Micah J. Ferrell

EDUCATION

2020 **Ph.D., Biological Science**
University of Notre Dame
Dissertation Title: "Investigations of the Virulence Mechanisms of *Mycobacterium marinum*"
Research Advisor: Patricia Champion

2008 **M. S., Microbiology Molecular Biology and Biochemistry**
University of Idaho
Thesis Title: “Interaction Analysis of Intraflagellar Transport Proteins”
Research Advisor: Douglas Cole

2007 **B. S., Molecular Biology and Biochemistry**
University of Idaho
Computer Science Minor

LABORATORY EXPERIENCE

2021-Present **Postdoctoral Fellow**
Michigan State University, East Lansing MI
Studying nucleotide depletion as part of phage-defense systems in bacteria. Investigating dinucleotide synthesis and function in eukaryotes.

2020-2021 **Postdoctoral Fellow**
Washington University, St. Louis MO
Studied the type IV secretion system of *Legionella pneumophilla* focusing on the chaperones associated with the DotL ATPase.

2014-2020 **PhD Student**
University of Notre Dame, Notre Dame IN
Studied the mycobacterial ESX-1 protein secretion system and its effectors. Utilizing *in vitro* protein expression and enzymatic assays I identifed enzymes responsible for post-translational modification of secreted virulence factors. Characterized the transcription factor EspM biochemically and genetically.

2012-2014 **Oilfield Chemist**
Intertek Prudhoe Bay Laboratory, Prudhoe Bay AK
Analyzed water and oil samples using ion exchange chromatogrpahy and ICP-AES spectromety. Job involved working in a remote Arctic oil field in three week shifts of 12-hour days.

2009-2012 **Protein Technician**
Seattle Biomedical Research Institute, Seattle WA
Worked in a protein production core laboratory supporting research programs across the institute. Designed and implemented protein expression strategies using prokaryotic and eukaryotic systems. Primary duties involved high-throughput purification of recombinant proteins using ÄKTA FPLC systems as part of the Seattle Structural Genomics Center for Infectious Disease structural biology program.

2004-2008 **MS Student**
University of Idaho, Moscow ID
Mapped protein-protein interactions between subunits of the intraflagellar transport particles of *Chlamydomonas reinhardtii*. Employed a strategy of deletional analysis and bacterial coepxression to identify key interaction domains of a supramolecular complex.

PUBLICATIONS

Ferrell MJ, Waters CM. Slings and arrows: sRNAs mediate intragenomic competition. *Cell Host Microbe.* 2024 May 8;32(5):634-636

Hsueh BY, **Ferrell MJ**, Sanath-Kumar R, Bedore AM, Waters CM. Replication cycle timing determines phage sensitivity to a cytidine deaminase toxin/antitoxin bacterial defense system. *PLoS Pathog.* 2023 Sep 8;19(9)

Tai JB*, **Ferrell MJ***, Yan J, Waters CM. New Insights into *Vibrio cholerae* Biofilms from Molecular Biophysics to Microbial Ecology. *Adv Exp Med Biol.* 2023;1404:17-39. *co-first authors

Cronin RM, **Ferrell MJ**, Cahir CW, Champion MM, Champion PA. Proteo-genetic analysis reveals clear hierarchy of ESX-1 secretion in *Mycobacterium marinum*. *Proc Natl Acad Sci* U S A. 2022 Jun 14;119(24)

Sanchez KG*, **Ferrell MJ***, Chirakos AE, Nicholson KR, Abramovitch RB, Champion MM, Champion PA. EspM is a conserved transcription factor that regulates gene expression in response to the ESX-1 system. *mBio.* 2020 Jan/Feb; 11(1):02807-19. *co-first authors

Norris-Mullins B, Krivda JS, Smith KL**, Ferrell MJ**, Morales MA. *Leishmania* phosphatase PP5 is a regulator of HSP83 phosphorylation and essential for parasite pathogenicity. *Parasitol Res.* 2018 Sep;117(9):2971-2985.

Bosserman RE, Nguyen TT, Sanchez KG, Chirakos AE, **Ferrell MJ**, Thompson CR, Champion MM, Abramovitch RB, Champion PA. WhiB6 regulation of ESX-1 gene expression is controlled by a negative feedback loop in *Mycobacterium marinum*. *Proc Natl Acad Sci* U S A. 2017 Dec 12;114(50)

Williams EA, Mba Medie F, Bosserman RE, Johnson BK, Reyna C, **Ferrell MJ**, Champion MM, Abramovitch RB, Champion PA.
A nonsense mutation in *Mycobacterium marinum* that is suppressible by a novel mechanism. *Infection and Immunity.* 2017 Jan 26;85(2). pii: e00653-16. doi: 10.1128/IAI.00653-16.

Baugh L, Phan I, Begley DW, Clifton MC, Armour B, Dranow DM, Taylor BM, Muruthi MM, Abendroth J, Fairman JW, Fox D 3rd, Dieterich SH, Staker BL, Gardberg AS, Choi R, Hewitt SN, Napuli AJ, Myers J, Barrett LK, Zhang Y, **Ferrell M**, Mundt E, Thompkins K, Tran N, Lyons-Abbott S, Abramov A, Sekar A, Serbzhinskiy D, Lorimer D, Buchko GW, Stacy R, Stewart LJ, Edwards TE, Van Voorhis WC, Myler PJ. Increasing the structural coverage of tuberculosis drug targets. *Tuberculosis (Edinburgh)* 2015 Mar;95(2):142-8

Ferrell M, Abendroth J, Zhang Y, Sankaran B, Edwards TE, Staker BL, Van Voorhis WC, Stewart LJ, Myler PJ. Structure of Aldose Reductase from *Giardia lamblia*. *Acta chrystallographica Section F* 2011 Sep 1;67(Pt 9):1113-7

PRESENTATIONS

Don't Panic: Host homeostasis as a regulator of a toxin-antitoxin phage defense system. Micah J. Ferrell, Aubree C. Muthel, Christopher M. Waters. Talk, ASM Microbe 2024; June 13th-17th 2024, Atlanta, GA, USA

Characterization of the Enzymatic Activities of the AvcD Phage-Defense Enzymes. Talk, Michigan ASM Meeting; April 6th 2024, Ann Arbor, MI USA

Characterizations of AvcD Phage-Defense Cytosine Deaminases. Micah J. Ferrell, Brian Y. Hsueh, Aubree C. Muthel, Christopher M. Waters. Poster, 29th Midwest Microbial Pathogenesis Conference; October 20th -22nd 2023, Chicago, IL, USA

Characterizations of AvcD Phage-Defense Cytosine Deaminases. Micah J. Ferrell, Brian Y. Hsueh, Aubree C. Muthel, Christopher M. Waters. Poster, 2023 Microbial Adhesion and Signal Transduction Gordon Research Conference; July 16th-21st 2023, Newport, RI, USA

Characterizations of AvcD Phage-Defense Cytosine Deaminases. Micah J. Ferrell, Brian Y. Hsueh, Aubree C. Muthel, Christopher M. Waters. Poster, 2023 Microbial Adhesion and Signal Transduction Gordon Research Seminar; July 15th-16th 2023, Newport, RI, USA

Biochemical Characterizations of AvcD Phage-Defense Cytosine Deaminases. Micah J. Ferrell, Brian Y. Hsueh, Aubree C. Muethel, Christopher M. Waters. Poster, 28th Midwest Microbial Pathogenesis Conference; September 30th-October 1st 2022, Madison, WI, USA

Biochemical Characterizations of AvcD Phage-Defense Cytosine Deaminases. Micah J. Ferrell, Brian Y. Hsueh, Aubree C. Muethel, Christopher M. Waters. Poster, Molecular Genetics of Bacteria and Phages; August 1st-5th 2022, Madison, WI, USA

Quantification and Characterization of N-terminal Protein Acetylation in Pathogenic Mycobacteria. Micah J. Ferrell, Cristal Reyna, Matthew M. Champion, Patricia A. Champion. Poster, Keystone Symposium on Tuberculosis: Mechanisms, Pathogenesis and Treatment; January 17th-21st 2019, Banff, Alberta, Canada

Characterization of N-terminal Protein Acetylation in Pathogenic Mycobacteria
Micah J. Ferrell, Cristal Reyna, Matthew M. Champion, Patricia A. Champion. Poster, 12th Cold Spring Harbor Meeting on Microbial Pathogenesis and Host Response; September 10th-14th 2019, Cold Spring Harbor, New York, USA

Characterization of N-terminal Protein Acetylation in Pathogenic Mycobacteria
Micah J. Ferrell, Cristal Reyna, Matthew M. Champion, Patricia A. Champion. Poster, 26th Midwest Microbial Pathogenesis Conference; September 20th-22nd 2019, Toledo, Ohio, USA

Genetic Analysis of ESX-1 Substrates Reveals Complex Secretory Phenotypes in Mycobacteria. Micah J. Ferrell, Alexandra E. Chirakos, Matthew M. Champion, Patricia A. Champion. Poster, 25th Annual Midwest Microbial Pathogenesis Conference; September 29th 2018, Iowa City, IA, USA

Genetic Analysis of ESX-1 Substrates Reveals Complex Secretory Phenotypes in Mycobacteria. Micah J. Ferrell, Alexandra E. Chirakos, Matthew M. Champion, Patricia A.

Champion. Poster, Molecular Genetics of Bacteria and Phages; August 9th 2018, Madison, WI, USA

Identification of an N-acetyl Transferase from *Mycobacterium marinum* with Activity Towards the Virulence Factor EsxA (ESAT-6). Micah J. Ferrell, Matthew M. Champion and Patricia A. Champion, Poster, Biology of Intracellular Pathogens Retreat; June 23rd 2017, Indianapolis, IN, USA

Identification of an N-acetyl Transferase from *Mycobacterium marinum* with Activity Towards the Virulence Factor EsxA (ESAT-6). Micah J. Ferrell, Matthew M. Champion and Patricia A. Champion. Poster, 2017 Molecular Genetics of Bacteria and Phages; August 9th 2017, Madison, WI, USA

Identification of an N-acetyl Transferase from *Mycobacterium marinum* with Activity Towards the Virulence Factor EsxA (ESAT-6). Micah J. Ferrell, Matthew M. Champion and Patricia A. Champion. Poster, 24th Annual Midwest Microbial Pathogenesis Conference; August 26th 2017, Notre Dame, IN, USA

Differential N-Terminal Acetylation of S18 Paralogs by *Mycobacterium marinum* RimI. Micah J. Ferrell, Matthew M. Champion, Patricia A. Champion. Poster, 23rd Annual Midwest Microbial Pathogenesis Conference; September 23-25, 2016; Urbana, IL, USA

Differential N-Terminal Acetylation of S18 Paralogs by *Mycobacterium marinum* RimI. Micah J. Ferrell, Matthew M. Champion, Patricia A. Champion. Poster, 2016 Molecular Genetics of Bacteria & Phages Meeting; August 8-13, 2016; Madison, WI, USA

GRANTS AND FELLOWSHIPS

2024	**Peggy Cotter Travel Award**, American Society for Microbiology
2023	**Dylan Mortimer Student Travel Award**, Hunt for a Cure Targeting Cystic Fibrosis
2022	**Dell Postdoctoral Research Fellowship**, MSU College of Osteopathic Medicine
2019	**Catalyst Grant,** Center for Rare and Neglected Diseases
2019	**Conference Attendance Grant**, Keystone Future of Science Fund Scholarship
2018	**Conference Attendance Grant**, Notre Dame Graduate Student Union
2016, 2017	**Eck Global Health Fellowship**, Eck Institute for Global Health (renewed)

SERVICE AND OUTREACH

2024	**Poster Judge**, Mid-Michigan Symposium for Undergraduate Research Experiences (Mid-SURE)
2024	**Poster Judge**, MSU University Undergraduate Research and Arts Forum
2023-2024	**Faculty Search Committee**, MSU Department of Microbiolgy Genetics & Immunology
2023	**Poster Judge**, MSU University Undergraduate Research and Arts Forum
2023, 2024	**Scientific Demonstrator**, Murphy Elementary Science Night
2023	**Scientific Demonstrator**, MSU Science Festival
2023	**Poster Judge**, MI-ASM 2023 Meeting
2017-2018	**President**, Notre Dame Science Policy Initiative
2017	**Scientific Demonstrator**, Paradigm Shift
2016-2017	**Discussion Moderator**, Notre Dame Biophysics Journal Club
2015-2019	**Judge**, Northern Indiana Regional Science Fair
2010-2012	**School Tour Guide**, Bioquest Program, Seattle Biomedical Research Institute

TEACHING

2019	**Course Development Assistant**, Undergraduate Molecular Biology Lab, University of Notre Dame
2018	**Teaching Assistant**, Introductory Biology, University of Notre Dame
2015-2019	**Guest Lecturer**, Genetics, University of Notre Dame
2014	**Laboratory Teaching Assistant**, Genetics, University of Notre Dame

MENTORING

Undergraduate Students

2023-2024	Aubree C. Muthel, microbiology
2019-2020	Jack Garcia, undergraduate, biology
2018-2020	Clare W. Cahir, chemistry; graduate student in microbiology at Rockefeller University
2018	Ciara Walsh, summer student; graduate student in medicine at University College Dublin
2017-2018	Su Jean Park, mathematics; senior associate PwC

Rotation Students

2023	Jisung Park
2022	Hazel McGuffin

2017	Kathleen Nicholson, William McManus
2016	Lindsay Seren, Daniel Hammers

PROFESSIONAL MEMBERSHIPS

American Chemical Society, 2003-present
Association for Computing Machinery, 2005-present
American Association for the Advancement of Science, 2005-present
American Society for Microbiology, 2006-present