

Meleah A. Hickman, Ph.D.

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Graduate Program of Genetics & Molecular Biology
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RESEARCH INTERESTS

Genome plasticity serves to generate genetic variation within a population of cells and provides the underpinnings for natural selection to facilitate adaptation. We investigate the genome dynamics of the yeast *Candida albicans*, a commensal that primarily resides in human gastrointestinal tracts, yet causes superficial infection in healthy individuals and serious infection in immunocompromised individuals and can rapidly acquire resistance to antifungal drugs. We are interested in characterizing the host and environmental drivers as well as the cellular mechanisms resulting in genomic alterations ultimately leading to fungal pathogen virulence and adaptation.

ACADEMIC POSITIONS

2020-present Director of Graduate Students, Program in Genetics & Molecular Biology
2014-present Assistant Professor, Department of Biology, Emory University
Graduate Program in Genetics and Molecular Biology (GMB)
Graduate Program in Population Biology, Ecology & Evolution (PBEE)
2011 Lecturer, University of Minnesota, MicB 3301 (Microbiology)
2010-2014 Postdoctoral fellow, University of Minnesota
Advisor: Judith Berman, PhD.

EDUCATION

2010 Ph.D., Genetics & Genomics, Duke University, Durham NC
Advisor: Laura Rusche, Ph.D.
2003 B.A./B.S. The Evergreen State College, Olympia WA
2001 A.A., South Puget Sound Community College, Olympia WA

PUBLICATIONS (G - graduate student author, U - undergraduate student author)

ORCID: 0000-0003-4237-6981

2020 Feistel D^G, Elmostafa R^U, and **MA Hickman**. Fungal virulence depends on interaction between pathogen ploidy and genetic background in healthy and immunocompromised hosts. *BioRxiv* <https://doi.org/10.1101/672519>; *in press, Ecology & Evolution*
Smith AC^G and **MA Hickman**, Host-Induced Genome Instability Rapidly Generates Phenotypic Variation across *Candida albicans* Strains and Ploidy States. *mSphere* **5**: e00433-20
Humphrey KM, Zhu L, **Hickman MA**, Hasan S, Maria H, Liu T, and LN Rusche. Evolution of distinct responses to low NAD⁺ stress by rewiring the Sir2 deacetylase network in yeasts. *Genetics* 214: 855-68.
2019 Avramovska O^G and **MA Hickman**. The magnitude of *Candida albicans* stress-induced genome instability results from an interaction between ploidy and antifungal drugs. *G3* **9**:4019-4027

- Feistel D^G, Elmostafa R^U, Nguyen N^U, Penley M, Morran L. and **MA Hickman**. A novel virulence phenotype rapidly assesses *Candida* fungal pathogenesis in healthy and immunocompromised *Caenorhabditis elegans* hosts. *mSphere*, 4:e00697-18
- 2017 Gerstein AC, Lim H, Berman J, & **MA Hickman**. Ploidy tug-of-war: evolutionary and genetic environments influence the rate of ploidy drive in a human fungal pathogen. *Evolution*, 71: 1025-1038
- 2016 Ciudad T, **Hickman MA**, Bellido A, Berman J, & G Larriba. The Phenotypic Consequences of a Spontaneous Loss of Heterozygosity in a Common Laboratory Strain of *Candida albicans*. *Genetics*, 203: 1161-1176.
- 2015 **Hickman MA**, Paulson C, Dudley A & J Berman. Parasexual ploidy reduction drives population heterogeneity through random and transient aneuploidy in *Candida albicans*. *Genetics*, 200: 781–794.
Press Coverage: Recommended in Faculty of 1000
- 2014 Tsai HJ, Baller JA, Liachko I, Koren A, Burrack LS, **Hickman MA** Thevandavakkam MA, Rusche LN, Dunham MJ, & J Berman. Origin replication complex binding, nucleosome depletion patterns and a primary sequence motif can predict origins of replication in a genome with epigenetic centromeres. *mBio*, 5: e01703-14.
- 2013 **Hickman MA**, Zeng G, Forche A, Hiraikawa MP, Abbey D, Harrison BD, Wang YM, Su CH, Bennett RB, Wang Y, & J Berman. The ‘obligate diploid’ *Candida albicans* forms mating-competent haploids. *Nature*, **494**: 55-59.
Press Coverage: Gow, N. (2013) Multiple mating strategies. Nature, 494: 45-46. Recommended in Faculty of 1000
- 2011 Abbey D, **Hickman MA**, Gresham D, & J Berman. High-Resolution SNP/CGH Microarrays Reveal the Accumulation of Loss of Heterozygosity in Commonly Used *Candida albicans* Strains. *G3*, 1: 523-530
- Hickman MA**, Froyd CA, & LN Rusche. Reinventing heterochromatin in budding yeasts: Sir2 and the origin recognition complex take center stage. *Euk Cell*, 10(9): 1183-92
- 2010 **Hickman MA** & LN Rusche. Transcriptional silencing functions of the yeast protein Orc1/Sir3 subfunctionalized after gene duplication. *PNAS*, 107(45): 19384-9
- 2009 **Hickman MA** & LN Rusche. The Sir2-Sum1 complex represses transcription using both promoter-specific and long-range mechanisms to regulate cell identity and sexual cycle in the yeast *Kluyveromyces lactis*. *PLoS Genetics*, 5: e1000710
- 2007 **Hickman MA** & LN Rusche. Substitution as a Mechanism for Genetic Robustness: the Duplicated Deacetylases Hst1p and Sir2p in *Saccharomyces cerevisiae*. *PLoS Genetics*, 3: e126
Press Coverage: Louis, EJ. (2007) Evolutionary genetics: Making the most of redundancy. Nature, 449: 673-674.
- Hickman MA** & LN Rusche. (2007). “Evolution of Silencing at the Mating-Type Loci in Hemiascomycetes” J. Heitman, JW Taylor, JW Kronstad and LA Casselton (eds) Sex in Fungi: Molecular Determination and Evolutionary Implications. ASM Press

AWARDS & GRANTS

- 2020-2024 NSF CAREER (DEB-1943415) Role: PI. Total funds \$1,104,310
- 2017-2020 NSF GRFP awarded to Ognenka Avramovska. Role: Sponsor
- 2014 DeLill Nasser Award for Professional Development in Genetics, GSA

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- 2013 Outstanding Postdoctoral Scholar Award, University of Minnesota
2011-2013 NIH F32 NRSA fellowship (F32 GM096536-01A1, NIGMS). Sponsor: Judith Berman
2003 Evergreen Foundation Grant, Sponsor: Nancy Murray, Ph.D. 2003

PRESENTATIONS

Invited Research Talks

- 2020 Mt. Desert Island Biological Labs 2nd Workshop on Polyploidy in Organ Development, Repair and Disease, Bar Harbor, ME
October 9-11, 2020, *postponed due to COVID-19*
Cold Spring Harbor Laboratory Yeast Genetics & Genomics, Blackford NY
July 23 – August 6, 2020, *postponed due to COVID-19*
Microbiology Society Conference on Candida & Candidiasis, Montreal, Canada
April 19-23, 2020, *postponed due to COVID-19*
- 2019 Emory University, Biology Department, Atlanta GA
November 26, 2019 “(para)sex, drugs & virulence: ploidy dynamics in an opportunistic pathogen”
University of Arkansas, Department of Biological Sciences, Fayetteville, AK
April 18, 2019 “Ploidy Dynamics of an Opportunistic Fungal Pathogen”
- 2018 University of Birmingham, Host & Pathogen Interactions, Birmingham, United Kingdom
June 25 – 28, 2018 “Interactions between host immune status and pathogen ploidy in Candida infections”
Genetics Society of America South Eastern Mycology Symposium, Athens GA
March 31, 2018 “Oh, The Ploidies You’ll Go!”
Plant and Animal Genome Sciences XXVI, Polyploidy workshop, San Diego, CA
January 13-17, 2018 “Ploidy Dynamics of an Opportunistic Pathogen”
- 2017 University Program in Genetics and Genomics, Duke University, Durham NC
December 12, 2018 “Oh, The Ploidies You’ll Go!”
European Molecular Biology Organization Conference on Comparative Genomics of Eukaryotic Microbes, Sant Feliu de Guixols, Spain
October 14-19, 2018 “Ploidy Dynamics of an Opportunistic Pathogen”
Department of Genetics, University of Wisconsin, Madison, WI
October 4, 2018 “Ploidy Dynamics of an Opportunistic Pathogen”
Department of Genetics, University of Georgia, Athens, GA
April 5, 2018 “What’s Sex Got to do With it? Generating variation in an opportunistic fungal pathogen”
- 2016 Department of Microbiology, University of Georgia, Athens, GA
March 31, 2016 “What’s Sex Got to do With it? Generating variation in an opportunistic fungal pathogen”
- 2015 Department of Biochemistry, Emory University, Atlanta, GA
February 19, 2015 “What’s Sex Got to do With it? Generating variation in an opportunistic fungal pathogen”
- 2014 Department of Biology and Biotechnology, Worcester Polytechnic Institute, Worcester, MA
November 4, 2014 “Generating Genetic Diversity in an opportunistic fungal pathogen”
Department of Biology, Emory University, Atlanta, GA
February 20, 2014 “Generating Genetic Diversity in an opportunistic fungal pathogen”
Department of Biology, Clemson University, Clemson, SC

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- February 18, 2014 *“Generating Genetic Diversity in an opportunistic fungal pathogen”*
 Department of Medical Microbiology, Washington University at St. Louis, St. Louis, MI
 February 11, 2018 *“Generating Genetic Diversity in an opportunistic fungal pathogen”*
- 2013 Department of Biological Sciences, SUNY Buffalo, Buffalo, NY
 October 10, 2013 *“What’s Sex Got to do With it? Generating variation in an opportunistic fungal pathogen”*
- 2012 Department of Molecular Microbiology & Biotechnology, Tel Aviv University, Tel Aviv, Israel
 October 23, 2012 *“Dramatic Ploidy Shifts in Candida albicans”*

Contributed Research Presentations

- 2019 Federation of European Biochemical Societies 8th Advanced Lecture Course on Human Fungal Pathogens, Nice, France
 May 18-24, 2019 *“Host immune function impacts genome and ploidy dynamics of Candida albicans”* (poster)
- Genetics Society of America 30th Conference on Fungal Genetics, Asilomar CA
 March 12-19, 2019 *“Host immune status modulates fungal pathogen virulence and genome stability”* (poster)
- 2018 Mt. Desert Island Biological Labs Workshop on Polyploidy in Organ Development, Repair and Disease, Bar Harbor, ME
 October 13-14, 2018 *“Virulence of a fungal pathogen depends on pathogen ploidy and host immune status”* (talk)
- Genetics Society of America 2nd Conference on Population, Evolutionary & Quantitative Genetics, Madison WI
 May 13-17, 2018 *“Impact of pathogen ploidy and genotype on virulence within a nematode host system”* (poster)
- American Society of Microbiology 14th Conference on Candida & Candidiasis, Providence, RI
 April 15-19, 2018 *“Impact of Candida albicans Ploidy on Pathogenesis Depends on Host Immune Status”* (talk)
- 2017 Gordon Research Conference on Molecular Mechanisms of Evolution, Easton, MA
 June 11-15, 2017 *“Ploidy tug-of-war: evolutionary and genetic environments influence the rate of ploidy drive in a human fungal pathogen”* (poster)
- 2016 Genetics Society of America The Allied Genetics Conference, Orlando, FL
 July 13-17, 2016 *“Ploidy tug-of-war: evolutionary and genetic environments influence the rate of ploidy drive in a human fungal pathogen”* (talk)
- Gordon Research Conference on Cellular & Molecular Fungal Biology, Holderness, NH
 June 19-24, 2016 *“Ploidy tug-of-war: evolutionary and genetic environments influence the rate of ploidy drive in a human fungal pathogen”* (talk)
- 2015 Gordon Research Conference on Molecular Mechanisms of Evolution, Easton, MA
 June 28-July 3, 2015 *“Heterogeneity in ‘clonal’ populations”* (talk)
- 2014 Genetics Society of America Conference on Yeast Genetics & Molecular Biology Meeting, Seattle, WA
 July 29-August 3 2014 *“Polyploidy drives population heterogeneity through random chromosome loss”* (talk)
- American Society of Microbiology 12th Conference on Candida & Candidiasis, New Orleans, LA *Honored as a top talk by a young investigator
 March 26-30 2014 *“Polyploidy drives population heterogeneity”* (talk)
- 2013 Cold Spring Harbor Laboratories Meeting on Microbial Pathogenesis & Host Response

Cold Spring Harbor, NY
September 17-21, 2013 *“Discovery of a viable, avirulent haploid state in Candida albicans”* (talk)

Federation of European Biochemical Societies 5th Advanced Lecture Course on Human Fungal Pathogens: Molecular Mechanisms of Host-Pathogen Interactions & Virulence, Nice, France, May 25-31, 2013 *“Dramatic ploidy shifts in C. albicans”* (talk)

- 2012 European Molecular Biology Organization Conference on Experimental Approaches to Evolution & Ecology using Yeast, Heidelberg, Germany
October 17-21, 2012 *“Obligate diploid no more: Candida albicans forms mating-competent haploids”* (poster)
- Gordon Research Conference on Cellular & Molecular Fungal Biology, Holderness, NH
June 17-22, 2012 *“Dramatic ploidy shifts in Candida albicans”* (talk)
- 2011 Genetics Society of America 26th Fungal Genetics Conference, Asilomar, CA
March 15-20, 2018 *“Genome-wide Identification of Replication Origins in Candida albicans”* (talk)
- 2008 European Molecular Biology Organization Workshop on Evolutionary & Environmental Genomics of Yeasts, Heidelberg, Germany
October 1-5, 2008 *“Gene Duplication and the Evolution of SIR Silencing”* (talk)
- Genetics Society of America Conference on Yeast Genetics & Molecular Biology, Toronto, Canada
July 22-27, 2008 *“Gene Duplication and the Evolution of SIR Silencing”* (talk)
- 2007 Federation of American Societies for Experimental Biology Summer Research Conference on Chromatin & Transcription, Snowmass Village, CO
July 7-12, 2007 *“Gene Duplication and the Evolution of Gene Repression Mechanisms”* (poster)
- 2006 Federation of American Societies for Experimental Biology Summer Research Conference on Transcriptional Regulation during Cell Growth, Differentiation & Development, Saxton’s River, VT
August 12-17, 2006 *“Duplicate Gene Pairs: Functional Diversity or Functional Redundancy? A case in transcriptional repression”* (poster)

TEACHING (at Emory University unless otherwise noted)

I serve as an educator in many capacities: both in the undergraduate and graduate student classroom and in my research laboratory where I have mentored scientists at all stages, including high school, college, graduate and postdoctoral trainees. The motivation underpinning my educational activities is to engage students/trainees in scientific principles and research practices, and to facilitate their independence in scientific literacy and thinking, collaboration, and communication.

Courses

- 2020 Spring: BIO264 Genetics: From a human perspective
BIO 499R Research mentor, Emily Rego
IBS 706-2: Ethical Conduct in Research (GMB)
- 2019 Fall: BIO 385W: So you have some data ... now what?
BIO 499R Research mentor, Emily Rego
- Spring: BIO 499 Research mentor, Nia Lucas
IBS 706-2: Ethical Conduct in Research (GMB)
- 2018 Fall: BIO 499R Research mentor, Judy Dinh, Qiulin Li, Nia Lucas
- Spring: BIO 264: Genetics: From a human perspective
BIO 499R Research mentor, Qiulin Li, Judy Dinh

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2017 IBS 706-2: Ethical Conduct in Research (GMB), co-taught with Bing Yao
 Fall: PBEE 790r: Practice of Science, co-taught with Nicole Gerardo
 BIO 499R Research mentor, Nancy Nguyen
 Spring: IBS 706-2: Ethical Conduct in Research (GMB), co-taught with Guy Benian

2016 Fall: BIO 264: Genetics: From a human perspective
 BIO 499R Research mentor, Mimi Wang
 NBB 499R Research mentor, Jennifer Lenchner
 Spring: BIO 264: Genetics: From a human perspective, co-taught with Gray Crouse
 BIO 499R Research mentor, Mimi Wang, Panyachote Ketyungyoenwong
 NBB 499R Research mentor, Jennifer Lenchner

2015 Fall: IBS 515: Current Topics in Molecular Genetics, co-taught with Roger Deal
 PBEE 790r: Practice of Science, co-taught with Nicole Gerardo

2011 Su: MicB 3301: Microbiology, University of Minnesota

2008 Spring: BIO 118: Molecular Biology and Genetics (TA), Duke University

2007 Spring: Biochem 228: Intro Biochem II, (TA), Duke University

2003-2004 AY: Molecule to Organism (Biology TA), The Evergreen State College

Scientific Mentoring (*female, *URM)

Postdoctoral associates (1):

Jennifer M. Mason*, 2016-2017

Graduate students (4):

Current (3): Ognenka Avramovska* 2016 – present (GMB, T32 awardee, NSF GRFP awardee)
 Amanda Shurzinske* 2018-present (GMB)
 Lauren Hodkinson* 2019-present (GMB)

Former (1): Dorian Feistel (PBEE), 2015-2017 graduated with MSc - “*Ploidy & Allelic Variation Affects Fungal Pathogen Virulence in a Nematode Host*”

Rotation students (8): Lauren Hodkinson* (GMB), Ellen Krall* (GMB), Taylor Smith** (GMB),
 Amanda Shurzinske* (GMB), Kari Mattison* (GMB), Douglas Terry
 (GMB), Ognenka Avramovska* (GMB), Alyssa Scott* (GMB)

Undergraduate students (16):

Current (2): Mehnez Shafquat*, Emily Rego*

Former (14): Katharine Greene* (summer student, Boston University), Rohan Kanakamedala, Nia Lucas*, Sarah Hernandez*, Judy Dinh*, Qiulun (Jasmine) Lin*, Dahlia Walters** (summer student, University of Chicago), Nancy Nguyen*, Lin Jiang*, Rema Elmostafa* (awarded Emory URP grant), Panyachote Ketyungyoenwong, Jennifer Lenchner*, Mimi Wang*, Talent Chaunzwa+ (summer student, Duke University)

High school students (5):

Current (0):

Former (5): Alan Huynh, Victoria Lamar**, Maya Chande*, Ishani Rao*, Bernabe Becerra**

Graduate thesis committees (6):

GMB - *Current*: Kari Mattison*, Alyssa Scott*

Former: Taylor Smith** (MSc Su20), Sara Mereby* (MSc, F17), Shannon Torres* (PhD, Sp 18)

Ga Tech: April Miguez*

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Graduate qualifying exam committees (14):

GMB: Taylor Smith**, Kari Mattison*, Christy Kinney*, Sarah Curtis*, Sara Mereby*, Alyssa Scott*, Hari Somineni, Sarah Whelan*

PBEE: Ashley Alexander, Nick Johnson, Erika Harris**, Travis Dynes, Timothy O'Sullivan+, Kathryn Schaber*

Undergraduate honors thesis committees (5):

Current (2): Arthur Menezes (Biology), Becca Anderson (Biology)

Former (3): Stephanie Pintas* (Human Health), Joan Shang* (Biology), Sasicha Manupipatpong* (Biology)

Community Outreach/Service

Emory College/University:

2018 STEM Symposium sub-committee
2018 GMB Scholar Selection Committee
2017 – present GMB Ethics Seminar course director
2017 – 2018 Biology Search Committee – Tenure Track Position in Biology (hired: Dr. Leila Reider)
2017 – 2018 Science Art Wonder (SAW) mentor
2017 – 2019 GMB Qualifying Exam Committee
2017 Biology Graduate Student Scholar Selection Committee
2016 - 2017 Biology Search Committee – Tenure Track and Lecture Track Cluster Hire in Natural Sciences (hired: Dr. Nic Vega)
2016 - present Biology department reviewer for undergraduate admissions
2015 – present Graduate Program in Genetics and Molecular Biology Admissions Committee
2015 – present Graduate Program in Population Biology Admissions Committee
2015 – present Mentor for SOAR program
2015 – 2017 TATTO advisory committee

Outside Emory

2019-2020 Scientific Program Committee and Session Chair (Genome Dynamics, Variation & Evolution) 2020 Conference on Candida & Candidiasis
2019 Session Organizer & Chair (Genome evolution and epidemiology) FEBS Advanced Lecture Course on Human Fungal Pathogens
2019 Session Chair (DNA & genome stability) 26th South East Regional Yeast Meeting
2018 – 2019 Co-organizer, 26th South East Regional Yeast Meeting
2018 Session Chair (Cell cycle & chromosome segregation fidelity) Mt. Desert Island Biological Labs Workshop on Polyploidy in Organ Development, Repair and Disease, Bar Harbor, ME
2016 Panelist, "Negotiating Job Offers" Genetics Society of America, The Allied Genetics Conference, Orlando FL, July 13-17, 2016

Ad hoc reviewer

Granting Agencies

National Science Foundation (NSF)
Israeli Science Foundation (ISF)

Scientific Journals

Current Biology mBio
Ecology & Evolution mSphere
FEMS Yeast Research Nature Communications

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G3
Genes
Genetics
Genome Biology & Evolution
JoVE
Molecular Biology & Evolution

PLoS Genetics
PLoS One
PNAS
Science
Scientific Reports

Memberships

Atlanta Society for Mentors (ASOM)
American Society for Microbiology (ASM)
Genetics Society of America (GSA)
Women in Science at Emory (WiSE)