

Zachary Holmes

zholmes23@gmail.com
zachary-holmes.com

Education

- 2016–2021 **Duke University, PhD**, Molecular Genetics and Microbiology
Thesis: Dietary Manipulation of Metabolic Function in the Human Gut Microbiome
Mentor: Lawrence David
- 2010–2014 **University of Georgia, BS**, Ecology & Biology
summa cum laude, Highest Honors

Skills

- Research
- Team leadership (scientific lead for lab's first human study)
 - Human studies design
 - Human gut microbiome
 - Chemostat bioreactor / *ex vivo* fermentations / bacterial culture
 - Next generation sequencing: sample processing through analysis
 - Assay development
 - Gas chromatography
 - Preclinical murine study design and analysis
- Computational
- Bioinformatics (16S amplicon sequencing, metagenomics)
 - Multi-omics data integration
 - Multivariate methods (co-inertia, LDA)
 - Machine learning (random forest, unsupervised clustering)
 - Generalized linear mixed models
 - R (ape, vegan, lme4, ALDEx2, ggplot2)
 - Python (pandas, seaborn)
 - Unix / High Performance Computing

Recent Experience

- 2021 **The Bioinformatics CRO**
BIOINFORMATICS CONSULTANT - FREELANCE
- Specialized in analysis of metagenomic data from human microbiomes
 - Developed bioinformatic pipelines to meet client needs
 - Implemented machine learning solutions and visualizations to classify samples

- 2016 – 2021 **Duke University**, *Department of Molecular Genetics and Microbiology*
PHD CANDIDATE *Mentor: Dr. Lawrence David*
- Designed and led a human dietary intervention microbiome study
 - Oversaw IRB compliance, participant engagement, sample processing for human study
 - Independently analyzed targeted metagenomic, metabolomic, and clinical data sets
 - Established targeted metabolomic capacity for our lab
 - Developed novel *in vitro* prebiotic fermentation assay
 - Led collaboration with clinical and murine studies team on graft-versus-host disease
 - Analyzed impact of microbiome on bone marrow transplant outcomes
- 2014–2016 **Centers for Disease Control and Prevention**, *Rickettsial Zoonoses Branch*
ORISE RESEARCH FELLOW *Mentor: Dr. Gregory Dasch*
- Developed and implemented high-throughput sequencing and bioinformatic pipeline
 - Led multi-locus sequence typing project for *Francisella*-like tick endosymbionts
 - Assisted with *de novo* assembly of tick endosymbiont genomes
- 2011–2014 **University of Georgia**, *Center for Tropical and Emerging Global Diseases*
RESEARCH ASSISTANT *Mentor: Dr. Boris Striepen*
- Human host cell and apicomplexan parasite culture
 - Molecular biologist (PCR, qPCR, cloning, Western) for *Toxoplasma gondii* studies

Honors & Awards

- 2019 Duke MGM Distinguished Fellows Travel Award
- 2017 DoD National Defense Science and Engineering Graduate Fellowship
- 2017 NSF Graduate Research Fellowship [*declined*]
- 2014 Odum School of Ecology Global Scholars Fund
- 2013 University of Georgia Amazing Student
- 2013 John J. Scarano Memorial Scholarship
- 2013 Brittney Fox Watts Memorial Scholarship
- 2013 Long Island University Summer Research Internship award
- 2012 NSF Research Experience for Undergraduates award
- 2012 University of Georgia Honors International Scholar Program award

Publications

- 12 **Holmes ZC**, Tang H, Liu C, Bush A, Neubert BC, Jiao Y, Covington M, Cardona DM, Chen BJ, Chao NJ, David LA, Sung AJ. (2021) Prebiotic galactooligosaccharides interact with the gut microbiota to attenuate acute graft-versus-host disease. *submitted*
- 11 **Holmes ZC**, Villa MM, Durand HK, Jiang S, Dallow EP, Petrone BL, Silverman JD, Lin PW, David LA. (2021) Microbiota Responses to Different Prebiotics are Conserved Within Individuals and Associated with Habitual Fiber Intake. *bioRxiv*
- 10 Letourneau J, **Holmes ZC**, Dallow EP, Durand HK, Jiang S, Gupta S, Mincey AC, Muehlbauer MJ, David LA. (2021) Ecological Memory of Prior Nutrient Exposure in the Human Gut Microbiome. *bioRxiv*

- 9 Becken B, Davey L, Middleton D, Mueller KD, Sharma A, **Holmes ZC**, Dallow EP, Remick B, Barton GM, David LA, McCann JR, Armstrong SC, Malkus P, Valdivia RH. (2021) Genotypic and Phenotypic Diversity Among Human Isolates of *Akkermansia muciniphila*. *mBio*
- 8 **Holmes ZC**, Silverman JD, Dressman HK, Zhengzheng W, Dallow EP, Armstrong SC, Seed PC, Rawls JF, David LA. (2020) Short-Chain Fatty Acid Production by Gut Microbiota from Children with Obesity Differs According to Prebiotic Choice and Bacterial Community Composition. *mBio*
- 7 Cholan PM, Han A, Woodie BR, Kurz ARM, Britton WJ, Ye L, **Holmes ZC**, McCann JR, David LA, Rawls JF, Oehlers SH. (2020) Conserved anti-inflammatory effects and sensing of butyrate in zebrafish. *Gut Microbes*
- 6 Dasch GA, Ramaiah A, **Holmes ZC**, Zambrano ML, Shirey TB. (2019) Use of the Ion Torrent PGM for Determining the Genomic Sequences of *Francisella* and *Coxiella*-Like Endosymbionts and *Rickettsia* Directly from Hard Ticks. In: Skvarla M., Ochoa R., Verle Rodrigues J., Hutcheson H. (eds) *Contemporary Acarology*, Springer, Cham
- 5 Silverman JD, Roche K, **Holmes ZC**, David LA, Mukherjee S. (2019) Bayesian Multinomial Logistic Normal Models through Marginally Latent Matrix-T Processes. *arXiv*
- 4 Wright JT, **Holmes ZC**, Byers JE. (2018) Stronger positive association between an invasive crab and a native intertidal ecosystem engineer with increasing wave exposure. *Marine Environmental Research*
- 3 Byers JE, **Holmes ZC**, Malek JC. (2017) Contrasting complexity of adjacent habitats influences the strength of cascading predatory effects. *Oecologia*
- 2 Byers JE, **Holmes ZC**, Blakeslee AMH. (2016) Consistency of trematode infection prevalence in host populations across large spatial and temporal scales. *Ecology*
- 1 Sheiner L, Fellows JD, Ovcariakova J, Brooks CF, Agrawal S, **Holmes ZC**, Bietz I, Flinner N, Heiny S, Mirus O, Przyborski JM, Striepen B. (2015) Toxoplasma gondii Toc75 functions in import of stromal but not peripheral apicoplast proteins. *Traffic*

Invited Presentations

2018 East Carolina University Department of Biology, Greenville, NC

Conference Presentations

2021 Harnessing the Microbiome for Disease Prevention and Therapy - Keystone Symposium, Virtual

2019 Microbiome: Therapeutic Implications - Keystone Symposium, Killarney, Ireland

2019 National Defense Science and Engineering Graduate Fellowship Conference, San Diego

2015 Entomological Society of America, Minneapolis, MN

2015 International Conference on Emerging Infectious Diseases, Atlanta, GA

2015 Ecology and Evolution of Infectious Diseases Conference, Athens, GA

2015 Southeastern Ecology and Evolution Conference, Athens, GA

2014 Society for Integrative and Comparative Biology, Austin, TX

2014 Odum School of Ecology Graduate Student Symposium, UGA, Athens, GA

2013 42nd Annual Benthic Ecology Meeting, Savannah, GA

Professional Experience

- 2021 **The Bioinformatics CRO**
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- 2014–2016 **Centers for Disease Control and Prevention, Rickettsial Zoonoses Branch**
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RESEARCH ASSISTANT *Mentor: Dr. Boris Striepen*
- 2011–2014 **Odum School of Ecology, University of Georgia**
UNDERGRADUATE RESEARCHER *Mentor: Dr. Jeb Byers*
- Spring 2014 **Institute for Marine and Antarctic Studies, University of Tasmania**
VISITING RESEARCHER *Mentor: Dr. Jeffrey Wright*
- Summer 2013 **Department of Biology, Long Island University**
SUMMER RESEARCH INTERN *Mentor: Dr. April Blakeslee*

Service

- 2019 Chair: Jim McGinnis Memorial Lecture planning committee, Duke MGM
- 2018 – 2019 Diversity and Inclusion Committee, Duke MGM
- 2018 Co-lead student organizer for graduate student recruitment, Duke MGM
- 2017 – 2018 Jim McGinnis Memorial Lecture planning committee, Duke MGM
- 2017 Primary student host for graduate student recruitment, Duke MGM
- 2013 Treasurer for Georgia Chapter of the Society for Conservation Biology