Kevin Bonham, Ph.D.

Senior Research Scientist

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Education

2008 - 2014 | **Harvard - Cambridge, MA**
PhD in Immunology
Thesis: Cellular and Biochemical Events in Toll-like Receptor Signaling

2002 - 2006 | **University of California, San Diego**
BS Cum laude *in Biochemistry and Cell Biology*

Research Positions

Jan 2019 - Present | **Wellesley College – Wellesley, MA**
Senior Research Scientist
Promoted from Research Scientist to Senior RS in March, 2021.
Projects:
- ECHO / Khula - Longitudinal cohorts of child brain development and the microbiome
- PASC - Subsets of Post-acute sequelae of COVID-19 (Long-COVID) with machine learning
- Microbiome.jl - software for microbial community data analysis
- GaPLAC - Gaussian Process modeling software tool for microbiome analysis

May 2017 - Dec 2018 | **Broad Institute and Harvard T.H. Chan School of Public Health – Boston, MA**
Postdoctoral Fellow - Huttenhower Lab
Projects:
- Human microbiome associations with inflammatory arthritis
- Human Microbiome Project phase 2 (HMP-II)
- Computational infrastructure for juvenile diabetes research consortium

May 2014 - Apr 2017 | **Harvard University and UCSD – Cambridge, MA**
Postdoctoral Fellow - Dutton Lab
Project: Horizontal gene transfer (HGT) in cheese-associated bacteria

Sep 2008 - Apr 2014 | **Boston Children's Hospital – Boston, MA**
Graduate Research Assistant - Kagan Lab
Project: Cellular localization and function in endosomal Toll-like receptor (TLR) signaling

May 2006 - Aug 2008 | **Scripps Research Institute – La Jolla, CA**
Lab Manager, Research Technician - Mowen Lab
Project: Small molecule inhibitors of enzymes (PRMTs) in T-cell signaling

Honors and Awards

2014 | Jeffry Modell Immunology Prize

2003 - 2006 | Provost's Honor

2002 - 2006 | UCSD Millenium Scholarship

Research Funding

Current

2021 - present | **Co-Investigator on Wellcome LEAP 1kD**
A multi-scale approach to characterizing developing executive function

Past

2018-2019 | **Sloan Foundation - JuliaLang Diversity and Inclusion Award**
Increasing Representation of Women in Computational Biology

2009 - 2013 | **NSF Graduate Research Fellowship** *Integration of Distinct Signaling Pathways: Toll-like Receptors and Cytokine-Activated Macrophages*

Major Research Interests

1. Effects of microbial metabolism on neurocognitive development
2. Dynamics of microbial communities
3. Computational and statistical methods for longitudinal microbiome research

Narrative report

The development of the human gut microbiome and neurocogntive development are intimately linked. They are also dynamic, complex, and multi-causal, necessitating advanced computational and statistical methods. My current focus is on understanding the role of the human microbiome in neurocognitive development, and on developing software tools that facilitate investigation of longitudinal microbiome data and other complex biological data in humans.

Publications

* indicates co-first authorship.
† indicates corresponding authorship.

In review or in prep

1. **Bonham, K. S.**, Bottino, G. Z., McCann, S. H., Beauchemin, J., Weisse, E., O'Muircheartaigh, J., Huttenhower, C., D'Sa, V., Bruchhage, M., Deoni, S. C. L. & Klepac-Ceraj, V. Gut microbes and their genes in infant children predict neurocognitive development. *In preparation.*
2. * Laue, H. E., **Bonham, K. S.**, Coker, M. O., Moroishi, Y., Pathmasiri, W., McRitchie, S., Sumner, S., Hoen, A. G., Karagas, M. R., Klepac-Ceraj, V. & Madan, J. C. Prospective Association of the Infant Gut Microbiome with Autism-Related Behaviors in the ECHO Consortium. *In Review - Scientific Reports.*
3. Schoenborn, A. A., Yannarell, S. M., MacVicar, C. T., Barriga-Medina, N. N., Markillie, M., Mitchell, H., **Bonham, K. S.**, Leon-Reyes, A., Riveros-Iregui, D., Klepac-Ceraj, V. & Shank, E. A. Microclimate is a strong predictor of the native and invasive plant-associated soil microbiota on San Cristóbal Island, Galápagos archipelago. *In revision - Environmenal Microbiology.*
4. Thompson, K. N., **Bonham, K. S.**, *et al.* Alterations in the gut microbiome in inflammatory arthritis implicate key taxa and metabolic pathways across arthritis phenotypes. *In revision - Science Translational Medicine.*
5. * Woodruff, M. C., **Bonham, K. S.**, *et al.* Inflammation and autoreactivity define a discrete subset of patients with post-acute sequelae of COVID-19, or long-COVID. *In revision - Nature; medRxiv - doi: 10.1101/2021.09.21.21263845.*

2021

6. † **Bonham, K. S.**, Kayisire, A., Luo, A. & Klepac-Ceraj, V. Microbiome.jl and BiobakeryUtils.jl - Julia packages for working with microbial community data. *J. Open Source Softw.* **6,** 3876 (Nov. 2021).
7. Gauthier, A. E., Chandler, C. E., *et al.* Deep-sea microbes as tools to refine the rules of innate immune pattern recognition. en. *Sci Immunol* **6** (Mar. 2021).
8. Lewis, C. R., **Bonham, K. S.**, McCann, S. H., Volpe, A. R., D'Sa, V., Naymik, M., De Both, M. D., Huentelman, M. J., Lemery-Chalfant, K., Highlander, S. K., Deoni, S. C. L. & Klepac-Ceraj, V. Family SES Is Associated with the Gut Microbiome in Infants and Children. en. *Microorganisms* **9,** 1608 (July 2021).
9. Peterson, D., **Bonham, K. S.**, Rowland, S., Pattanayak, C. W., RESONANCE Consortium & Klepac-Ceraj, V. Comparative Analysis of 16S rRNA Gene and Metagenome Sequencing in Pediatric Gut Microbiomes. en. *Front. Microbiol.* **12,** 670336 (July 2021).
10. * Tso, L., **Bonham, K. S.**, Fishbein, A., Rowland, S. & Klepac-Ceraj, V. Targeted High-Resolution Taxonomic Identification of *Bifidobacterium longum* subsp. *infantis* Using Human Milk Oligosaccharide Metabolizing Genes. en. *Nutrients* **13,** 2833 (Aug. 2021).

2019

16. Lloyd-Price, J., Arze, C., *et al.* Multi-omics of the gut microbial ecosystem in inflammatory bowel diseases. en. *Nature* **569,** 655–662 (May 2019).
19. Tett, A., Huang, K. D., *et al.* The Prevotella copri Complex Comprises Four Distinct Clades Underrepresented in Westernized Populations. en. *Cell Host Microbe* **26,** 666–679.e7 (Nov. 2019).

2017

22. † **Bonham, K. S.** & Stefan, M. I. Women are underrepresented in computational biology: An analysis of the scholarly literature in biology, computer science and computational biology. en. *PLoS Comput. Biol.* **13,** e1005134 (Oct. 2017).
24. **Bonham, K. S.**, Wolfe, B. E. & Dutton, R. J. Extensive horizontal gene transfer in cheese-associated bacteria. en. *Elife* **6** (June 2017).

2015

26. Brubaker, S. W., **Bonham, K. S.**, Zanoni, I. & Kagan, J. C. Innate immune pattern recognition: a cell biological perspective. en. *Annu. Rev. Immunol.* **33,** 257–290 (Jan. 2015).

2014

27. **Bonham, K. S.** & Kagan, J. C. Endosomes as platforms for NOD-like receptor signaling. en. *Cell Host Microbe* **15,** 523–525 (May 2014).
28. **Bonham, K. S.**, Orzalli, M. H., Hayashi, K., Wolf, A. I., Glanemann, C., Weninger, W., Iwasaki, A., Knipe, D. M. & Kagan, J. C. A promiscuous lipid-binding protein diversifies the subcellular sites of toll-like receptor signal transduction. *Cell* **156,** 705–716 (2014).

2010

30. **Bonham, K. S.**, Hemmers, S., Lim, Y.-H., Hill, D. M., Finn, M. G. & Mowen, K. A. Effects of a novel arginine methyltransferase inhibitor on T-helper cell cytokine production. *FEBS J.* **277,** 2096–2108 (2010).
31. Fathman, J. W., Gurish, M. F., Hemmers, S., **Bonham, K. S.**, Friend, D. S., Grusby, M. J., Glimcher, L. H. & Mowen, K. A. NIP45 controls the magnitude of the type 2 T helper cell response. en. *Proc. Natl. Acad. Sci. U. S. A.* **107,** 3663–3668 (Feb. 2010).

Presentations

Invited Talks

2022 **Boston Bacterial Meeting - Cambridge, MA**
Microbiomes and Microbial Ecosystems
Panel discussion

2019 **Wellesley Science Center Faculty Seminar - Wellesley, MA**
The role of human gut microbial communities in the neurocognitive development of children
JuliaCon - Baltimore, MD
Raising Diversity and Inclusion among Julia users
with Anna Harris and Elwin van t' Wout

2018 **HSPH Biostatistics Retreat - Boston, MA**
Strain-resolved microbial profiling in inflammatory arthritis

2016 **Bowdoin College Biology Department Seminar - Brunswick, ME**
Extensive horizontal gene transfer in cheese-associated bacteria

Workshops Taught

2018 **Juvenile Diabetes Research Foundation Microbiome Initiative - Cambridge, MA**
The bioBakery for human microbiome epidemiology
Wageningen University - Wageningen, Netherlands
Creating Effective Graphics for Scientific Presentations
SETAC, North Atlantic Chapter - Durham, NH
Creating Effective Graphics for Scientific Presentations
Physalia Microbiome Analysis, Berlin DE
Taxonomic profiling with MetaPhlAn
Functional profiling with HUMAnN
Targeted functional profiling with ShortBRED
Searching for horizontal gene transfer with WAAFLE

2017 **ACM Conference on Bioinformatics, Computational Biology, and Health Informatics - Boston, MA**
Workshop on Algorithms in Bioinformatics - HUMAnN2
PEGS Summit - Boston, MA
Immunology for Drug Discovery Scientists

2016 **PEGS Summit - Boston, MA**
Immunology for Drug Discovery Scientists

Conference Posters

Since 2014

2020

11. **Bonham, K. S.**, Bruchhage, M., Rowland, S., Volpe, A., Dyer, K., D'Sa, V., Huttenhower, C., Deoni, S. & Klepac-Ceraj, V. *ASM Microbe - Gut microbes and their genes are associated with brain development and cognitive function in healthy children.* June 2020.
12. Peterson, D., Rowland, S., **Bonham, K. S.** & Klepac-Ceraj, V. *Boston Bacterial Meeting - Comparing early childhood gut microbiomes obtained from 16S rRNA gene and metagenome sequencing.* July 2020.
13. Tso, L., **Bonham, K. S.**, Rowland, S. & Klepac-Ceraj, V. *ASM Microbe - Baby steps: Characterizing Bifidobacterium longum subsp. infantis and its presence in American infants.* June 2020.
14. Tso, L., **Bonham, K. S.**, Rowland, S. & Klepac-Ceraj, V. *Boston Bacterial Meeting - Baby steps: Characterizing Bifidobacterium longum subsp. infantis and its presence in American infants.* July 2020.

2019

15. **Bonham, K. S.**, Rowland, S., Bruchhage, M., D'Sa, V., Huttehnower, C., Deoni, S. & Klepac-Ceraj, V. *Boston Bacterial Meeting - The relationship of the gut microbiome, environmental exposure and neurocognitive development in infants and children* May 2019.
17. Peterson, D., Rowland, S., Tso, L., **Bonham, K. S.**, Bruchhage, M., D'Sa, V., Huttehnower, C. & Klepac-Ceraj, V. *MIT-Harvard Microbiome Symposium - The relationship of the gut microbiome, environmental exposures, and neurocognitive development in infants and children* Mar. 2019.
18. Rowland, S., **Bonham, K. S.**, Bruchhage, M., D'Sa, V., Huttehnower, C., Deoni, S. & Klepac-Ceraj, V. *ASM Microbe - The early childhood gut microbiome, environmental exposures, and neurocognitive development.* June 2019.

2018

20. **Bonham, K. S.**, Peterson, D., Tso, L., Rowland, S., Deoni, S., Huttenhower, C. & Klepac-Ceraj, V. *Lake Arrowhead Microbial Genomics -The role of the gut microbiome in early childhood cognitive development* Sept. 2018.
21. **Bonham, K. S.**, Franzosa, E. A., Sayoldin, B., Ilott, N. E., Fehlner-Peach, H., Bullers, S., Littman, D. R., Young, S. P., Raza, K., Powrie, F. & Huttenhower, C. *Keystone: Microbiome, Host Resistance and Disease - Strain-resolved microbial and metabolomic profiling ininflammatory arthritis* Jan. 2018.

2017

23. **Bonham, K. S.**, Wolfe, B. E. & Dutton, R. J. *American Society of Microbiology, Mechanisms of Interbacterial Competition and Cooperation - Extensive horizontal transfer in cheese-associated bacteria* Mar. 2017.

2015

25. **Bonham, K. S.**, Wolfe, B. E. & Dutton, R. J. *ASM Microbe - Extensive horizontal transfer in cheese-associated bacteria* May 2015.

2014

29. **Bonham, K. S.**, Wolfe, B. E. & Dutton, R. J. *Boston Bacterial Meeting - Identifying horizontal transfer in cheese-associated bacteria* May 2014.

Teaching

Positions

May 2016 - Apr 2017 | **Harvard Medical School – Boston, MA**
Course Lead - Harvard Medical School Online
Course: Biochemistry Fundamentals

May 2014 - Apr 2016 | **Harvard Medical School – Boston, MA**
Instructor in Microbiology and Immunobiology, Curriculum Fellow
Role: Founding instructor for HMS Masters of Medical Science in Immunology. Designed and taught 2 courses:
- Research Methods in Experimental Immunology
- Understanding Immunology Literature

Spring 2015 | **Harvard Extension School – Cambridge, MA**
Instructor
Course: Viruses: Molecular machines existing on the boundaries of life

Spring 2012, 2014 | **Emmerson College – Boston, MA**
Adjunct Professor
Course: Plagues and Pandemics

Graduate Courses

2018 | **Harvard T.H. Chan School of Public Health - Boston, MA**
BST273 - Introduction to programming
Co-taught with Eric Franzosa.

2014-2016 | **Harvard Medical School - Boston, MA**
IMM701 - Research Methods in Experimental Immunology

2014-2016 | **Harvard Medical School - Boston, MA**
IMM703 - Understanding Immunology Literature

Undergraduate Courses

2022 | **Wellesley College - Wellesley, MA**
BISC314 - Environmental Microbiology Lab

2021 | **Wellesley College - Wellesley, MA**
BISC195 - Essential skills for computational biology

2016-2017 | **Harvard Medical School Online - Boston, MA**
Biochemistry essentials

2015 | **Harvard Extension School - Cambridge, MA**
BIOS E-157 - Viruses: A molecular arms race

2013, 2014 | **Emmerson College - Boston, MA**
SC214 - Plagues and Pandemics

Open Source Software

Package Author

2020-present | **GaPLAC - bioBakery**
http://github.com/biobakery/GaPLAC
- Gaussian Process (GP) command line tool
- Ideal for longitudinal data, especially when sampled at irregular intervals
- Use GLM model-like syntax for specifying formula

2020-present | **Airtable.jl**
http://github.com/kescobo/Airtable.jl
- Interact with airtable.com REST API
- Rate-limiting control over request frequency to avoid limits
- FETCH, POST, and PATCH functionality using julia types

2016-present | **Microbiome.jl - BioJulia**
http://github.com/BioJulia/Microbiome.jl
- Data structures for biosamples, sample features (eg taxa)
- Attaching metadata to biosamples
- Data structures for taxonomic and community profiles
- Interfaces with statistical packages (eg `Distances.jl` and `Hclust.jl`)

BiobakeryUtils.jl - BioJulia
http://github.com/BioJulia/BiobakeryUtils.jl
- Utilities for I/O of file types used with bioBakery tools
- Plotting utilities

2014-2016 | **Kvasier - Dutton Lab**
https://github.com/DuttonLab/kvasir
- Python-based command line tool for HGT discovery
- Stores genomic information, BLAST hits in MongoDB
- API for reading genomes, performing search, and generating tables

Package Maintainer

2017-present | **Co-founder, BioJulia**
http://github.com/BioJulia/
YAML.jl - JuliaData
http://github.com/JuliaData/YAML.jl

2018-present | **ClusterManagers.jl - JuliaParallel**
https://github.com/JuliaParallel/ClusterManagers.jl

2020-present | **PowerAnalysis.jl**
https://github.com/johnmyleswhite/PowerAnalysis.jl

Package Contributor

2021 | **Franklin.jl** - *https://github.com/tlienart/Franklin.jl*
LoggingExtras.jl - *https://github.com/JuliaLogging/LoggingExtras.jl*
EcoBase.jl - *https://github.com/EcoJulia/EcoBase.jl*

2020 | **Julia** - *https://github.com/JuliaLang/julia*
DataFrames.jl - *https://github.com/JuliaData/DataFrames.jl*
CSV.jl - *https://github.com/JuliaData/CSV.jl*
Documenter.jl - *https://github.com/JuliaDocs/Documenter.jl*
Literate.jl - *https://github.com/fredrikekre/Literate.jl*
LightGraphs.jl - *https://github.com/JuliaGraphs/LightGraphs.jl*
SQLite.jl - *https://github.com/JuliaDatabases/SQLite.jl*

2019 | **StatsPlots.jl** - *https://github.com/JuliaPlots/StatsPlots.jl*
Documenter.jl - *https://github.com/JuliaDocs/Documenter.jl*
DataDeps.jl - *https://github.com/oxinabox/DataDeps.jl*
Clustering.jl - *https://github.com/JuliaStats/Clustering.jl*
language-weave - *https://github.com/JunoLab/language-weave*

2018 | **Colors.jl** - *https://github.com/JuliaGraphics/Colors.jl*
Julia - *https://github.com/JuliaLang/julia*
DataFrames.jl - *https://github.com/JuliaData/DataFrames.jl*
SpatialEcology.jl - *https://github.com/EcoJulia/SpatialEcology.jl*

2017 | **Distances.jl** - *https://github.com/JuliaStats/Distances.jl*
BioSequences.jl - *https://github.com/BioJulia/BioSequences.jl*
Bio.jl - *https://github.com/BioJulia/Bio.jl*

Outreach

Online Publications

2014-2019 | **Co-founder of "Emmunity.org"**
Co-Host of the podcast Audiommunity

2014-Present | **Creator: Adobe Illustrator for Scientists tutorial videos (youtube)**

2013-2016 | **Blogger: "Food Matters" Scientific American Blogs**
Notable posts (links included):

- What's in your poo?
- Time is the enemy, unless it's colonic transfer time
- Antibiotics and Obesity–an Unexpected Casualty in the War on Microbes
- My new fermentation obsession
- Probiotics, the immune system, and mouse balls

2009-2013 | **Founder: "We, Beasties," ScienceBlogs.com**

Notable posts (links included):

- Snow, cold, influenza and colds - Temperature and Infectious Disease
- Ebola Outbreak in Uganda - Both More and Less Frightening Than You Think
- The future of science publishing
- Autoimmunity to spunk
- A Bitter Sweet Nobel - Beutler, Janeway, and the Dawn of Innate Immunity

Other

2016 | **Panel Moderator: Boston Fermentation Festival**

2015 | **Presenter: Boston Science Museum Health Science Fair**

2009-2013 | **Lecturer: Harvard Science in the News (SITN).**

- Autoimmunity and Disease: When the Body Attacks Itself (2009)
- Our Microbial Organ: The Good and Bad Bugs of The Human Gut (2010)
- How to Spot a Virus: The Origins of an Immune Response (2011)
- Avian flu and scientific censorship: When should scientists keep their mouths shut? (2012)
- Living Factories: Engineering Cells to Manufacture Molecules (2013)

2010-2012 | **Co-founder: Harvard Policy PATH**

2011 | **Student Advocate: ASBMB "Hill Day"**