-resistance-a-total-synthesis-of-pleuromutilin-opens-the-door-to-new-long-lasting-antibiotics/%29)
3. **S. Berry** (2017) Reading your annotated code: mapping cytosine methylation with Nanopore sequencing. *Yale Scientific Magazine* (online feature), [http://www.yalescientific.org/2017/06/reading-your-annotated-code-mapping-cytosine-methylation-with-nanopore-sequencing/](http://www.yalescientific.org/2017/06/reading-your-annotated-code-mapping-cytosine-methylation-with-nanopore-sequencing/%29)

**PRESENTATIONS**

*Research talks:*

1. **S. Berry**, Nikki Thadani and Debora Marks. “Learning the GPCR-G protein interactome from coevolutionary sequence data.” Harvard Biophysics Symposium G2 Talks, October 2020
2. **S. Berry**, G. Gürsoy and M. Gerstein. “Toward a Predictive Model of Three-Dimensional Genome Structure from Epigenome Sequence.” MB&B Undergraduate Research Symposium, September 2018

*Poster sessions:*

1. **S. Berry,** D. Marks and R. Gaudet. “The determinants of substrate selectivity in a bacterial metal transporter.” Harvard Structural Biology Retreat, June 2022.
2. **S. Berry**, E. Lee, G. Zavala, E. Lee, A. Singharoy, and R. Gaudet. “The influence of conformational dynamics on the coupling of metal and proton transport in a bacterial Nramp protein.” Molecular and Cellular Biology departmental retreat, September 2021
3. **S. Berry**, G. Gürsoy and M. Gerstein. “Prediction of 3D Chromatin Organization from the Linear Epigenome.” Yale Undergraduate Research Symposium, September 2018

**TEACHING & MENTORING EXPERIENCE**

**Harvard University**, Teaching Fellow (January – May, 2020): Teaching fellow for MCB 65 (“Physical Biochemistry: Mechanisms of Molecular Machines”) at Harvard. As the class’s sole TF, I have lead a virtual section in which I show students how to do experiments; I have also purified and assayed a variety of mutant constructs of the nucleotide binding domains of the transporter associated with antigen processing (TAP) in order to provide data for our students. I have worked closely with the other teaching staff to write problem sets and exams and define the direction of the course during a challenging pandemic period.

**Polygence**, Mentor (March 2019 – present): Have mentored four motivated and curious high school students virtually or in-person through self-guided research projects at the interface of chemistry and biology. Projects typically begin as personally designed mini-curriculum, including interactive lectures and tailored readings with accompanying assignments, and evolve into literature reviews or small research projects on a topic related to my broad field of research that the student is interested in.

* Website: https://www.polygence.org/welcome
* Personal profile: https://www.polygence.org/dashboard/mentor/400

**Health Professions Recruitment and Exposure Program (HPREP)**, Mentor (October 2019 –February 2020): I served as a mentor to a Boston high school student from an underrepresented background and guided her as she pursued an independent research project related to social anxiety disorder as well as giving her advice about her college applications and future career paths in science and medicine. 

***Journal of Emerging Investigators***, Peer reviewer (October 2019 – present): Provide scientific feedback on high school students’ scientific manuscripts for publication in the *Journal of Emerging Investigators*, guiding students on both experimental design and manuscript presentation.

• Website: https://www.emerginginvestigators.org/

**Splash at Yale**, Instructor (September 2017 – October 2018): Have designed and taught a number of one- and three- lecture classes aimed at inspiring motivated middle- and high-school students, including:

* “Protein Structure, Function and Design” (Sprout at Yale, September 30 – October 14, 2017, and Splash at Yale, November 11, 2017), Grades 10-12
* “Genome Editing with CRISPR/Cas9” (Splash at Yale, November 11, 2017), Grades 10-12
* “Atoms and Molecules” (Sprout at Yale, February 17 – March 8, 2018), Grades 7-8
* “Chemistry of Life” (Splash at Yale, April 7, 2018), Grades 9-12
* “Writing the Short Story” (Sprout at Yale, September 29 – October 13, 2018), Grades 9-12

• “A Splendid Molecular Machine” (Splash at Yale, October 27, 2018)

**Breakthrough New Haven**, Instructor (Fall 2013 – Spring 2015):

• Helped teach promising but underserved New Haven city middle-schoolers math and English to prepare for entrance into more competitive high schools. Attended three semesters of teacher training (one each year) and moved from acting as a teaching assistant my sophomore year of high school to leading a classroom (including designing lesson plans and managing teaching assistants) as a senior.

**SKILLS & INTERESTS**

**Programming.** I have extensive experience developing scientific programs in Python through four years of computational research. Basic familiarity with R and MATLAB as well as considerable experience with command-line and cluster programming. Familiarity with probabilistic programming frameworks for model inference and deep learning including PyTorch, pymc3 and Pyro.

**Mathematics.** Have studied and learned to apply calculus (including multivariable calculus), linear algebra, probability theory, and statistics; some familiarity with Fourier analysis, differential equations, and information theory.

**Jazz piano**. Have studied classical and jazz piano since first grade and performed at weddings, receptions, and charity events. Have played piano and electric keyboard in Latin jazz, jazz standards, and rock ensembles.

**Languages**: English (native), French (proficient)