

# *Curriculum Vitae*

**Alex Washburne**

## *Education*

Ph.D. Princeton University, Quantitative & Computational Biology (May 2015)  
B.S. in Applied Mathematics *Summa cum laude*, University of New Mexico (2010)  
B.S. in Biology *Summa cum laude*, University of New Mexico (2010)

## *Awards & Scholarships*

Co-PI DARPA PREEMPT grant (\$16M)  
DARPA director's award nomination for work with Raina Plowright (2018)  
Invited consultant for hedge funds and microbiome diagnostic corporations  
Invited speaker at ESA 2017, CoDa Work 2017, and the Royal Statistical Society, 2017  
Princeton President's Fellowship in Science & Engineering (2010-2011)  
NSF Graduate Research Fellow (2010-2013)  
NSF-MCTP scholar (2009-2010)  
ABRCMS prize for oral presentation in physics & mathematical sciences (2009)  
SACNAS prize for undergraduate poster presentation in mathematics (2008)  
President of UNM Kappa Mu Epsilon (mathematics honor society) (2008-2010)  
NIH-MARC scholar (2007-2009)  
Dean's List, University of New Mexico (2007-2010)

## *Publications*

**Washburne AD**, Crowley DE, Manlove K, Becker DJ, Plowright RK (*accepted*) Percolation models of pathogen spillover. *Philosophical Transactions of the Royal Society B*

**Washburne AD**, Silverman JD, Morton J, Crowley D, Becker D, Mukherjee S, David LA, Plowright R (2019) Phylofactorization – a graph partitioning algorithm for identifying phylogenetic scales of ecological data. *Ecological Monographs*

Rocca JD, Simonin M, Blaszczyk JR, Ernakovich JG, Gibbons SM, Midani FS, **Washburne AD** (2019) The Microbiome Stress Project: towards a global meta-analysis of environmental stressors and their effects on microbial communities. *Frontiers Microbiology*

**Washburne AD**, Crowley DE, Becker DJ, Olival KJ, Taylor M, Munster VJ, Plowright RK. (2018) Taxonomic patterns in the zoonotic potential of mammalian viruses. *PeerJ* 6:e5979

**Washburne AD\***, Morton J\*, Sanders J, McDonald D, Zhu Q, Oliverio AM & Knight R (2018) Methods for phylogenetic analysis of microbiome datasets. *Nature Microbiology* 3 (652-661)

Faust K, Bauchinger F, De Buyl S, Lahti L, **Washburne AD**, Laroche L, Gonze D, Widder S (2018) Signatures of

ecological processes in microbial community time series. *Microbiome* 6:120

Angela M. Oliverio, Jean F. Power, **Alex D. Washburne**, S. Craig Cary, Matthew B. Stott, Noah Fierer (2018) The ecology and diversity of microbial eukaryotes in geothermal springs. *ISME*

Vázquez-Baeza, Y., Gonzalez, A., Xu, Z. Z., **Washburne, A.**, Herfarth, H. H., Sartor, R. B., & Knight, R. (2017). Guiding longitudinal sampling in IBD cohorts. *Gut*, gutjnl-2017.

Silverman JD, **Washburne AD**, Mukherjee S and David LA (2017) A phylogenetic transform enhances analysis of compositional microbiome data *eLife* 6:e21887

**Washburne AD**, Silverman JD, Leff JW, Bennett DJ, Darcy JL, Mukherjee S, Fierer N, and David LA. (2017) Phylogenetic factorization of compositional data yields lineage-level associations in microbiome datasets *PeerJ* 5:e2969

**Washburne AD**, Burby J & Lacker D (2016). Novel covariance-based neutrality test reveals competitive asymmetries in ecological and economic systems. *PLoS Computational Biology* 12(9): e1005124. doi: 10.1371/journal.pcbi.1005124

Socolar J\* and **Washburne AD\*** (2015) Prey carrying capacity modulates the effect of prey-switching predation on prey diversity. *The American Naturalist* 186:3, 333-347

Tarnita CE\*, **Washburne AD\***, Martinez-Garcia R, Sgro AE, Levin SA (2015) Fitness tradeoffs between spores and nonaggregating cells can explain the coexistence of diverse genotypes in cellular slime molds *PNAS* 112 (9) 2776-2781; doi:10.1073/pnas.1424242112

\*Co-first authors

## **Skills**

- **Applied mathematics:** dynamical systems, numerical analysis, computational mathematics, partial differential equations, stochastic processes (discrete and continuous), graph theory, algorithm development, parallel computing, advanced matrix theory, mathematical analysis of massive datasets, statistics & probability theory, stochastic portfolio theory, adaptive dynamics
- **Computer languages:** MATLAB, R, SQL, GitHub
- **Empirical skills:** microarrays, cytometric assays, ELISA & serological assays, metagenomic sequencing, X-ray crystallography, mass-spectrometry, stable isotope ecology
- **Financial skills:** Knowledge of rules, regulations, tickers & common derivatives in international exchanges, trading strategy development, Sharpe maximization, P&L analyses, portfolio development and forecasting, big data analysis, time series analysis

## **Research Experience**

- Phylogenetic analysis consulting (January 2019 – present)  
*Topic:* Phylogenetic analysis of glacier fed stream microbiome, metagenome & biogeochemical data.  
*Skills:* Biogeographical analyses of microbes, microbiome-metagenome interface
- Microbiome data analyst & consultant (January 2018-April 2019)

*Topic:* Phylogenetic-based machine learning for sample-site classification and focused sequencing.  
*Skills:* Personally-developed phylogenetic neural networks for multi-million dollar decisions.

- **Pathogen spillover modelling, analysis & theory development (July 2017-present)**  
*Topic:* Understand, manage, simplify and predict pathogen spillover on a global scale  
*Skills:* epidemiological modelling, adaptive dynamics, translation of research for management.
- **Trading Strategy Development (June 2016-present)**  
*Topic:* Analysis of financial big-datasets; trading strategy development; portfolio optimization  
*Skills:* SQL, financial data analysis, statistical consulting
- **Microbiome Statistical Tools, Duke University with Diana Nemergut (2015-July 2017)**  
*Topic:* Analyzing phylogenetically-structured compositional datasets to infer patterns in microbial community assembly, competition, and turnover.  
*Skills:* Programming in R, parallel computing, amplicon sequencing, use of Github, and analysis of big datasets.
- **Theoretical Ecology, Princeton University with Simon Levin (2010-2015)**  
*Topic:* Null models in ecology, mechanisms for maintenance of biodiversity, dispersal/dormancy tradeoffs and ecological species concepts for metagenomic datasets.  
*Skills:* Stochastic models (discrete and continuous time and state), adaptive dynamics, parallel computing (MATLAB), mathematical analysis of high-dimensional data, theory of complex adaptive systems
- **Mathematical Biology, University of New Mexico with Helen Wearing (2009-2010)**  
*Topic:* Comparing dynamics of lytic and lysogenic viruses; evolution of virulence and lysogeny  
*Skills:* Nonlinear dynamics, systems of ordinary and partial differential equations, phage-host models and epidemiology/epizootiology
- **Comparative Immunology, University of New Mexico with Eric S. Loker (2008-2009)**  
*Topic:* Ecoimmunology & gene expression in *Biomphalaria Glabrata* exposed to schistosomiasis  
*Skills:* Microarray data analysis and visualization, ecoimmunology & comparative immunology
- **Evolutionary Protein Biochemistry, Brandeis University with Greg Petsko (2007)**  
*Topic:* Catalytic/functional evolution of beta-lactamases from beta-lactonases (with Dali Liu)  
*Skills:* Protein production, purification, x-ray crystallography, kinetics, mass-spec, spectrophotometry
- **Marine Biology, Lizard Island (Great Barrier Reef) with Ursula Shepherd (2006)**  
*Topic:* Spatial variation in bioerosion: densities of bivalves on reef-building corals on inner vs outer reefs.  
*Skills:* Coral reef population surveys, statistical analysis of ecological count data
- **LTER Community Ecology, University of New Mexico with Blair Wolf (2005-2007)**  
*Topic:* Seasonal pulses of C3 and C4 carbon flux in avian, reptilian and mammalian communities in an arid grassland (with Robin Warne and Alena Pershall); Sexual dimorphism in behavioral and field metabolic ecology of collared lizards during reproductive season (personal project).  
*Skills:* IACUC handling, intraperitoneal injection and orbital bleeding of reptiles and small mammals; isotope ecology; capture-mark-recapture population surveys; food web theory and physiological ecology.

## **Teaching Experience**

Theoretical Ecology (EEB 324) - Teaching assistant

Mathematical Modelling in Medicine (EEB 325) - Teaching assistant  
Method & Logic in Quantitative Biology (MOL 515/PHS 570) - Teaching assistant  
MCTP mathematics mini-course on "Symmetry of Chemistry" - lecturer