Michelle Hays

mhays@stanford.edu

EDUCATION

Postdoctoral Fellow: Stanford University, Genetics Department — 2020 - Present
PhD: Molecular and Cellular Biology program, — 2013 - 2019
University of Washington (UW), Fred Hutchinson Cancer Research Center — Conferred Dec 2019
Bachelor of Science: Microbiology and German, — 2001 - 2005
Colorado State University; Ft. Collins, CO

CURRENT POSITION

Postdoctoral Scholar: Stanford University - Dr. Gavin Sherlock — 2020 - Present

I am developing budding yeast and its natural parasites, including Totiviruses, viral satellites, transposons and selfish plasmids, as a tractable system to study genetic conflict using experimental evolution, lineage tracking genomics and bioinformatics approaches. I was awarded a Life Science Alliance Exchange grant for a 3-month funded sabbatical in 2023 to visualize selfish elements in budding yeast in Dr. Gautam Dey's lab at the European Molecular Biology Laboratory, Heidelberg using a combination of FISH+expansion microscopy and live cell imaging.

ACADEMIC RESEARCH EXPERIENCE

PhD dissertation research: Fred Hutchinson Cancer Center – Dr. Harmit Malik — 2014 - 2019

I developed new high throughput, single-cell plasmid loss assay (SCAMPR), and identified natural *Saccharomyces cerevisiae* isolates that are resistant to plasmid parasitism. Using bulk segregant analysis and QTL mapping I identified genomic loci linked to the plasmid restriction phenotype, and one dominant host allele of *MMS21* that contributes to plasmid restriction.

Research Associate II – Dr. Aimée Dudley — 2011 – 2013
Institute for Systems Biology — Seattle, WA

- Structured *S. cerevisiae* strains utilize aneuploidy as mechanism to undergo switching between complex colony morphologies (euploid) and "smooth" (disomic) colony phenotypes common to lab strains.
- Developed other molecular tools to understand quantitative traits in natural populations: identification of enzymes responsible for novel metabolite synthesis, metabolic modeling of colony growth, isolation of wild yeasts, automated tetrad dissection development.

Research Associate II – Dr. Tim Galitski — 2009 - 2011
Institute for Systems Biology — Seattle, WA

Generated training and test set data for genetic network modeling (developed by Dr. Greg Carter) predicting phenotypic outcomes of complex genotypic interactions based on known partial pleiotropy to inform network interactions.

Research Associate I – Dr. Richard Slayden — 2006 - 2007
Colorado State University — Fort Collins, CO

Developed and manufactured research materials (such as microarrays and null mutant TB lines) distributed under the TB Vaccine Testing and Research Materials Contract, a NIH NIAID program supporting the Mycobacteria research community.

RISE Summer Research Intern – Dr. Rita Bernhardt, Universität des Saarlandes — 2005
Deutscher Akademischer Austausch Dienst — Saarbrücken, Germany

Participant in the Research Internships in Science and Engineering program. Creation of a *Schizosaccharomyces pombe* assay to screen small molecules for sensitivity and specificity of cytochrome p450 targeting.

INDUSTRY EXPERIENCE

ZymoGenetics, Inc. – Contract Quality Control Associate II, Seattle, WA — 2009
Bayer HealthCare – Contract Quality Control Analyst II, Seattle, WA — 2008-2009
GeneCheck – Diagnostics Laboratory Technician, Greeley, CO — 2008
Insmed Therapeutic Proteins – Quality Control Laboratory Technician, Boulder, CO — 2006

FELLOWSHIPS and GRANTS

2022 - Howard Hughes Medical Institute **Hanna Gray Postdoctoral Fellow**

- provides 2-4 years of postdoctoral support and 4 years of funding as a faculty member

2021 - 2024 – National Institutes of Health, National Institute for Allergy and Infectious Disease (NIH NIAID) Ruth L. Kirschstein **F32 Postdoctoral Individual National Research Service Award** (F32AI160906)

- provides 3 years of postdoctoral support. I declined the final year upon receiving the Hanna Gray

2020 - 2021 - Stanford Center for **Computational, Evolutionary and Human Genomics (CEHG) Postdoctoral Fellow**

- provides partial salary support and a travel award for recipients at the PhD to postdoc transition

2020 - 2021 NIH NHGRI **Stanford Genomics Training Program** (SGTP) Training Grant (5 T32 HG 000044-24)

- only 3 competitive postdoctoral positions are available on the training grant and are limited to 2 years support. I declined after 6 months upon receiving F32 funding.

2015 - 2020 **National Science Foundation Graduate Research Fellow** (NSF GRFP Grant No. DGE-1256082)

- a five year fellowship providing 3 years of full graduate support

2014 - 2015 - NIH NHGRI **UW Genome Training Grant** (5 T32 HG000035-20)

- competitive predoctoral training grant position limited to 2 years of support. I declined the final year of support upon receiving the NSF GRFP

AWARDS

2021 - **Stanford School of Medicine Dean's Award**

- provides one year of partial salary support for awardees. Funds declined upon receiving NIH NIAID F32 support

2019 - MCB Departmental **Nominee for UW Graduate Medal**

- recognizes exceptional 'Scholar-Citizens'. Each department may only nominate a single PhD candidate

2018 - **Finalist, UW Excellence in Teaching Award**

- recognizes excellence in teaching effectiveness, innovation. Two recipients chosen from five nominated finalists

2018, 2019 - **Finalist Nancy Hutchison Mentoring award**

- recognizes a single non-faculty member from the Fred Hutch Cancer Center for exceptional mentoring

2014 - 2019 - Portal to the Public **Science Communication Fellow**, Pacific Science Center

- Fellows take workshops on engaging with broad audiences about science, and I built two hands-on activities to introduce my research to the public. I participated in several all-ages science museum events, including Meet A Scientist, Paws-on-Science, and Life Science Research Weekends.

2017 - 2018 - Summer Institute for Scientific Teaching; National Academy of Sciences **Scientific Teaching Fellow**

- I was awarded a travel, lodging and materials stipend to attend a week-long workshop for teaching and pedagogy where I co-created a card game to teach population genetics and evolutionary concepts

2017 - **Hutch United Travel Award** for Gordon Research Conference on Molecular Mechanisms in Evolution

2018 - Society for Molecular Biology and Evolution (**SMBE**) **Registration Award**, Annual Conference in Tokyo

2018 - FHCC Student-Postdoc Advisory Committee (**SPAC**) **Travel Award** for EMBO Yeast Eco-Evo meeting

2016, 2018 - Work featured in GSA meeting reports for both 2016 and 2018 EMBO Experimental Approaches to Ecology and Evolution Using Yeast and Other Model Systems conferences

PUBLICATIONS

*authors contributed equally to this work

1. **Hays M***, Schwartz K*, Schmidtke DT, Aggeli D, Sherlock G (2023) Paths to adaptation under fluctuating nitrogen starvation: The spectrum of adaptive mutations in *Saccharomyces cerevisiae* is shaped by retrotransposons and microhomology-mediated recombination. PLOS Genetics 19(5): e1010747.
2. **Hays M,** Young JM, Levan P, Malik HS. A natural variant of the essential host gene *MMS21* restricts the parasitic 2-micron plasmid in *Saccharomyces cerevisiae*. eLife 2020;9:e62337 DOI: 10.7554/eLife.62337

3. Intosalmi J, Scott AC, **Hays M**, Flann N, Yli-Harja O, Lähdesmäki H, Dudley AM, Skupin A. Data-driven multiscale modeling reveals the role of metabolic coupling for the spatio-temporal growth dynamics of yeast colonies. *BMC Mol Cell Biol. 2019 Dec 19; 1(20)59*
4. Cromie GA, Tan Z, **Hays M**, Sirr A, Jeffery EW, Dudley AM. Transcriptional Profiling of Biofilm Regulators Identified by an Overexpression Screen in *Saccharomyces cerevisiae*. G3 (Bethesda). 2017 Aug 7;7(8):2845-2854
5. Cromie GA, Tan Z, **Hays M**, Jeffery EW, Dudley AM. Dissecting Gene Expression Changes Accompanying a Ploidy-Based Phenotypic Switch. G3 (Bethesda). 2017 Jan 5;7(1):233-246.
6. Ludlow CL, Cromie GA, Garmendia-Torres C, Sirr A, **Hays M**, Field C, Jeffery EW, Fay JC, Dudley AM. Independent Origins of Yeast Associated with Coffee and Cacao Fermentation. Curr Biol. 2016 Apr 4;26(7):965-71.
7. Cary GA, Yoon SH, Torres CG, Wang K, **Hays M**, Ludlow C, Goodlett DR, Dudley AM. Identification and characterization of a drug-sensitive strain enables puromycin-based translational assays in Saccharomyces cerevisiae. Yeast. 2014 May;31(5):167-78.
8. Tan Z, **Hays M***, Cromie GA, Jeffery EW, Scott AC, Ahyong V, Sirr A, Skupin A, Dudley AM. Aneuploidy underlies a multicellular phenotypic switch. Proc Natl Acad Sci U S A. 2013 Jul 23;110(30):12367-72.
9. Ludlow CL*, Scott AC*, Cromie GA, Jeffery EW, Sirr A, May P, Lin J, Gilbert TL, **Hays M**, Dudley AM. High-throughput tetrad analysis. Nat Methods. 2013 Jul;10(7):671-5.
10. Carter GW, **Hays M**, Sherman A, Galitski T. Use of pleiotropy to model genetic interactions in a population. PLoS Genet. 2012;8(10):e1003010.
11. Carter GW, **Hays M**, Li S, Galitski T. Predicting the effects of copy-number variation in double and triple mutant combinations. Pac Symp Biocomput. 2012:19-30.

MANUSCRIPTS IN PREPARATION

1. **Hays M.** Genetic conflicts in budding yeast: the 2-micron plasmid as a model selfish element. Solicited review in Seminars in Cell and Dev Biol. In submission.
2. **Hays M,** Chan A, Hickey A, PIeczynska M, de Visser A, Sherlock G. Learning to live with a killer: variation in osmotic response regulator *SSK1* underlies K1 toxin resistance in coevolved *Saccharomyces cerevisiae*. In preparation, preprint anticipated October 2023.
3. **Hays M***, Shwartz K*, Visher E, Sherlock G. Experimentally evolved adaptive alleles exhibit differing epistatic interactions. In preparation, preprint anticipated October 2023.

TEACHING EXPERIENCE

Postdoc Teaching Certificate – Stanford University 2020 - ongoing
70 hours of training and workshops on pedagogy and 30 hours of mentored classroom instruction

Inclusive teaching and mentoring training 2017 – ongoing
Workshops on just and equitable teaching and mentoring practices including:
Stanford OPA two-day Culturally Inclusive Mentoring workshop
Stanford Bioengineering Inclusive Mentoring Workshop
Stanford Teaching and Mentoring Academy Antiracism in Biomedical Research and Practice
TEACH Stanford Symposium
Summer Institute for Scientific Teaching fellow
Stanford Office of Postdoctoral Affairs Preparing for Faculty Careers course
UW Scientists Advocating for Justice and Equity (SAJE) social and racial justice training

MCB Mentored Teaching Experience – University of Washington 2017 – 2018
Conceived of and worked to found a new mentored teaching experience for UW graduate students. With MCB program directors and Biology Department faculty, this program continues now as STEP-UP, an NSF funded project: http://depts.washington.edu/stepuw/home/step-up/

Instructor of Record – University of Washington Spring 2018
Current Topics in Molecular and Cellular Biology BIOL410 – Competition and Conflict. Developed a new course centered on the scientific method and reading primary literature, culminating in student research proposals addressing a topic of their choosing.

National Academy of Sciences Scientific Teaching Fellow 2017 – 2018
Summer Institute for Scientific teaching - University of Oregon, Northwest region
Pedagogy-intensive summer program including co-development of a Teachable Tidbit: a card game teaching population genetics and evolution concepts

Girls in Engineering, Math and Science (GEMS) project leader 2017 – 2018
Led a series of activities to teach middle school girls about DNA and Evolution. Co-created a new card game activity to model different types of evolution in the classroom population.

Science Communication Fellow – Portal to the Public, Pacific Science Center 2014 – 2019
Created a series of hands-on all-ages activities to talk to the general public about evolution and genetic conflict at museum and public events.

Pacific Science Center Events Volunteer 2010 – 2019
Facilitated a wide range of hands-on activities for all ages: Life Sciences Research Weekend, PAWS on Science, Meet a Scientist

Science Education Partnership - Fred Hutchinson Cancer Research Center 2015, 2016
Mentored visiting rural high school students in multi-day laboratory workshops learning about molecular biology

Academic Teaching Assistantships
University of Washington – Laboratory techniques in Molecular and Cellular Biology (Biol302) 2015
Prof. Linda Martin-Morris
North Seattle College – Organic Chemistry I & II 2011 – 2012
Profs. Randall Engel and Guy Ting

Guest Lecturer
University of Pittsburgh – Beneficial Microbes Autumn 2022
North Seattle College – Organic Chemistry I & II 2012, 2013

Tutor
Organic Chemistry – North Seattle College 2010 – 2013
Academic Advancement Center, Colorado State University 2002 - 2006

MENTORING EXPERIENCE

Mentor for Rotation and Graduate Students
Darren Lam , Stanford Genetics, NSF GRFP honorable mention, Gilliam Nominee Spring 2021 - ongoing
Matthew Gill, Stanford Genetics, NSF GRFP Winter 2021
Angela Hickey, Stanford Genetics, NSF GRFP Autumn 2020
Danica Schmidtke, Stanford Microbiology and Immunology, NSF GRFP Winter 2020 - ongoing
Alanna Pyke, Stanford Genetics, NSF GRFP and RAISE fellow Winter 2020 - Summer 2022
Sam Hart, University of Washington MCB, NSF GRFP honorable mention Winter 2019
Patrick Nugent, University of Washington MCB Winter 2018

Mentor for Undergraduate and Postbaccalaureate Researchers
Jonathan Mulenga, Stanford University
Angelina Chan, HB Rex program, Goldwater scholar, Stanford University
Lubna Mullah, SSRP-Amgen Scholar, Dominican University of California
Andreea Jitaru, HB Rex Program, Stanford University
Juli Porto, HB Rex Program, Stanford University
Cara Ly, San Francisco State University
Audrey Yingwei Xu, HB Rex program, Stanford University
Paula Levan, University of Washington
Cynthis Wong, University of Washington, Herschel Roman Awardee and Mary Gates Scholar, MD at California University of Science and Medicine, currently resident at Baylor Orthopaedic Surgery

*All students presented their summer projects as posters and/or oral presentations to members of their host programs and as oral presentations to our lab.

ORAL PRESENTATIONS

2023 - Cornell FIRST Future Faculty Symposium, selected speaker
2023 - ICYGMB31 Yeast Florence meeting, selected abstract for oral presentation
2023 - Gordon Research Seminar Molecular Mechanisms in Evolution, Discussion Leader Easton MA
2023 - University of Massachusetts Amherst, invited speaker
2023 - Stanford Center for Genomics and Personalized Medicine annual symposium, invited talk
2023 - University of Kansas, invited speaker
2022 - University of Pittsburgh, invited speaker
2022 - HHMI Hanna Gray Fellows Program Science Meeting, pre-recorded talk and short live presentation, Janelia Research Campus, Ashburn VA
2021 - Invited speaker, Pittsburgh Area Microbial Pathogenesis seminar series, online
2021 - Invited speaker, California State University, Fresno, Department of Biology Colloquium seminar series, online
2020 - Invited speaker, Eastern Michigan University seminar series, online
2020 - EMBO Molecular Mechanisms in Evolution and Ecology, prerecorded talk, online
2019 - Gordon Research Seminar on Molecular Mechanisms in Evolution, Chair. Building inclusive lab communities: peer workshop, with Dr. Devon Fitzgerald. Curriculum developed with input from the Center for Improvement of Mentored Experiences in Research (CIMER), Easton MA
2015 - 2018 - American Indian Science and Engineering Society (AISES) National Conference (2015-2018)
- Awarded Excellence in Biology for graduate oral presentation, 2017
- Best Graduate Student Oral Presentation: Biology Track 2016
- Honorable Mention for graduate student oral presentation award 2015

2017 - Gordon Research Seminar on Molecular Mechanisms in Evolution, Easton MA
*Selected abstract for oral presentation, travel award and conference registration award
2016 - Friday Night Seminar series, Fred Hutchinson Cancer Center, Seattle WA
2016 - EMBO Experimental Approaches to Ecology and Evolution Using Yeast and Other Model Systems, platform talk, Heidelberg Germany
2016 - University of Washington, University of Tokyo Joint Symposium, University of Tokyo Graduate Program for Leaders in Life Innovation, Seattle WA

POSTER PRESENTATIONS

2023 - Gordon Research Conference and Seminar, Molecular Mechanisms in Evolution, Easton MA
2023 - HHMI Hanna Gray Fellows retreat, iPoster presentation, Janelia Research Campus, Ashburn VA
2022 - EMBO Molecular Mechanisms in Evolution Workshop, Heidelberg Germany
2020, 2021, 2022 - Stanford Genetics Department Retreat
2021 - SMBE international meeting, online
2021 - NHGRI trainee meeting, online
2020 - The Allied Genetics Conference 2020, online
2019 - Gordon Research Conference on Molecular Mechanisms in Evolution. Joint Chair for affiliated GRS meeting.
2018 - EMBO Experimental approaches to evolution and ecology using yeast and other model systems
*selected for poster award
2018 - SMBE meeting, Yokohama Japan (2018)
*abstract selected for a registration award
2014 - 2018 – Fred Hutchinson Cancer Center Basic Sciences retreat
*selected for poster award: 2015, 2018
2017 - Fred Hutchinson Cancer Research Center Scientific Advisory Board poster session
2017 - University of Washington Molecular and Cellular Biology program recruitment faculty poster session
2017 - Gordon Research Conference in Molecular Mechanisms of Evolution

2012 - co-presenter with Zhihao Tan, Genetics Society of America's Yeast Genetics and Molecular Biology Meeting, Princeton University
* selected for poster award in Chromosome Dynamics category

LEADERSHIP, SERVICE and CAREER DEVELOPMENT

2023 - Gordon Research Seminar for Molecular Mechanisms in Evolution, discussion leader

2022 - **Stanford Grant Writing Academy**, panelist for Hanna Gray workshop

2022 - Organized and led inclusive **mentoring skills workshop** for grad students, postdocs and faculty at annual retreat

2021, 2022 - **NIAID fellowship workshop**: resources for successful transition into research independence

2021, 2022 - Stanford **Genetics Department Retreat** organizing committee member

2021 - **Annual NHGRI Meeting** Research Training and Career Development, online

2021 - **Stanford Grant Writing Academy and Stanford Biosciences Student Association** – panelist for NIH NRSA Award workshop

2021 - Stanford Summer Research Program (**SSRP-Amgen Scholars) application reviewer and mentor**

2020, 2021- Genetics Society of America **Bridging Research and Education Workshop** (GSA BREW) attendee

2020, 2021 - Stanford Grant Writing Academy, Fellowship Application Bootcamp

2019 - **Elected joint Chair for Gordon Research Seminar** in Molecular Mechanisms in Evolution, 2019 meeting

2017 - 2019 **Student Liaison** to Fred Hutch Office of Education and Training, and UW MCB Program Operations

2018 - FHCC **Invited speaker student committee member** - selected and invited speakers for the ongoing Fred Hutch Current Biology Seminar series

2016 - 2019 - **MCB program Student Area Director** for Genetics, Genomics and Evolution: helped incoming graduate students select courses and rotation labs in area of interest, shaped MCB core curriculum offerings for subfield

2017 - Weintraub Award Selection Committee

2015 - **Co-organizer for Seattle Genetic Instability and Cancer Symposium**