Kevin Bonham, PhD

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 CA, San Diego - La Jolla, CA **2002-2006**

B.S. 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. Interactions between the gut microbiome and neurocognitive development

2. Immune dysregulation in long-term sequelae of viral infection
3. Research software for machine learning and Bayesian modeling of large biological datasets

Narative Report

Biological data generation from multi-'omic studies vastly outstrips the capacity of researchers to make use of it, and many associations and discoveries made *in silico* remain unverified by experiment. I am interested in using machine learning and other advanced computational methods to extract meaning from large biological datasets from human studies and use them to inform targeted *in vivo* and *in vitro* experiments. My current focus is investigating the microbiome's influence on neurocognitive development in children and the effects of viral disruption of immune homeostasis.

Honors and Awards

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

Reserach Funding

Current

Co-Invenstigator on Wellcome Leap 1kD **2021 - present**
A multi-scale approach to characterizing developing executive function

Past

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

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

Publications

* indicates co-first authorship

† indicates corresponding authorship

* Laue, Hannah E., * **Bonham, Kevin S**., Coker, Modupe O., Moroishi, Yuka *et. al.*, "Prospective Association of the Infant Gut Microbiome with Social Behaviors in the ECHO Consortium". *Molecular Autism (in press)*. (2024) doi: 10.1186/s13229-024-00597-2

Bonham, Kevin S., Bottino, Guilherme Fahur, McCann, Shelley Hoeft, Beauchemin, Jennifer *et. al.*, "Gut-resident microorganisms and their genes are associated with cognition and neuroanatomy in children". *Science Advances*. (2023) doi: 10.1126/sciadv.adi0497

* Woodruff, Matthew C., * **Bonham, Kevin S**., Anam, Fabliha A., Walker, Tiffany A. *et. al.*, "Chronic Inflammation, Neutrophil Activity, and Autoreactivity Splits Long COVID". *Nature Communications*. (2023) doi: 10.1038/s41467-023-40012-7

Thompson, Kelsey N, **Bonham, Kevin S**., Ilott, Nicholas E, Lam, Lilian H *et. al.*, "Alterations in the Gut Microbiome in Inflammatory Arthritis Implicate Key Taxa and Metabolic Pathways Across Arthritis Phenotypes". *Science Translational Medicine*. (2023) doi: 10.1126/scitranslmed.abn4722

Schoenborn, Alexi A., Yannarell, Sarah M., MacVicar, Caroline T., Barriga-Medina, Noelia N. *et. al.*, "Microclimate Is a Strong Predictor of the Native and Invasive Plant-Associated Soil Microbiome on San Cristóbal Island, Galápagos Archipelago". *Environmental Microbiology*. (2023) doi: 10.1111/1462-2920.16361

† **Bonham, Kevin S**, Kayisire, Annelle, Luo, Anika and Klepac-Ceraj, Vanja, “Microbiome.jl and BiobakeryUtils.jl - Julia Packages for Working with Microbial Community Data”. *Journal of Open Source Software*. (2021) doi: 10.21105/joss.03876

* Tso, Lauren, * **Bonham, Kevin S**., Fishbein, Alyssa, Rowland, Sophie *et. al.*, “Targeted High-Resolution Taxonomic Identification of *Bifidobacterium longum* subsp. *infantis* Using Human Milk Oligosaccharide Metabolizing Genes”. *Nutrients*. (2021) doi: 10.3390/nu13082833

Peterson, Danielle, **Bonham, Kevin S**., Rowland, Sophie, Pattanayak, Cassandra W. *et. al.*, “Comparative Analysis of 16S rRNA Gene and Metagenome Sequencing in Pediatric Gut Microbiomes”. *Frontiers in Microbiology*. (2021) doi: 10.3389/fmicb.2021.670336

Lewis, Candace R., **Bonham, Kevin S**., McCann, Shelley Hoeft, Volpe, Alexandra R. *et. al.*, “Family SES Is Associated with the Gut Microbiome in Infants and Children”. *Microorganisms*. (2021) doi: 10.3390/microorganisms9081608

Gauthier, Anna E., Chandler, Courtney E., Poli, Valentina, Gardner, Francesca M. *et. al.*, “Deep-Sea Microbes as Tools to Refine the Rules of Innate Immune Pattern Recognition”. *Science Immunology*. (2021) doi: 10.1126/sciimmunol.abe0531

Lloyd-Price, Jason, Arze, and Cesar, Ananthakrishnan, Ashwin N., Schirmer, Melanie *et. al.*, “Multi-Omics of the Gut Microbial Ecosystem in Inflammatory Bowel Diseases”. *Nature*. (2019) doi: 10.1038/s41586-019-1237-9

Tett, Adrian, Huang, Kun D., Asnicar, Francesco, Fehlner-Peach, Hannah *et. al.*, “The *Prevotella copri* Complex Comprises Four Distinct Clades Underrepresented in Westernized Populations”. *Cell Host and Microbe*. (2019) doi: 10.1016/j.chom.2019.08.018

† **Bonham, Kevin S**. and Stefan, Melanie I., “Women Are Underrepresented in Computational Biology: An Analysis of the Scholarly Literature in Biology, Computer Science and Computational Biology”. *PLoS Computational Biology*. (2017) doi: 10.1371/journal.pcbi.1005134

Bonham, Kevin S, Wolfe, Benjamin E and Dutton, Rachel J, “Extensive Horizontal Gene Transfer in Cheese-Associated Bacteria”. *eLife*. (2017) doi: 10.7554/elife.22144

Bonham, Kevin S., Orzalli, Megan H., Hayashi, Kachiko, Wolf, Amaya I. *et. al.*, “A Promiscuous Lipid-Binding Protein Diversifies the Subcellular Sites of Toll-like Receptor Signal Transduction”. *Cell*. (2014) doi: 10.1016/j.cell.2014.01.019

Fathman, J. W., Gurish, M. F., Hemmers, S., **Bonham, Kevin S**. *et. al.*, “NIP45 Controls the Magnitude of the Type 2 T Helper Cell Response”. *Proceedings of the National Academy of Sciences*. (2010) doi: 10.1073/pnas.0914700107

Bonham, Kevin S, Hemmers, Saskia, Lim, Yeon-Hee, Hill, Dawn M. *et. al.*, “Effects of a Novel Arginine Methyltransferase Inhibitor on T-helper Cell Cytokine Production”. *FEBS Journal*. (2010) doi: 10.1111/j.1742-4658.2010.07623.x

Presentations

Invited Talks

Cambridge Area Julia Users Network, MIT - Cambridge, MA **2024**
Doing biology in Julia

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 WAAFLE*

ACM Conference on Bioinformatics, Computational Biology, and Health Informatics - Boston, MA **2017**
Workshop on Algorithms in Bioinformatics - HUMAnN2

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

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

Conference Posters

Bonham, Kevin S, Wolfe, Benjamin E and Dutton, Rachel J, "Identifying horizontal transfer in cheese-associated bacteria". *Boston Bacterial Meeeting*. (2014)

Bonham, Kevin S, Wolfe, Benjamin E and Dutton, Rachel J, "Extensive horizontal transfer in cheese-associated bacteria". *ASM Microbe*. (2015)

Bonham, Kevin S, Wolfe, Benjamin E and Dutton, Rachel J, "Extensive horizontal transfer in cheese-associated bacteria". *ASM Microbe*. (2017)

Bonham, Kevin S., Franzosa, Eric A., Sayoldin, Bahar, Ilott, Nicholas E. *et. al.*, "Strain-resolved microbial and metabolomic profiling ininflammatory arthritis". *Keystone: Microbiome, Host Resistance and Disease*. (2018)

Bonham, Kevin S., Peterson, D, Tso, L, Rowland, S *et. al.*, "The role of the gut microbiome in early childhood cognitive development". *Lake Arrowhead Microbial Genomics*. (2018)

Peterson, D, Rowland, S, Tso, L, **Bonham, Kevin S**. *et. al.*, "The relationship of the gut microbiome, environmental exposures, and neurocognitive development in infants and children". *MIT Microbiome Symposium*. (2019)

Bonham, Kevin S., Rowland, S, Bruchhage, MMK, D'Sa, V *et. al.*, “The relationship of the gut microbiome, environmental exposure and neurocognitive development in infants and children”. *Boston Bacterial Meeeting*. (2019)

Rowland, S, **Bonham, Kevin S**., Bruchhage, MMK, D'Sa, V *et. al.*, “The early childhood gut microbiome, environmental exposures, and neurocognitive development.”. *ASM Microbe*. (2019)

Bonham, Kevin S., Bruchhage, MMK, Rowland, S, Volpe, AR *et. al.*, “Gut microbes and their genes are associated with brain development and cognitive function in healthy children.”. *ASM Microbe*. (2020)

Tso, L, **Bonham, Kevin S**., Rowland, S and Klepac-Ceraj, V, “Baby steps: characterizing *Bifidobacterium longum* subsp. *infantis* and its presence in american infants.”. *ASM Microbe*. (2020)

Tso, L, **Bonham, Kevin S**., Rowland, S and Klepac-Ceraj, V, “Baby steps: characterizing *Bifidobacterium longum* subsp. *infantis* and its presence in american infants.”. *Boston Bacterial Meeeting*. (2020)

Peterson, D, Rowland, S, **Bonham, Kevin S**. and Klepac-Ceraj, V, “Comparing early childhood gut microbiomes obtained from 16S rRNA gene and metagenome sequencing.”. *Boston Bacterial Meeeting*. (2020)

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**

Instructor

Course: Viruses: Molecular machines existing on the boundaries of life

Emmerson College – Boston, MA **Spring 2012, 2014**

Adjunct Professor

Course: Plagues and Pandemics

Graduate Courses

Harvard T.H. Chan School of Public Health - Boston, MA **2018**

BST273 - Introduction to programming

Co-taught with Eric Franzosa.

Harvard Medical School - Boston, MA **2014-2016**

IMM701 - Research Methods in Experimental Immunology

Harvard Medical School - Boston, MA **2014-2016**

IMM703 - Understanding Immunology Literature

Undergraduate Courses

Wellesley College - Wellesley, MA **2022**

BISC314 - Environmental Microbiology Lab

Wellesley College - Wellesley, MA **2021**

BISC195 - Essential skills for computational biology

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

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

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

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**

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**

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

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

- 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**

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