**Emily A. Higgins Keppler**

Assistant Research Scientist

Arizona State University · School of Life Sciences

The Biodesign Institute · Center of Fundamental and Applied Microbiomics

Phone 602-550-0273 · Email Emily.Higgins@asu.edu

# Education

**2017 - 2023 Doctor of Philosophy in Microbiology**

Arizona State University, Tempe, AZ

 *Dissertation:* Volatile biomarkers for a Valley fever breath test

*Advisor:* Heather D. Bean, PhD

**2012 - 2015 Bachelor of Science in Microbiology**

 Arizona State University, Tempe, AZ

 *Cum Laude*

**2000 - 2004 Bachelor of Arts in Anthropology**

 Arizona State University, Tempe, AZ

# Employment Experience

2023 – Present **Assistant Research Scientist,** School of Life Sciences

 Arizona State University, Tempe, AZ

2018 – 2023 **Graduate Research Assistant*,*** School of Life Sciences,

Arizona State University, Tempe, AZ; *Advisor:* Heather D. Bean, PhD

2017 – 2021 **Graduate Teaching Assistant**

Arizona State University, Tempe, AZ

2013 – 2015 **Undergraduate Teaching Assistant*,*** General Biology II Lab,

Arizona State University, Tempe, AZ

2005 – 2017 **Supervisory Archaeologist/Lab Manager*,***

Archaeological Consulting Services, Ltd., Tempe, AZ

# Selected Honors, Positions, & Awards

2022 – 2024 Young Ambassador to Arizona, American Society for Microbiology

2023 Aristotle Poster Award – Most Transdisciplinary Approach, FUSION

2022 Graduate College Completion Fellowship, Arizona State University

2022 Graduate College University Grant, Arizona State University

2022 1st Place, Best Poster Presentation, ASM AZ/S. NV Branch Meeting

2022 GPSA Outstanding Researcher Award, Arizona State University

2022 LoBrutto Family Fund Fellowship

2022 The College’s Graduate Excellence Award, Arizona State University

2022 Multidimensional Gas Chromatography Poster Prize, MCW

2022 Harry Lowell Swift Advancing Health Scholarship

2021 Life & Physical Sciences Best Presenter Award, GRSP Lightning Talk

2021 Runner up: Best Graduate Presentation, ASM AZ/S. NV Branch Meeting

2021 Marie Curie Poster Award – Best Use of Chemistry, FUSION

# Publications

# (\*Authors contributed equally; Corresponding author)

# Peer-Reviewed Publications

1. **Emily A. Higgins Keppler**, Marley C. Cabellero Van Dyke, Heather L. Mead, Douglas F. Lake, D. Mitchell Magee, Bridget M. Barker, Heather D. Bean. (2023) Volatile metabolites in lavage fluid are correlated to with cytokine production in a Valley fever murine model. *Journal of Fungi*, 9, 115. <https://doi.org/10.3390/jof9010115> **Editor’s Choice Article** Impact Factor (2022): 4.7; Citations: 3
2. Trenton J. Davis\*, Tarek R. Firzli\*, **Emily A.** **Higgins Keppler\***,Matthew Richardson, Heather D. Bean. (2022) Addressing missing data in GC×GC metabolomics: Identifying missingness type and evaluating the impact of imputation methods on experimental replication. *Analytical Chemistry*, 94, 10912-10920. <https://doi.org/10.1021/acs.analchem.1c04093> Impact Factor (2022): 7.4; Citations: 12
3. **Emily A. Higgins Keppler**, Heather L. Mead, Bridget M. Barker, Heather D. Bean. (2021) Life cycle dominates the volatilome character of the dimorphic fungus *Coccidioides* spp. *mSphere* 6:e00040-21. <https://doi.org/10.1128/mSphere.00040-21> Impact Factor (2021): 4.447; Citations: 8
4. Ghazal Ebadzadsahrai, **Emily A. Higgins Keppler**, Scott D. Soby, Heather D. Bean. (2020) Inhibition of fungal growth and induction of a novel volatilome in response to *Chromobacterium vaccinii* volatile organic compounds. *Frontiers in Microbiology* 11:1035, pp 1-17. <https://doi.org/10.3389/fmicb.2020.01035> Impact Factor (2020): 4.076; Citations: 66
5. H.L. Mead, C.C. Roe, **E.A. Higgins Keppler**, M.C.C. Van Dyke, K.L. Laux, A.L. Funke, K.J. Miller, H.D. Bean, J.W. Sahl, B.M. Barker. (2020) Defining critical genes during spherule remodeling and endospore development in the fungal pathogen, *Coccidioides posadasii*. *Frontiers in Genetics* 11:483, pp 1-18. <https://doi.org/10.3389/fgene.2020.00483> Impact Factor (2020): 8.789; Citations: 24

# Peer Reviewed Book Chapters & Review Articles

1. Jenna Diefenderfer, Heather D. Bean, **Emily A. Higgins Keppler**. (2024) New breath diagnostics for fungal disease. *Current Clinical Microbiology Reports*. <https://doi.org/10.1007/s40588-024-00216-x> Impact Factor (2022): 5.2; Citation: 0
2. **Emily A. Higgins Keppler**, Carrie L. Jenkins, Trenton J. Davis, Heather D. Bean. (2018) Advances in the application of comprehensive two-dimensional gas chromatography in metabolomics. *Trends in Analytical Chemistry* 109,pp 275-286. <https://doi.org/10.1016/j.trac.2018.10.015> Impact Factor (2018): 8.428; Citations: 134

# Manuscripts in prep or Under Review

1. **Emily A. Higgins Keppler,** Trenton J. Davis, Jenna Diefenderfer, Jake Drewes, Darakshan Zabin, Nicole Dorn, Heather D. Bean. Specialized metabolomics in animal studies in relation to physiological or pathological states: focus on volatile metabolites. *Anticipated submission Aug 2024.*
2. **Emily Higgins Keppler**, Kenta S. Reilly,Katherine McAulay,Thomas E. Grys, Heather D. Bean (*In prep*) Volatile molecules in human bronchoalveolar lavage fluid can discriminate Valley fever from other lung infections. *Anticipated submission Dec 2024.*
3. Daniela F. Gutiérrez-Muñoz, **Emily A. Higgins Keppler**, Daniel F. Wolter, Lucas R. Hoffman, Heather D. Bean. Volatile signatures of *Staphylococcus aureus* methicillin resistance and small colony variants. *Anticipated submission Dec 2024.*
4. Jenna Diefenderfer\*, Jake Drewes\*, Diana Ramirez, **Emily A. Higgins Keppler**, Heather D. Bean. The volatile metabolome of *Chromobacterium* spp. during in vitro growth. *Anticipated submission Sept 2024.*

# Selected Contract Reports (36)

1. Bastin, Kerri A. and **Emily Higgins Keppler**, 2017, Chapter 7: AZ U:10:310(ASM), In *Between Two Rivers: Results of Eligibility Testing, Data Recover, and Archival Research for the Powerline Channel and Vineyard Road Retarding Structure Conducted for the Food Control District of Maricopa County Near Apache Junction, Pinal County, Arizona,* edited by Andrea Gregory and Lourdes Aquila, pp 323-406, Project No. 14-313. Archaeological Consulting Services, Tempe.
2. Gregory, Andrea, **Emily Higgins Keppler**, Gary Huckleberry, and Thomas Jones 2015, *Preliminary Report of Findings of Eligibility Testing for the Flood Control District of Maricopa County Cave Buttes Dam Phase II Final Alignment Project, Maricopa County, Arizona.* ACS Project No. 13-231. Archaeological Consulting Services, Tempe.
3. Gregory, Andrea, Joanne C. Tactikos, Kerri Bastin, Katy Copeland, Thomas Jones, Alanna Ossa, and **Emily Higgins** 2013, *Class III Cultural Resources Survey for the Flood Control District of Maricopa County Vineyard Road and Rittenhouse Flood Retarding Structures Project, Pinal County, Arizona.* ACS Project No. 12-332. Archaeological Consulting Services, Tempe.
4. **Higgins, Emily** 2012, *A Class III Cultural Resources Assessment of Approximately 3.8 Miles of Proposed Trails in the McDowell Sonoran Preserve Near Rock Knob in Scottsdale, Maricopa County, Arizona.* Project No. 12-106-02. Archaeological Consulting Services, Tempe.
5. **Higgins, Emily** 2011, *A Cultural Resource Survey of 25 Acres South of the Wildlife World Zoo and Aquarium, near Goodyear and Litchfield Park Maricopa County, Arizona.* ACS Project No. 11-095. Archaeological Consulting Services, Tempe.
6. **Higgins, Emily** 2009, *Cultural Resources Survey of 129 Acres For The Proposed Buckeye Hills Expansion Area on Bureau of Land Management Property For Kilauea Crushers, Maricopa County, Arizona.* Project No. 09-144-02. ACS
7. **Higgins, Emily** 2008, *Cultural Resources Survey of 10 Acres Near Bruce Church Road and Cattle Drive, Yuma, Yuma County, Arizona.* Project No. 08-086-02. ACS

# Patents & Copyrights

**Patents**

Volatile biomarkers for discriminating Valley fever from other lung infections

U.S. Provisional Patent Application Serial No. 63/604,469

Filing Date: 30 November 2023

**Copyrights**

Volatile Biomarkers for Discriminating Valley Fever – Source Code for M23-284

Invention ID: D24-078

Technology ID: M24-105L

Submitted: 16 October 2023

Status: Pending, Under Review at Skysong Innovations

# Computer Code & Data Sets

**Code**

**MetabImpute**: An R package to explore various aspects of metabolomics data sets, especially those with technical or biological replicates. Included in the package are tools to evaluate the mechanisms of data missingness and variable distributions, tools to impute missing values using several methods, and to evaluate the effects of imputation on data reproducibility, measured by intra-class correlation.

<https://github.com/BeanLabASU/metabimpute>

**Publically Available Data Sets**

Study Title: Identify putative volatile biomarkers of Coccidioides spp. grown in vitro
Description: GC×GC-TOFMS untargeted metabolomics analysis of in vitro headspace volatiles from 6 Coccidioides posadasii and 6 Coccidioides immitis strains grown in triplicate under conditions to induce two growth phases (spherule and mycelia).
Study ID: ST001659
<http://dx.doi.org/10.21228/M85H6W>

Study Title: Identify putative volatile biomarkers of Valley fever using a murine lung infection model
Description: GC×GC-TOFMS untargeted metabolomics analysis of headspace volatiles from the bronchoalveolar lavage fluid of 6 mice infected with Coccidioides posadasii, 6 mice infected with Coccidioides immitis, and 4 PBS controls.
Study ID: ST002350
<http://dx.doi.org/10.21228/M85H6W>

Study Title: Identify putative volatile biomarkers of Valley fever using a murine lung infection model (Human Study)
Description: GC×GC-TOFMS untargeted metabolomics analysis of headspace volatiles from the bronchoalveolar lavage fluid or sputum of patients treated for community-acquired pneumonia at Mayo Clinic in Scottsdale, Arizona.
Study ID: ST002449
<http://dx.doi.org/10.21228/M85H6W>

# Grants & Scholarships

$690 2024 ASM Travel Young Ambassador Science Retreat & ASM Microbe Atlanta, GA

$690 2023 ASM Travel Young Ambassador Science Retreat & ASM Microbe Houston, TX

$500 2023 CSG Travel 67th Annual Coccidioidomycosis Study Group Tucson, AZ

$950 2023 GPSA Travel 67th Annual Coccidioidomycosis Study Group Tucson, AZ

$1200 2022 GPSA Award Open Access Manuscript Publication – *Journal of Fungi*, 9(1): 115

$1000 2022 ISHAM Travel 21st ISHAM, (*declined*) New Delhi, India

$950 2022 GPSA Travel 21st ISHAM, (*declined*) New Delhi, India

$1200 2022 GPSA Award Open Access Manuscript Publication – *Anal Chem* 94:10912-10920

$500 2022 ASU Grant Sun Devil Child Care Subsidy

$60 2022 GPSA Grant ASU Career Development – GC×GC Advanced Course

$690 2022 ASM Travel Young Ambassador Science Retreat & ASM Microbe Washington, D.C.

 $400 2022 SOLS Travel Young Ambassador Science Retreat & ASM Microbe Washington, D.C.

$950 2022 GPSA Travel 66th Annual Coccidioidomycosis Study Group Bakersfield, CA

$500 2022 ASU Grant Sun Devil Child Care Subsidy

$500 2021 ASU Grant Sun Devil Child Care Subsidy

$100 2021 ASU Award Professional Development Student Support Scholarship

$900 2022 GPSA Award Open Access Manuscript Publication – *mSphere* 6:e00040-21

$500 2021 ASU Grant Sun Devil Child Care Subsidy

$950 2020 GPSA Travel 64th Annual Cocci Study Group (*canceled*) Tucson, AZ

$400 2019 SOLS Travel 43rd ISCC/16th GC×GC Symposium Fort Worth, TX

$500 2019 GPSA Travel 43rd ISCC/16th GC×GC Symposium Fort Worth, TX

$450 2022 GPSA Travel 63th Annual Coccidioidomycosis Study Group Sacramento, CA

$600 2018 GPSO Award Graduate Student Funding – Immunology Graduate Student Association

# Research Experience

2023 – Present **Assistant Research Scientist**, Arizona State University, Tempe, AZ,

 *Advisor:* Heather D. Bean

Project I: Identify putative volatile biomarkers of methicillin-resistant *Staphylococcus aureus* (MRSA) and small-colony variants (SCVs)

Project II: Investigating the *Chromobacterium* volatilome during in vitro growth

Project III: Breath biomarkers for diagnosing Valley fever and monitoring treatment

2017-2023 **Graduate Research Assistant**, Arizona State University, Tempe, AZ,

*Advisor*: Heather D. Bean

Project I: Identification of bacterial volatile compounds that inhibit fungal growth

Project II: Volatile biomarkers for a Valley fever breath test

Project III: Data post-processing tools for untargeted metabolomics: *MetabImpute*

2017 **Graduate Research Assistant**, Arizona State University, Tempe, AZ,

*Advisor*: Shelley E. Haydel

Project: Tested synthetic peptide antimicrobials against *Mycobacterium abscessus*

# Invited Podium Presentations (presenter)

2023 **Emily A. Higgins Keppler**, Kenta Reilly, Katherine McAulay, Thomas Grys, Heather D. Bean. Volatile molecules in human bronchoalveolar lavage fluid can discriminate Valley fever from other lung infections. 20th International GC×GC Symposium. Canmore, Alberta, Canada. May 2023

2022 **Emily A. Higgins Keppler**, Heather Mead, Marley C. Van Dyke,Douglas F. Lake, D. Mitchell Magee, Bridget M. Barker, Heather D. Bean. Progress toward a Valley fever breath test: *In vivo* biomarkers from a murine model. 19th International GC×GC Symposium. Virtual Teleconference. May 2022

2021 **Emily A. Higgins Keppler**, Heather Mead, Marley C. Van Dyke,Bridget M. Barker, Heather D. Bean. Characterizing the Valley fever volatile metabolome for breath test development. 18th International GC×GC Symposium. Virtual Teleconference. June 2021 <https://youtu.be/jjCqnZtZEMg>

2021 **Emily A. Higgins Keppler**, Heather Mead, Bridget M. Barker, Heather D. Bean. Life cycle dominates the volatilome character of the dimorphic fungus *Coccidioides* spp. 2021 GRSP Lighting Talks. Virtual Teleconference. April 2021**\*Life & Physical Sciences Best Presenter Award**

# Contributing Conference Podium Presentations (presenter)

2024 **Emily A. Higgins Keppler**, Heather L. Mead, Marley C. Van Dyke,Douglas F. Lake, D. Mitchell Magee, Bridget M. Barker, and Heather D. Bean. Next gen diagnostics: Developing a breath test for Valley fever. 2024 ASM Microbe. Atlanta, GA. June 2024

2024 Daniela F. Gutiérrez-Muñoz, **Emily A. Higgins Keppler**, Heather D. Bean. Identifying putative volatile biomarkers for *Staphylococcus aureus* methicillin-resistant and small-colony variant subtypes. International Association for Breath Research Summit. Indianapolis, IN . June 2024

2024 **Emily A. Higgins Keppler**, Kenta Reilly, Katherine McAulay, Thomas Grys, Heather D. Bean. Volatile molecules in human bronchoalveolar lavage fluid can discriminate Valley fever from other lung infections. 15th Multidimensional Chromatography Workshop. Los Angeles, CA. January 2024 (*declined*)

2023 **Emily A. Higgins Keppler**, Kenta Reilly, Katherine McAulay, Thomas Grys, Heather D. Bean. Volatile molecules in human bronchoalveolar lavage fluid can discriminate Valley fever from other lung infections. 2023 ASM Microbe. Houston, TX, June 2023 **\*Selected for poster spotlight presentation**

2023 **Emily A. Higgins Keppler**, Katherine McAulay, Kenta Reilly, Thomas Grys, Heather D. Bean. Volatile molecules in human bronchoalveolar lavage fluid can discriminate Valley fever from other lung infections. Fusion 2023. Phoenix, AZ. April 2023 **\*Selected for rapid fire presentation from poster abstract**

2023 **Emily A. Higgins Keppler**, Kenta Reilly, Katherine McAulay, Thomas Grys, Heather D. Bean. Volatile molecules in human bronchoalveolar lavage fluid can discriminate Valley fever from other lung infections. 67th Annual Coccidioidomycosis Study Group. Tucson. April 2023

2022 **Emily A. Higgins Keppler**, Heather L. Mead, Marley C. Van Dyke,Bridget M. Barker, Heather D. Bean. Development of a breath-based diagnostic for Valley fever, an endemic fungal pneumonia. 2022 21st Congress of the International Society of Human and Animal Mycology (ISHAM). New Delhi, India, September 2022 (*declined*)

2022 **Emily A. Higgins Keppler**, Heather L. Mead, Marley C. Van Dyke,Bridget M. Barker, Heather D. Bean. Development of a breath-based diagnostic for Valley fever, an endemic fungal pneumonia. 2022 ASM Microbe. Washington D.C., June 2022

2022 Trenton J. Davis, Tarek R. Firzli, **Emily A.** **Higgins Keppler**,Matthew Richardson, and Heather D. Bean. Missing data imputation in untargeted metabolomics. 13th Multidimensional Chromatography Workshop. Virtual Teleconference. February 2022

2021 **Emily A. Higgins Keppler**, Heather Mead, Marley C. Van Dyke,Bridget M. Barker, Heather D. Bean. Characterizing *in vitro* and *in vivo* biomarkers for a Valley fever breath test. BioSci Southwest 2021. Tempe, AZ. October 2021

2021 **Emily A. Higgins Keppler**, Heather Mead, Marley C. Van Dyke,Bridget M. Barker, Heather D. Bean. Characterizing *in vitro* and *in vivo* volatile metabolome for a Valley fever breath test. Center for Fundamental & Applied Microbiomics Summer Seminar Series. Virtual Teleconference. July 2021

2021 Trenton J. Davis, Tarek R. Firzli, **Emily A.** **Higgins Keppler**,Matthew Richardson, and Heather D. Bean. Missing data and imputation in metabolomics. Center for Fundamental & Applied Microbiomics Summer Seminar Series. Virtual Teleconference. July 2021

2021 Heather D. Bean, Trenton J. Davis, Daniela Gutiérrez-Muñoz, **Emily A. Higgins Keppler**. Three C’s for Engaging your Brain’s Visual Center to Extract Biological Information from Untargeted GC×GC Metabolomics Data. 18th International GC×GC Symposium. Virtual Teleconference. June 2021

2021 Trenton J. Davis, Tarek R. Firzli, **Emily A.** **Higgins Keppler**,Matthew Richardson, and Heather D. Bean. Missing data and imputation in metabolomics. 18th International GC×GC Symposium. Virtual Teleconference. June 2021

2021 **Emily A. Higgins Keppler**, Heather Mead, Marley C. Van Dyke,Bridget M. Barker, Heather D. Bean. Characterizing *in vitro* and *in vivo* biomarkers for a Valley fever breath test. 65th Annual Coccidioidomycosis Study Group. Tucson, AZ: Virtual Teleconference. April 2021: <https://youtu.be/DUYKT5ht5cQ?t=5466>

2021 **Emily A. Higgins Keppler**, Heather Mead, Marley C. Van Dyke,Bridget M. Barker, Heather D. Bean. Characterizing *in vitro* and *in vivo* biomarkers for a Valley fever breath test. ASM AZ/S. NV Branch Meeting. Henderson, NV: Virtual Teleconference. April 2021**\*Runner up – Best Graduate Presentation**

2020 **Emily A. Higgins Keppler**, Heather Mead, Bridget M. Barker, Heather D. Bean. Volatilomes of *Coccidioides* spp. produced during spherule and mycelial growth. BioSci Southwest. Virtual Teleconference. October 2020

2020 **Emily A. Higgins Keppler,** Ghazal Ebadzadsahrai, Scott D. Soby, Heather D. Bean. Inhibition of fungal growth and induction of a novel volatilome in response to *Chromobacterium vaccinii* volatile organic compounds. Center for Fundamental & Applied Microbiomics Summer Seminar Series. Virtual Teleconference. July 2020

2020 Diana Ramirez, **Emily A. Higgins Keppler**, Trenton Davis, Heather D. Bean. Exploring the effect of growth conditions on the volatile metabolome of *Chromobacterium vaccinii* using GC×GC-TOF-MS. Experimental Biology 2020. Virtual Teleconference. April 2020

2020 Diana Ramirez, **Emily A. Higgins Keppler**, Trenton Davis, Heather D. Bean. Exploring the effect of growth conditions on the volatile metabolome of *Chromobacterium vaccinii* using GC×GC-TOF-MS. 29th Annual Statewide Arizona/NASA Space Grant Undergraduate Research Symposium. Tucson, AZ: Virtual Teleconference. April 2020

2020 Diana Ramirez, **Emily A. Higgins Keppler**, Trenton Davis, Heather D. Bean. Exploring the effect of growth conditions on the volatile metabolome of *Chromobacterium vaccinii* using GC×GC-TOF-MS. 27th Annual School of Life Sciences Undergraduate Research Symposium. Virtual Teleconference. April 2020

2020 **Emily A. Higgins Keppler**, Heather Mead, Marley C. Caballero Van Dyke, Bridget M. Barker, Heather D. Bean. Progress toward a Valley fever breath test: *In vivo* biomarkers from a murine model. 64th Annual Coccidioidomycosis Study Group Tucson. AZ. April 2020 (*cancelled*)

2019 **Emily A. Higgins Keppler**, Heather Mead, Bridget M. Barker, Heather D. Bean. Identifying volatile biomarkers for a Valley fever breath test. International Association for Breath Research Summit. Loughborough, England. September 2019

2019 **Emily A. Higgins Keppler,** Ghazal Ebadzadsahrai, Scott D. Soby, Heather D. Bean. Identifying inter-kingdom volatilome interactions in wetland bog soil microbiomes using GC×GC-TOFMS. AZ Symposium on Virology, Immunology, Microbiomes, and Infectious Disease. Phoenix, AZ. June 2019 **\*selected for rapid fire presentation**

2019 **Emily A. Higgins Keppler**, Heather Mead, Bridget M. Barker, Heather D. Bean. Identifying volatile biomarkers for a Valley fever breath test. 4th Annual ABRC Research Conference. Phoenix, AZ. May 2019

2019 **Emily A. Higgins Keppler**, Heather Mead, Bridget M. Barker, Heather D. Bean. Identifying volatile biomarkers for a Valley fever breath test. 63rd Annual Coccidioidomycosis Study Group. Sacramento, CA. April 2019

# Contributing Poster Presentations (presenter)

2024 Jenna Diefenderfer, **Emily A. Higgins Keppler**, Janis E. Blair, Heather D. Bean. Launching a breath analysis study to identify volatile biomarkers for Valley Fever. FUSION. Phoenix, AZ. April 2024

2024 Jake Drewes, Finlay Warsop Thomas**, Emily A. Higgins Keppler**, Corey Nelson, Ferran Garcia-Pichel, Heather D. Bean. Exploration of the *Microcoleus vaginatus* Volatilome Using GC×GC–TOFMS. FUSION. Phoenix, AZ. April 2024

2024 Jenna Diefenderfer, **Emily A. Higgins Keppler**, Janis E. Blair, Heather D. Bean. Launching a breath analysis study to identify volatile biomarkers for Valley Fever. 68th Annual Coccidioidomycosis Study Group. San Antonio, TX. April 2024

2024 Daniela F. Gutiérrez-Muñoz, **Emily A. Higgins Keppler**, Heather D. Bean. Identifying putative volatile biomarkers for *Staphylococcus aureus* methicillin-resistant and small-colony variant subtypes. 15th Multidimensional Chromatography Workshop. Los Angeles, CA. January 2024

2023 Daniela F. Gutiérrez-Muñoz, **Emily A. Higgins Keppler**, Heather D. Bean. Identifying putative volatile biomarkers for *Staphylococcus aureus* methicillin-resistant and small-colony variant subtypes. North American Cystic Fibrosis Conference. Phoenix, AZ. October 2023

2023 **Emily A. Higgins Keppler**, Kenta Reilly, Katherine McAulay, Thomas Grys, Heather D. Bean. Volatile molecules in human bronchoalveolar lavage fluid can discriminate Valley fever from other lung infections. 2023 ASM Microbe. Houston, TX, June 2023 **\*Selected for poster spotlight presentation**

2023 **Emily A. Higgins Keppler**, Kenta Reilly, Katherine McAulay, Thomas Grys, Heather D. Bean. Volatile molecules in human bronchoalveolar lavage fluid can discriminate Valley fever from other lung infections. Fusion 2023. Phoenix, AZ. April 2023 **\*Aristotle** **Award: Most Transdisciplinary Approach; selected for rapid fire presentation**

2022 **Emily A. Higgins Keppler**, Heather L. Mead, Marley C. Van Dyke,Bridget M. Barker, Heather D. Bean. Development of a breath-based diagnostic for Valley fever, an endemic fungal pneumonia. 2022 21st Congress of the International Society of Human and Animal Mycology (ISHAM). New Delhi, India, September 2022 (*declined*)

2022 **Emily A. Higgins Keppler**, Heather Mead, Marley C. Van Dyke, Douglas F. Lake, D. Mitchell Magee, Bridget M. Barker, Heather D. Bean. Progress toward a Valley fever breath test: *In vivo* biomarkers from a murine model. ASM AZ/S. NV Branch Meeting. Tempe, AZ. April 2022 **\*1st Place, Best Poster Presentation**

2022 **Emily A. Higgins Keppler**, Heather Mead, Marley C. Van Dyke, Douglas F. Lake, D. Mitchell Magee, Bridget M. Barker, Heather D. Bean. Characterizing the Valley fever volatile metabolome for breath test development. 7th Annual ABRC-Flinn Research Conference. Phoenix, AZ. April 2022

2022 **Emily A. Higgins Keppler**, Heather Mead, Marley C. Van Dyke, Douglas F. Lake, D. Mitchell Magee, Bridget M. Barker, Heather D. Bean. Progress toward a Valley fever breath test: *In vivo* biomarkers from a murine model. 66th Annual Coccidioidomycosis Study Group. Bakersfield, CA. April 2022

2022 **Emily A. Higgins Keppler**, Heather Mead, Bridget M. Barker, Heather D. Bean. Progress towards a Valley fever breath test: Characterizing the *in vivo* volatile metabolome. 13th Multidimensional Chromatography Workshop. Virtual Teleconference. February 2022 **\*Multidimensional GC Poster Prize**

2021 **Emily A. Higgins Keppler**, Heather Mead, Marley C. Van Dyke,Bridget M. Barker, Heather D. Bean. Progress towards a Valley fever breath test: Characterizing the *in vitro* and *in vivo* volatile metabolome. 2021 International Association of Breath Research Summer Symposium. Twitter Poster Session @iabr2021. June 2021

2021 **Emily A. Higgins Keppler**, Heather Mead, Marley C. Van Dyke,Bridget M. Barker, Heather D. Bean. Characterizing *in vitro* and *in vivo* biomarkers for a Valley fever breath test. Fusion 2021. Tempe, AZ. April 2021 **\*Marie Curie Award: Best Use of Chemistry**

2021 **Emily A. Higgins Keppler**, Heather Mead, Marley C. Caballero Van Dyke, Bridget M. Barker, Heather D. Bean. Characterizing *in vitro* and *in vivo* biomarkers for a Valley fever breath test. 6th Annual ABRC-Flinn Research Conference. Virtual Teleconference. February 2021

2021 **Emily A. Higgins Keppler**, Heather Mead, Bridget M. Barker, Heather D. Bean. Volatilomes of Coccidioides spp. produced during spherule and mycelial growth. 12th Multidimensional Chromatography Workshop. Liege, Belgium: Virtual Teleconference. February 2021

2021 **Emily A. Higgins Keppler**, Heather Mead, Bridget M. Barker, Heather D. Bean. Lifecycle dominates the volatilome character of the dimorphic fungus *Coccidioides* spp. 3rd Annual reimagine Health Conference. Virtual Teleconference. January 2021

2020 Diana Ramirez, **Emily A. Higgins Keppler**, Trenton Davis, Heather D. Bean. Exploring the effect of growth conditions on the volatile metabolome of *Chromobacterium vaccinii* using GC×GC-TOF-MS. Experimental Biology 2020. San Diego, CA: Virtual Teleconference. April 2020

2020 **Emily A. Higgins Keppler**, Heather Mead, Marley C. Caballero Van Dyke, Bridget M. Barker, Heather D. Bean. Progress toward a Valley fever breath test – *In vitro* and *in vivo* biomarkers. 5th Annual ABRC-Flinn Research Conference. Phoenix, AZ. February 2020

2019 **Emily A. Higgins Keppler**, Heather Mead, Bridget M. Barker, Heather D. Bean. Identifying volatile biomarkers for a Valley fever breath test. 4th Annual ABRC Research Conference. Phoenix, AZ. May 2019

2019 **Emily A. Higgins Keppler,** Ghazal Ebadzadsahrai, Scott D. Soby, Heather D. Bean. Identifying inter-kingdom volatilome interactions in wetland bog soil microbiomes using GC×GC-TOFMS. AZ Symposium on Virology, Immunology, Microbiomes, and Infectious Disease. Phoenix, AZ. June 2019 **\*selected for rapid fire presentation**

2019 **Emily A. Higgins Keppler,** Ghazal Ebadzadsahrai, Scott D. Soby, Heather D. Bean. Identifying inter-kingdom volatilome interactions in wetland bog soil microbiomes using GC×GC-TOFMS. 43rd ISCC & 16th GC×GC Symposium. Fort Worth, TX. May 2019

# Teaching Experience

MIC 302: Advanced Bacteriology Lab, 32 students

 Graduate teaching assistant, 1 semester

BIO 182: Online General Biology II Laboratory, 231 students

 Graduate teaching assistant, 1 semester

MIC 206: Online Microbiology Laboratory, 135 students

 Graduate teaching assistant, 1 semester

BIO 181: General Biology I Laboratory, 24 undergraduate students, 2 sections

 Graduate teaching assistant, 1 semester

MIC 206: Microbiology Laboratory, 16 undergraduate students, 2 sections

 Graduate teaching assistant, 2 semesters

BIO 182: General Biology II Laboratory, 24 undergraduate students, 2 sections

 Undergraduate teaching assistant, 4 semesters

MIC 206: Microbiology Laboratory, 16 undergraduate students, 1 section

 Undergraduate lab leader, 1 semesters

BIO 182: General Biology II Laboratory, 24 undergraduate students, 1 sections

 Assistant teaching assistant, 2 semesters

# Professional Service

Conferences, Symposia, and Professional Organizations

2023 20th International GC×GC Symposium – Petroleum/Industrial (I) Session Chair

**2022 - Present ASM Young Ambassador to Arizona Ambassador**

2022 ASM AZ/S. NV Branch Meeting Local committee

2021 Chandler/Hamilton Invitational Science and Engineering Fair Poster Judge

2018 Hamilton Invitational Science and Engineering Fair Poster Judge

2003 Paleopathology Association 30th Annual North American Meeting Session Aide

2003 American Association of Physical Anthropologists 72nd Annual Meeting Session Aide

2003 American Association for the Advancement of Science Annual Meeting Session Aide

Peer Reviewer

2021 Talanta (1)

2020 Analytical Chemistry (1)

2018 – 2023 GPSA Travel Grants (85)

2018 – 2023 GPSA Research Grants (37)

2018 – 2019 Sun Devil Child Care Subsidy Grants (34)

Educational and Professional Outreach

2023 Arizona Science Center Micro Mysteries Activity Lead

2022 – 2023 Microbial Social Group Organizer

2020 SOLS Working Group – Faculty and TA, ASU Member

2020 Graduate Recruitment Lunch, ASU Panelist

2018 – 2023 ASU SOLS Graduate Peer Mentor (4 mentees) Mentor

2018 – 2019 ASU Family Resources Advisory Board Member

2018 AVID Career Day, Vista Verde Middle School Invited Speaker

2018 Open Door, Tumor Immunology Booth, ASU Volunteer

2018 SOLSMATE, Arizona State University Mentor

2018 Graduate Recruitment Weekend, ASU Micro Buddy

2015 Lake Pleasant Overnight Excursion, Sunset Canyon Elementary Chaperone

2014 Lake Pleasant Overnight Excursion, Sunset Canyon Elementary Chaperone

# Mentoring

2023 – Present Nicole Dorn, PhD student

*Research topic:* Influence of pollution and gut microbiome VOCs on Alzheimer’s disease

2023 – Present Jake Drewes, PhD student

*Research topic:* Volatile signaling in desert soil microbiomes

2023 – Present Jenna Diefenderfer, PhD student

*Thesis topic:* Breath biomarkers for diagnosing fungal infections

2020 – Present Bilal Ali, Masters student

*Thesis topic:* Expanding the utility of gas chromatography retention indexing for bioanalysis

2020 – 2021 Caitlin O’Malley, Post-baccalaureate

*Research topic:* Data analysis pipelines for untargeted metabolomics

2019 – 2020 Diana Ramirez, ASU LEAP Scholar, SOLUR Apprentice

*Research topic:* Influence of growth conditions on *Chromobacterium* VOCs

# Professional Development

2024 Young Ambassador of Science Retreat & ASM Microbe Atlanta, GA

2023 Young Ambassador of Science Retreat & ASM Microbe Houston, TX

2022 National Academy of Sciences Impact & Control of Valley Fever Virtual

2022 Dissertation Writing Camp ASU

2022 Young Ambassador of Science Retreat & ASM Microbe Washington, DC

2022 GC×GC Advanced Course GC×GC Symposium

2022 ADVANCEGeo Bystander Training ASU

2021 Success in Graduate Writing Camp ASU

2020 Graduate College Career Navigators ASU

2020 GC×GC Symposium & Workshop Leco

2020 Data Science Foundations ASU

2019 Statistics in Research ASU

2019 Graphic Design for Posters, Figures, and Proposals ASU

2019 CSW/SC Professional Development Conference ASU

2019 PFx Preparing Future Faculty and Scholars ASU

2019 GC×GC Short Course Ft Worth, TX

2019 Programming and Statistics Workshop ASU

2019 63rd Annual Coccidioidomycosis Study Group UC Davis

2018 R and Programming Skills Development Workshop ASU

2019 62nd Annual Coccidioidomycosis Study Group Flagstaff, AZ

# Professional Affiliations

American Association for the Advancement of Science 2003-Present

American Society for Microbiology 2017-Present

 ASM Young Ambassador to Arizona 2022-Present

American Society for Microbiology, AZ/Southern NV Branch 2017-Present

Association for Women in Science 2017-Present

Biodesign Center for Fundamental and Applied Microbiomics, ASU 2017-Present

Biodesign Center for Immunotherapy, Vaccines, and Virotherapy, ASU 2017-2023

Microbiology Graduate Student Association, ASU 2017-2023

Immunology Graduate Student Association, ASU 2017-2023

 President 2018-2023

International Society for Human and Animal Mycology 2022-Present

New York Academy of Science 2021-Present

# Skills & Certifications

Programming

R

Applications:

Microsoft Office, ChromaTOF, ChromaTOF Tile, Adobe Illustrator, Adobe Photoshop, Lab Archives

Platforms

Leco Pegaus 4D GC×GC-TOFMS, Gerstel MPS Robotic autosampler

# References

**Heather D. Bean, Ph.D.**

Associate Professor, School of Life Sciences

Arizona State University

School of Life Sciences

PO BOX 874501 Tempe, AZ 85287-4501

Phone: 480-727-3395; Email: Heather.D.Bean@asu.edu

**Bridget Marie Barker, Ph.D.**

Associate Professor, Dept. of Biological Sciences

Associate Director NAU ABSL3

Pathogen and Microbiome Institute

Northern Arizona University

PO Box 4073, Flagstaff AZ 86011

Phone: 928-523-6074; Email: Bridget.Barker@nau.edu