

# Bryan D. Merrill

PhD Candidate, Sonnenburg Lab

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## EDUCATION

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2022 (Aug)	Ph.D. Microbiology and Immunology	Stanford University School of Medicine
2015	M.S. Microbiology and Molecular Biology	Brigham Young University
2014	B.S. Molecular Biology ( <i>Magna Cum Laude</i> )	Brigham Young University

## TECHNICAL SKILLS

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**Programming** R/RStudio, Python/Jupyter, Bash

**HPC/Cloud** AWS (S3/EC2), Docker, Snakemake, SLURM, Linux systems administration

**Bioinformatics** Workflow management: GNU Parallel, Snakemake, Github  
Read QC and alignment: FASTQC, BBTools suite, Bowtie2, SAMtools,  
Metagenome assembly and binning: MEGAHIT, metaSPAdes, metaBAT2, anvi'o  
Genome ID/taxonomy/quality: QUAST, CheckM, GTDB-TK, dRep, CheckV, VirSorter  
Sample profiling: Kraken, MetaPhlan, MIDAS, IGGsearch, inStrain  
Gene function: Prodigal, Prokka, InterProScan, DIAMOND, HMMER, MMseqs2

**Wet Lab** DNA purification, PCR, gel electrophoresis, library preparation, anaerobic chamber, bacteria and phage isolation and culture.

## RESEARCH EXPERIENCE

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**2015-present** **Doctoral researcher – Stanford University School of Medicine – Dr. Justin L. Sonnenburg**

- Lead developer for terabase-scale shotgun metagenomics pipeline and bacterial isolate assembly pipeline (Github/Docker-based, deployed on AWS).
- Expertise in improving performance of existing tools + scaling bioinformatics analyses for the cloud (programming or consulting for VirSorter, anvi'o, dRep, inStrain)
- Designed, built, and managed Windows and Linux-based lab servers and backups

*Main project summaries*

- Identification of >90,000 prokaryote, eukaryote, and viral genomes from Hadza hunter-gatherer and rural Nepali gut metagenomes, comprising thousands of novel species.
- Isolation and characterization of *B. theta* bacteriophages with capsule-dependent tropism

**2012-2015** **Undergraduate and graduate researcher – Brigham Young University – Dr. Sandra Hope**

- Lead student for honeybee pathogen phage therapy research program. Gathered samples from local beekeepers for phage/pathogen isolation, performed in-lab characterization, and tested of phage therapy candidates on lab-owned beehives and infected hives in the community.

**2013** **BYU iGEM (International Genetically Engineered Machine) Team – Dr. Julianne Grose**

- Conducted research to modify capsid size of *Enterobacteria* phage T4

**2011-2012** **HHMI SEA-PHAGES (Phage Hunters) student – Brigham Young University**

- Isolation, sequencing, and annotation of *Mycobacterium smegmatis* bacteriophages

## TEACHING EXPERIENCE

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**2017** **Teaching Assistant – Stanford University School of Medicine**

- Gut Microbiome in Health and Disease – prepared and graded assignments, facilitated student group work, gave feedback on individual and group projects.

**2012-2015** **Teaching Assistant – Brigham Young University**

- Phage Hunters undergraduate research course - Gave lectures, prepared reagents and supplies, wrote and graded assignments, and guided student research culminating in conference poster presentations for each year-long class of 25-30 students.

## SELECTED JOURNAL PUBLICATIONS

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**Merrill BD\***, Carter MM\*, Olm MR\*, Dahan D, Yu FB, Jain S, Neff NF, Jha AR, Sonnenburg ED, Sonnenburg JL. Ultra-deep Sequencing of Hadza Hunter-Gatherers Recovers Vanishing Microbes. (2022) *bioRxiv* 2022.03.30.486478. <https://doi.org/10.1101/2022.03.30.486478>

Olm MR\*, Dahan D\*, Carter MM, **Merrill BD**, Yu FB, Jain S, Meng XD, Tripathi S, Wastyk HC, Neff NF, Holmes S, Sonnenburg ED, Jha AR, Sonnenburg JL. (2022) Robust variation of the infant gut microbiome across a spectrum of lifestyles. *Jun*;376(6598):1220-1223. <https://dx.doi.org/10.1126/science.abj2972>

Lynch JB, Bennett BD, **Merrill BD**, Ruby EG, Hryckowian AJ. (2022) Independent host- and bacterium-based determinants protect a model symbiosis from phage predation. *Cell Rep* Feb;38(7):110376. <https://dx.doi.org/10.1016/j.celrep.2022.110376>

Wastyk HC, Fragiadakis GK, Perelman D, Dahan D, **Merrill BD**, Yu FB, Topf M, Gonzalez CG, Van Treuren W, Han S, Robinson JL, Elias JE, Sonnenburg ED, Gardner CD, Sonnenburg JL. (2021) Gut-microbiota-targeted diets modulate human immune status. *Cell* 184(16):4137-4153.e14. <https://doi.org/10.1016/j.cell.2021.06.019>

Han S\*, Van Treuren W\*, Fischer CR, **Merrill BD**, DeFelice BC, Sanchez JM, Higginbottom SK, Guthrie L, Fall LA, Dodd D, Fischbach MA, Sonnenburg JL. (2021) A metabolomics pipeline enables mechanistic interrogation of the gut microbiome. *Nature* 595, 415-420. <https://doi.org/10.1038/s41586-021-03707-9>

Hryckowian AJ\*, **Merrill BD\***, Porter NT, Van Treuren W, Nelson EJ, Garlena RA, Russell DA, Martens EC, Sonnenburg JL. (2020) *Bacteroides thetaiotaomicron*-infecting bacteriophage isolates inform sequence-based host range predictions. *Cell Host & Microbe* 28(3):371.379.e5. <https://doi.org/10.1016/j.chom.2020.06.011>

Tropini C, Moss EL, **Merrill BD**, Ng KM, Higginbottom SK, Casavant EP, Gonzalez CG, Fremin B, Bouley DM, Elias JE, Bhatt AS, Huang KC, Sonnenburg JL. (2018) Transient osmotic perturbation causes long-term alteration to the gut microbiota. *Cell* 173(7):1742-1754.e17. <https://dx.doi.org/10.1016/j.cell.2018.05.008>

**Merrill BD**, Ward AT, Grose JH, Burnett SH. (2016) Software-based analysis of bacteriophage genomes, physical ends, and packaging strategies. *BMC Genomics* 17:679. <https://doi.org/10.1186/s12864-016-3018-2>

\* Equal contribution

Direct involvement in isolation, sequencing, assembly, annotation, and publication of 86 bacteriophages in NCBI GenBank (as of June 2022). <https://tinyurl.com/bmerrillNCBIphages>

## HONORS, AWARDS, RESEARCH SUPPORT

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2015	National Science Foundation Graduate Research Fellowship
2014 (Fall)	BYU College of Life Sciences Dean's List
2013-2014	BYU student research grants to investigate phage therapy treatment for honeybee disease
2013	Gold Medal, iGEM North American Regional Jamboree

## SELECTED PRESENTATIONS

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*Hunter-gatherers across geography share conserved gut bacterial species absent in industrialized societies.* **Bryan Merrill**. Department of Microbiology and Immunology Seminar, Stanford University School of Medicine. Stanford, CA. April 24, 2019. Oral presentation.

*Novel bacterial genomes from the Hadza hunter-gatherer gut microbiota.* **Bryan Merrill**, Gabriela K. Fragiadakis, Samuel A. Smits, Erica D. Sonnenburg, Justin L. Sonnenburg. The Third Annual Stanford Microbiome Summit. Stanford, CA. October 20, 2017. Poster presentation.

*Functional and genomic characterization of phages infecting a prominent member of the human gut microbiota.* **Bryan Merrill** and Drew Hryckowian. The California Microbiome Initiative Meeting. San Diego, CA. August 12-14, 2016. Oral presentation.

*Discovery and Characterization of Novel Paenibacillus larvae Bacteriophages.* **Bryan Merrill**, Sandra Hope, et al. Howard Hughes Medical Institute, Fifth Annual SEA-PHAGES Symposium, Ashburn, VA. June 7-9, 2013. Poster presentation, Honorable Mention.