

Kevin Bonham, Ph.D.

Senior Research Scientist

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Education

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

University of California, San Diego - La Jolla, CA 2002 - 2006
BS in Biochemistry and Cell Biology
Cum laude

Research Positions

Wellesley College – Wellesley, MA Jan 2019 - Present
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

Broad Institute and Harvard T.H. Chan School of Public Health – Boston, MA May 2017 - Dec 2018
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

Harvard University and UCSD – Cambridge, MA May 2014 - Apr 2017
Postdoctoral Fellow - Dutton Lab

Project: Horizontal gene transfer (HGT) in cheese-associated bacteria

Boston Children's Hospital – Boston, MA Sep 2008 - Apr 2014
Graduate Research Assistant - Kagan Lab

Project: Cellular localization and function in endosomal Toll-like receptor (TLR) signaling

Scripps Research Institute – La Jolla, CA May 2006 - Aug 2008
Lab Manager, Research Technician - Mowen Lab

Project: Small molecule inhibitors of enzymes (PRMTs) in T-cell signaling

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 neurocognitive 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.

Honors and Awards

Jeffrey Modell Immunology Prize	2014
Provost's Honor	2003 - 2006
UCSD Millenium Scholarship	2002 - 2006

Research Funding

Current

Co-Investigator on Wellcome LEAP 1kD	2021 - present
<i>A multi-scale approach to characterizing developing executive function</i>	

Past

Sloan Foundation - JuliaLang Diversity and Inclusion Award	2018-2019
<i>Increasing Representation of Women in Computational Biology</i>	
NSF Graduate Research Fellowship	2009 - 2013
<i>Integration of Distinct Signaling Pathways: Toll-like Receptors and Cytokine-Activated Macrophages</i>	

Publications

* indicates co-first authorship.

† indicates corresponding authorship.

- † **Bonham, Kevin S.**, Annelle Kayisire, Anika Luo, and Vanja Klepac-Ceraj. "Microbiome.jl and BiobakeryUtils.jl - Julia packages for working with microbial community data". In: *J. Open Source Softw.* 6.67 (Nov. 2021), p. 3876. doi: 10.21105/joss.03876.
- Gauthier, Anna E, Courtney E Chandler, et al. "Deep-sea microbes as tools to refine the rules of innate immune pattern recognition". en. In: *Sci Immunol* 6.57 (Mar. 2021). doi: 10.1126/sciimmunol.abe0531.
- Lewis, Candace R, **Kevin S. Bonham**, Shelley Hoefft McCann, Alexandra R Volpe, Viren D'Sa, Marcus Naymik, Matt D De Both, Matthew J Huentelman, Kathryn Lemery-Chalfant, Sarah K Highlander, Sean C L Deoni, and Vanja Klepac-Ceraj. "Family SES Is Associated with the Gut Microbiome in Infants and Children". en. In: *Microorganisms* 9.8 (July 2021), p. 1608. doi: 10.3390/microorganisms9081608.
- Peterson, Danielle, **Kevin S. Bonham**, Sophie Rowland, Cassandra W Pattanayak, RESONANCE Consortium, and Vanja Klepac-Ceraj. "Comparative Analysis of 16S rRNA Gene and Metagenome Sequencing in Pediatric Gut Microbiomes". en. In: *Front. Microbiol.* 12 (July 2021), p. 670336. doi: 10.3389/fmicb.2021.670336.
- * Tso, Lauren, **Kevin S. Bonham**, Alyssa Fishbein, Sophie Rowland, and Vanja Klepac-Ceraj. "Targeted High-Resolution Taxonomic Identification of *Bifidobacterium longum* subsp. *infantis* Using Human Milk Oligosaccharide Metabolizing Genes". en. In: *Nutrients* 13.8 (Aug. 2021), p. 2833. doi: 10.3390/nu13082833.
- Lloyd-Price, Jason, Cesar Arze, et al. "Multi-omics of the gut microbial ecosystem in inflammatory bowel diseases". en. In: *Nature* 569.7758 (May 2019), pp. 655–662. doi: 10.1038/s41586-019-1237-9.
- Tett, Adrian, Kun D Huang, et al. "The Prevotella copri Complex Comprises Four Distinct Clades Underrepresented in Westernized Populations". en. In: *Cell Host Microbe* 26.5 (Nov. 2019), 666–679.e7. doi: 10.1016/j.chom.2019.08.018.
- † **Bonham, Kevin S.** and Melanie I Stefan. "Women are underrepresented in computational biology: An analysis of the scholarly literature in biology, computer science and computational biology". en. In: *PLoS Comput. Biol.* 13.10 (Oct. 2017), e1005134. doi: 10.1371/journal.pcbi.1005134.
- Bonham, Kevin S.**, Benjamin E Wolfe, and Rachel J Dutton. "Extensive horizontal gene transfer in cheese-associated bacteria". en. In: *Elife* 6 (June 2017). doi: 10.7554/eLife.22144.
- Brubaker, Sky W, **Kevin S. Bonham**, Ivan Zanoni, and Jonathan C Kagan. "Innate immune pattern recognition: a cell biological perspective". en. In: *Annu. Rev. Immunol.* 33.1 (Jan. 2015), pp. 257–290. doi: 10.1146/annurev-immunol-032414-112240.
- Bonham, Kevin S.** and Jonathan C Kagan. "Endosomes as platforms for NOD-like receptor signaling". en. In: *Cell Host Microbe* 15.5 (May 2014), pp. 523–525. doi: 10.1016/j.chom.2014.05.001.
- Bonham, Kevin S.**, Megan H Orzalli, Kachiko Hayashi, Amaya I Wolf, Christoph Glanemann, Wolfgang Weninger, Akiko Iwasaki, David M Knipe, and Jonathan C Kagan. "A promiscuous lipid-binding protein diversifies the subcellular sites of toll-like receptor signal transduction". In: *Cell* 156.4 (2014), pp. 705–716.
- Bonham, Kevin S.**, Saskia Hemmers, Yeon-Hee Lim, Dawn M Hill, M G Finn, and Kerri A Mowen. "Effects of a novel arginine methyltransferase inhibitor on T-helper cell cytokine production". In: *FEBS J.* 277.9 (2010), pp. 2096–2108.

Fathman, John W, Michael F Gurish, Saskia Hemmers, **Kevin S. Bonham**, Daniel S Friend, Michael J Grusby, Laurie H Glimcher, and Kerri A Mowen. "NIP45 controls the magnitude of the type 2 T helper cell response". en. In: *Proc. Natl. Acad. Sci. U. S. A.* 107.8 (Feb. 2010), pp. 3663–3668. doi: 10.1073/pnas.0914700107.

Preprints and in-review

Bonham, Kevin S., Guilherme ZF Bottino, et al. "Gut-resident microorganisms and their genes are associated with cognition and neuroanatomy in children". In: *In review - Science Advances; bioRxiv* (2023). doi: 10.1101/2020.02.13.944181.

* Laue, Hannah E., **Kevin S. Bonham**, Modupe O. Coker, Yuka Moroishi, Wimal Pathmasiri, Susan McRitchie, Susan Sumner, Anne G. Hoen, Margaret R. Karagas, Vanja Klepac-Ceraj, and Juliette C. Madan. "Prospective Association of the Infant Gut Microbiome with Autism-Related Behaviors in the ECHO Consortium". In: *In revision - Scientific Reports* (2022).

Schoenborn, Alexi A, Sarah M Yannarell, Caroline T MacVicar, Noelia N Barriga-Medina, Meng Markillie, Hugh Mitchell, **Kevin S. Bonham**, Antonio Leon-Reyes, Diego Riveros-Iregui, Vanja Klepac-Ceraj, and Elizabeth A Shank. "Microclimate is a strong predictor of the native and invasive plant-associated soil microbiota on San Cristóbal Island, Galápagos archipelago". In: *In revision - Environmental Microbiology* (2022). doi: 10.1101/2022.04.05.487164.

* Woodruff, Matthew C, **Kevin S. Bonham**, et al. "Inflammation and autoreactivity define a discrete subset of patients with post-acute sequelae of COVID-19, or long-COVID". In: *In revision - Nature; medRxiv* (2022). doi: 10.1101/2021.09.21.21263845.

Thompson, Kelsey N, **Kevin S. Bonham**, et al. "Alterations in the gut microbiome in inflammatory arthritis implicate key taxa and metabolic pathways across arthritis phenotypes". In: *In revision - Science Translational Medicine* (2021).

Presentations

Invited Talks

UMass Amherst - Amherst, MA 2023

Gut microbes and their genes predict neurocognitive development in early life

Boston Bacterial Meeting - Cambridge, MA 2022

Microbiomes and Microbial Ecosystems

Panel discussion

Wellesley Science Center Faculty Seminar - Wellesley, MA 2019

The role of human gut microbial communities in the neurocognitive development of children

JuliaCon - Baltimore, MD 2019

Raising Diversity and Inclusion among Julia users

with Anna Harris and Elwin van t' Wout (Video link).

HSPH Biostatistics Retreat - Boston, MA 2018

Strain-resolved microbial profiling in inflammatory arthritis

Bowdoin College Biology Department Seminar - Brunswick, ME 2016

Extensive horizontal gene transfer in cheese-associated bacteria

Workshops Taught

Juvenile Diabetes Research Foundation Microbiome Initiative - Cambridge, MA 2018

The bioBakery for human microbiome epidemiology

Wageningen University - Wageningen, Netherlands 2018

Creating Effective Graphics for Scientific Presentations

SETAC, North Atlantic Chapter - Durham, NH 2018

Creating Effective Graphics for Scientific Presentations

Physalia Microbiome Analysis, Berlin DE 2018

- *Taxonomic profiling with MetaPhlan*
- *Functional profiling with HUMAnN*
- *Targeted functional profiling with ShortBRED*

- *Searching for horizontal gene transfer with WAAFL*

ACM Conference on Bioinformatics, Computational Biology, and Health Informatics - Boston, MA 2017
Workshop on Algorithms in Bioinformatics - HUMAN2

PEGS Summit - Boston, MA 2017
Immunology for Drug Discovery Scientists

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

Conference Posters

Since 2014

Bonham, Kevin S., MMK Bruchhage, S Rowland, AR Volpe, K Dyer, V D'Sa, C Huttenhower, S Deoni, and V Klepac-Ceraj. *Gut microbes and their genes are associated with brain development and cognitive function in healthy children.* ASM Microbe. Chicago, IL. June 2020.

Peterson, D, S Rowland, **Kevin S. Bonham**, and V Klepac-Ceraj. *Comparing early childhood gut microbiomes obtained from 16S rRNA gene and metagenome sequencing.* Boston Bacterial Meeting. Cambridge, MA. July 2020.

Tso, L, **Kevin S. Bonham**, S Rowland, and V Klepac-Ceraj. *Baby steps: Characterizing Bifidobacterium longum subsp. infantis and its presence in American infants.* ASM Microbe. Chicago, IL. June 2020.

– *Baby steps: Characterizing Bifidobacterium longum subsp. infantis and its presence in American infants.* Boston Bacterial Meeting. Cambridge, MA. July 2020.

Bonham, Kevin S., S Rowland, MMK Bruchhage, V D'Sa, C Huttenhower, S Deoni, and V Klepac-Ceraj. *The relationship of the gut microbiome, environmental exposure and neurocognitive development in infants and children.* Boston Bacterial Meeting. Cambridge, MA. May 2019.

Peterson, D, S Rowland, L Tso, **Kevin S. Bonham**, MMK Bruchhage, V D'Sa, C Huttenhower, and V Klepac-Ceraj. *The relationship of the gut microbiome, environmental exposures, and neurocognitive development in infants and children.* MIT-Harvard Microbiome Symposium. Cambridge, MA. Mar. 2019.

Rowland, S, **Kevin S. Bonham**, MMK Bruchhage, V D'Sa, C Huttenhower, S Deoni, and V Klepac-Ceraj. *The early childhood gut microbiome, environmental exposures, and neurocognitive development.* ASM Microbe. San Francisco, CA. June 2019.

Bonham, Kevin S., Eric A. Franzosa, Bahar Sayoldin, Nicholas E. Ilott, Hannah Fehlner-Peach, Samuel Bullers, Dan R. Littman, Stephen P. Young, Karim Raza, Fiona Powrie, and Curtis Huttenhower. *Strain-resolved microbial and metabolomic profiling in inflammatory arthritis.* Keystone: Microbiome, Host Resistance and Disease. Banff, Alberta, Canada. Jan. 2018.

Bonham, Kevin S., D Peterson, L Tso, S Rowland, S Deoni, C Huttenhower, and V Klepac-Ceraj. *The role of the gut microbiome in early childhood cognitive development.* Lake Arrowhead Microbial Genomics. Lake Arrowhead, CA. Sept. 2018.

Bonham, Kevin S., Benjamin E Wolfe, and Rachel J Dutton. *Extensive horizontal transfer in cheese-associated bacteria.* American Society of Microbiology, Mechanisms of Interbacterial Competition and Cooperation. Washington, D.C. Mar. 2017.

– *Extensive horizontal transfer in cheese-associated bacteria.* American Society of Microbiology, Microbe. New Orleans, LA. May 2015.

– *Identifying horizontal transfer in cheese-associated bacteria.* Boston Bacterial Meeting. Cambridge, MA. May 2014.

Teaching

Positions

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

Harvard Medical School – Boston, MA May 2014 - Apr 2016
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

Harvard Extension School – Cambridge, MA	Spring 2015
<i>Instructor</i>	
Course: Viruses: Molecular machines existing on the boundaries of life	
Emmerson College – Boston, MA	Spring 2012, 2014
<i>Adjunct Professor</i>	
Course: Plagues and Pandemics	
Graduate Courses	
Harvard T.H. Chan School of Public Health - Boston, MA	2018
<i>BST273 - Introduction to programming</i>	
Co-taught with Eric Franzosa.	
Harvard Medical School - Boston, MA	2014-2016
<i>IMM701 - Research Methods in Experimental Immunology</i>	
Harvard Medical School - Boston, MA	2014-2016
<i>IMM703 - Understanding Immunology Literature</i>	
Undergraduate Courses	
Wellesley College - Wellesley, MA	2022
<i>BISC314 - Environmental Microbiology Lab</i>	
Wellesley College - Wellesley, MA	2021
<i>BISC195 - Essential skills for computational biology</i>	
Harvard Medical School Online - Boston, MA	2016-2017
<i>Biochemistry essentials</i>	
Harvard Extension School - Cambridge, MA	2015
<i>BIOS E-157 - Viruses: A molecular arms race</i>	
Emmerson College - Boston, MA	2013, 2014
<i>SC214 - Plagues and Pandemics</i>	
Open Source Software	
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Package Author	
GaPLAC - bioBakery	2020-present
https://github.com/biobakery/GaPLAC	
<ul style="list-style-type: none"> • Gaussian Process (GP) command line tool • Ideal for longitudinal data, especially when sampled at irregular intervals • Use GLM model-like syntax for specifying formula 	
Airtable.jl	2020-present
https://github.com/kescobo/Airtable.jl	
<ul style="list-style-type: none"> • Interact with airtable.com REST API • Rate-limiting control over request frequency to avoid limits • FETCH, POST, and PATCH functionality using julia types 	
Microbiome.jl - EcoJulia	2016-present
https://github.com/EcoJulia/Microbiome.jl	
<ul style="list-style-type: none"> • Data structures for biosamples, sample features (eg taxa) • Attaching metadata to biosamples • Data structures for taxonomic and community profiles • Interfaces with statistical packages (eg <code>Distances.jl</code> and <code>Hc1ust.jl</code>) 	

BioBakeryUtils.jl - EcoJulia	2016-present
<i>https://github.com/BioJulia/BiobakeryUtils.jl</i>	
<ul style="list-style-type: none"> • Utilities for I/O of file types used with bioBakery tools • Plotting utilities 	
Kvasier - Dutton Lab	2014-2016
<i>https://github.com/DuttonLab/kvasir</i>	
<ul style="list-style-type: none"> • 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	
Co-founder, BioJulia	2017-present
<i>https://github.com/BioJulia/</i>	
YAML.jl - JuliaData	2019-present
<i>https://github.com/JuliaData/YAML.jl</i>	
ClusterManagers.jl - JuliaParallel	2018-present
<i>https://github.com/JuliaParallel/ClusterManagers.jl</i>	
PowerAnalysis.jl	2020-present
<i>https://github.com/johnmyleswhite/PowerAnalysis.jl</i>	
Package Contributor	
Pull Requests to	2021
Franklin.jl - <i>https://github.com/tlienart/Franklin.jl</i>	
LoggingExtras.jl - <i>https://github.com/JuliaLogging/LoggingExtras.jl</i>	
EcoBase.jl - <i>https://github.com/EcoJulia/EcoBase.jl</i>	
Pull Requests to	2020
Julia Language - <i>https://github.com/JuliaLang/julia</i>	
DataFrames.jl - <i>https://github.com/JuliaData/DataFrames.jl</i>	
CSV.jl - <i>https://github.com/JuliaData/CSV.jl</i>	
Documenter.jl - <i>https://github.com/JuliaDocs/Documenter.jl</i>	
Literate.jl - <i>https://github.com/fredrikekre/Literate.jl</i>	
LightGraphs.jl - <i>https://github.com/JuliaGraphs/LightGraphs.jl</i>	
SQLite.jl - <i>https://github.com/JuliaDatabases/SQLite.jl</i>	
Pull Requests to	2019
StatsPlots.jl - <i>https://github.com/JuliaPlots/StatsPlots.jl</i>	
Documenter.jl - <i>https://github.com/JuliaDocs/Documenter.jl</i>	
DataDeps.jl - <i>https://github.com/oxinabox/DataDeps.jl</i>	
Clustering.jl - <i>https://github.com/JuliaStats/Clustering.jl</i>	
language-weave - <i>https://github.com/JunoLab/language-weave</i>	
Pull Requests to	2018
Colors.jl - <i>https://github.com/JuliaGraphics/Colors.jl</i>	
Julia - <i>https://github.com/JuliaLang/julia</i>	
DataFrames.jl - <i>https://github.com/JuliaData/DataFrames.jl</i>	
StatsPlots.jl - <i>https://github.com/JuliaPlots/StatsPlots.jl</i>	
SpatialEcology.jl - <i>https://github.com/EcoJulia/SpatialEcology.jl</i>	
Pull Requests to	2017
Distances.jl - <i>https://github.com/JuliaStats/Distances.jl</i>	
BioSequences.jl - <i>https://github.com/BioJulia/BioSequences.jl</i>	
Bio.jl - <i>https://github.com/BioJulia/Bio.jl</i>	

Outreach

Online Publications

Co-founder of “Emmunity.org”, Co-Host of the podcast Audiommunity	2014-2019
Creator: Adobe Illustrator for Scientists tutorial videos (youtube)	2014-Present
Blogger: “Food Matters” Scientific American Blogs	2013-2016

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

Founder: “We, Beasties,” ScienceBlogs.com	2009-2013
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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

Panel Moderator: Boston Fermentation Festival	2016
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Presenter: Boston Science Museum Health Science Fair	2015
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Lecturer: Harvard Science in the News (SITN).	2009-2013
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- 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)

Co-founder: Harvard Policy PATH	2010-2012
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Student Advocate: ASBMB “Hill Day”	2011
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