William S. DeWitt, PhD

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ACADEMIC POSITIONS

Sept 2024 – present	University of Washington, Seattle Genome Sciences	Assistant Professor
May 2022 – June 2024	University of California, Berkeley Electrical Engineering & Computer Sciences	*McDonnell Foundation Fellow* host: Dr. Yun S. Song

EDUCATION

PhD 2022	University of Washington Genome Sciences	advisors: Dr. Erick Matsen, Dr. Kelley Harris dissertation: *Some problems in probabilistic modeling of germline and somatic evolutionary processes*
MS, BA 2011	University of Vermont Physics	advisor: Dr. Kelvin Chu thesis: *Imaging protein statistical substate occupancy in a spectrum-function phase space*

PUBLICATIONS AND PREPRINTS (* = co-first authorship, † = co-senior authorship)

WS DeWitt, SN Evans, E Hiesmayr, S Hummel. *Mean-field interacting multi-type birth-death processes with a view to applications in phylodynamics*. Theoretical Population Biology Volume 159 (2024)

M Celentano, **WS DeWitt**, S Prillo, YS Song. *Exact and efficient phylodynamic simulation from arbitrarily large populations*. arXiv:2402.17153 [q-bio.PE]

W Dumm, M Barker, W Howard-Snyder, **WS DeWitt**, FA Matsen IV, *Representing and extending ensembles of parsimonious evolutionary histories with a directed acyclic graph*. J. Math. Biol. 87, 75 (2023).

GE Boyle, K Sitko, JG Galloway, HK Haddox, AH Bianchi, A Dixon, RES Thomson, RK Garge, AE Rettie, AR, RC Geck, EMJ Gillam, **WS DeWitt**, FA Matsen IV, DM Fowler. *Deep mutational scanning of CYP2C19 reveals a substrate specificity-abundance tradeoff*. bioRxiv 2023.10.06.561250 (2023)

HK Haddox, JG Galloway, B Dadonaite, JD Bloom†, FA Matsen IV†, **WS DeWitt**†. *Jointly modeling deep mutational scans identifies shifted mutational effects among SARS-CoV-2 spike homologs*. bioRxiv 2023.07.31.551037 (2023)

WS DeWitt, L Zhu, MR Vollger, ME Goldberg, A Talenti, AC Beichman, K Harris, (2023). *mutyper: assigning and summarizing mutation types for analyzing germline mutation spectra*. JOSS 8(85), 5227 (2023)

MR Vollger, PC Dishuck, WT Harvey, **WS DeWitt**, X Guitart, ME Goldberg, A Rozanski, J Lucas, M Asri, KM Munson, AP Lewis, K Hoekzema, GA Logsdon, D Porubsky, B Paten, K Harris, P Hsieh, EE Eichler, Human Pangenome Reference Consortium, *Increased mutation and gene conversion within human segmental duplications*. Nature 617 (7960), 325-334 (2023)

TC Yu, ZT Thornton, WH Hannon, **WS DeWitt**, CE Radford, FA Matsen, JD Bloom. *A biophysical model of viral escape from polyclonal antibodies*. Virus Evolution, Volume 8, Issue 2, (2022)

AF Magee*, SK Hilton*, **WS DeWitt***, *Robustness of phylogenetic inference to model misspecification caused by pairwise epistasis*. Molecular Biology and Evolution, 38 (10), 4603-4615, (2021)

WS DeWitt, KD Harris, AP Ragsdale, K Harris. *Nonparametric coalescent inference of mutation spectrum history and demography*. Proceedings of the National Academy of Sciences, 118(21) (2021).

Z Montague, H Lv, J Otwinowski, **WS DeWitt**, G Isacchini, GK Yip, WW Ng, OTY Tsang, M Yuan, H Liu, IA Wilson, M Peiris, NC Wu, A Nourmohammad, CKP Mok. *Dynamics of B cell repertoires and emergence of cross-reactive responses in patients with different severities of COVID-19*. Cell Reports, 35 (8) (2021)

J Feng, **WS DeWitt**, A McKenna, N Simon, A Willis, FA Matsen. *Estimation of cell lineage trees by maximum-likelihood phylogenetics*. The Annals of Applied Statistics, 15 (1) (2021)

J Carlson, **WS DeWitt**, K Harris. *Inferring evolutionary dynamics of mutation rates through the lens of mutation spectrum variation*. Current Opinion in Genetics & Development 62, 50-57 (2020)

K Davidsen, BJ Olson, **WS DeWitt**, J Feng, E Harkins, P Bradley, FA Matsen. *Deep generative models for T cell receptor protein sequences*. eLlife (2019)

WS DeWitt, A Smith, G Schoch, JA Hansen, FA Matsen, PH Bradley. *Human T cell receptor occurrence patterns encode immune history, genetic background, and receptor specificity*. eLife. (2018)

DA Cusanovich, AJ Hill, D Aghamirzaie, RM Daza, HA Pliner, JB Berletch, GN Filippova, X Huang, L Christiansen, **WS DeWitt**, C Lee, SG Regalado, DF Read, FJ Steemers, CM Disteche, C Trapnell, J Shendure. *A single-cell atlas of in vivo mammalian chromatin accessibility*. Cell 174 (5) (2018)

WS DeWitt, KK Quan, D Wilburn, A Sherwood, M Vignali, SC De Rosa, CL Day, TJ Scriba, HS Robins, W Swanson, RO Emerson, P Bradley, C Seshadri. *A diverse lipid antigen–specific TCR repertoire is clonally expanded during active tuberculosis*. The Journal of Immunology 201 (3), 888-896 (2018)

WS DeWitt, L Mesin, GD Victora, VN Minin, FA Matsen. *Using genotype abundance to improve phylogenetic inference*. Molecular Biology and Evolution, Volume 35, Issue 5, 1 May 2018, Pages 1253–1265

RO Emerson*, **WS DeWitt***, M Vignali, J Gravley, JK Hu, EJ Osborne, C Desmarais, M Klinger, CS Carlson, JA Hansen, M Rieder, HS Robins. *Immunosequencing identifies signatures of cytomegalovirus exposure history and HLA-mediated effects on the T cell repertoire*. Nature Genetics 49, (2017)

WS DeWitt*, P Lindau*, TM Snyder*, AM Sherwood, M Vignali, CS Carlson, PD Greenberg, N Duerkopp, RO Emerson, HS Robins. *A Public Database of Memory and Naive B-Cell Receptor Sequences*. PLoS ONE 11(8) (2016)

WS DeWitt, RO Emerson, P Lindau, M Vignali, TM Snyder, C Desmarais, C Sanders, H Utsugi, EH Warren, J McElrath, KW Makar, A Wald, HS Robins. *Dynamics of the Cytotoxic T Cell Response to a Model of Acute Viral Infection*. J Virol 89:4517–4526 (2015)

WS DeWitt, P Lindau, TM Snyder, M Vignali, RO Emerson, HS Robins. *Replicate Immunosequencing as a Robust Probe of B Cell Repertoire Diversity*. arXiv:1410.0350 [q-bio.QM] (2014)

WS DeWitt, K. Chu. *Imaging Protein Statistical Substate Occupancy in a Spectrum-Function Phase Space*. Physical Review Letters 105, 098101 (2010)

PATENTS

Multiplexed digital quantitation of rearranged lymphoid receptors in a complex mixture
US 2016/0138011 A1 (2016)

Characterization of adaptive immune response to vaccination or infection using immune repertoire sequencing
US 11,066,705 B2 (2021)

Methods for diagnosing infectious disease and determining HLA status using immune repertoire sequencing
US 11,047,008 B2 (2021)

FUNDING

Santa Fe Institute Micro Working Groups. Role: co-organizer of four one-week collaborative workshops:	
Slow-fast dynamics in biological systems I	March 23–28, 2023
Slow-fast dynamics in biological systems II	Oct 7–11, 2023
Evolutionary dynamics of cheating in viral infections I	April 10–15, 2024
Evolutionary dynamics of cheating in viral infections II	Nov 2–7, 2024
Postdoctoral Fellowship in Understanding Dynamic and Multi-scale Systems, James S. McDonnell Foundation. Role: PI, full salary support and travel/equipment budget.	May 2022 – July 2024
Kirschstein Predoctoral Individual National Research Service Award (F31AI150163). NIAID, NIH. Role: PI. Impact Score: 13	Jan 2020 – Dec 2022
Genome Training Grant (T32HG000035-23). NHGRI, NIH. Role: trainee	Sept 2017 – Sept 2019

PROFESSIONAL EXPERIENCE

Fred Hutchinson Cancer Center	Programmer/Analyst II	Aug 2016 – Sep 2017
Adaptive Biotechnologies	Sr. Computational Biologist	Apr 2015 – Aug 2016
	Sr. Bioinformatics Scientist	Oct 2012 – Mar 2015
Columbia Genome Center	Senior Scientific Programmer	Nov 2011 – Sep 2012
Bloomberg L.P.	R&D Developer	Aug 2011 – Oct 2011
Ascension Technology Corp.	Computational Physicist	Jun 2010 – Aug 2011
	Numerical Analyst	Jun 2007 – Jun 2010

TEACHING EXPERIENCE

University of Washington Genome Sciences	Instructor of record for GENOME 541: Population Genetic Inference	Spring 2020
	Teaching Assistant for GENOME 361: Introduction to Genetics	Winter 2020
UVM Physics Dept.	Teaching Assistant / Tutor	Feb 2007 – May 2007
VT HITEC Inc.	Teaching Consultant	Jul 2006 – Sep 2006

INVITED TALKS

Effective theories and response functions for germinal center evolutionary dynamics. Kavli Institute for Theoretical Physics, Santa Barbara. Hosted by Thierry Mora.	October 2, 2024
Dynamics, prediction, and computation for evolutionary mechanisms in immune responses. Stanford University, Biomedical Data Science Seminar. Hosted by Chiara Sabatti.	March 7, 2024
Dynamics, prediction, and computation for evolutionary mechanisms in immune responses. University of Washington, Genome Sciences Seminar. Hosted by Douglas Fowler.	February 14, 2024
Experiments, theory, and inference for parallel replay of B-cell evolution. Aspen Center for Physics, Aspen, Colorado. Program on statistical physics & adaptive immunity. Hosted by Armita Nourmohammad	August 18, 2023

Evolution of antibody affinity maturation in replica germinal centers. Ohio State University, Biomedical Informatics seminar. Hosted by Dr. Brian Searle.	October 7, 2022
Inferring evolutionary processes across scales: from germline mutagenesis to adaptive immunity. Columbia University, Program for Mathematical Genomics. Hosted by Dr. Mohammed AlQuraishi.	March 10, 2022
Inferring evolutionary processes across scales: from germline mutagenesis to adaptive immunity. Arizona State University, Dept. of Physics and Center for Mechanisms of Evolution. Hosted by Dr. Banu Ozkan and Dr. Michael Lynch.	February 16, 2022
Evolutionary inference for mutagenesis, demography, and adaptive immunity. Cornell University Dept. of Computational Biology. Hosted by Dr. Philipp Messer [virtual].	November 16, 2020
Adaptive immune repertoires: a structured space of chemical sensors. Princeton Institute for Theoretical Sciences: Sensing chemical spaces.	December 12, 2019
Inferring ancient dynamics of mutational processes that shape modern genetic variation. University of Oregon The Institute of Ecology and Evolution. Hosted by Dr. Peter Ralph.	November 22, 2019
Antibody affinity maturation as a model system for sequence evolution. ETH Zürich Dept. of Environmental Systems Science. Hosted by Prof. Dr. Joshua Payne.	July 29, 2019
Computational approaches to adaptive immune repertoires. Roche Sequencing, Pleasonton, CA. Hosted by Dr. Jan Berka.	June 27, 2018
Quantitative methods for analysis of immunosequencing data. Google Life Sciences (formerly Google[x], currently Verily)	October 9, 2015
Imaging Protein Statistical Substate Occupancy in a Spectrum-Function Phase Space. Biocomputing Department, DFG Research Center MATHEON, Freie Universität Berlin. Hosted by Prof. Dr. Frank Noé	December 14, 2010
Imaging Protein Statistical Substate Occupancy in a Spectrum-Function Phase Space. Max Planck Institute for Biophysical Chemistry, Göttingen. Hosted by Prof. Dr. Helmut Grubmüller	October 1, 2010

CONTRIBUTED TALKS

Evolutionary dynamics of antibody affinity maturation in replica germinal centers. SMBE 2023, Ferrara, Italy.	July 24, 2023
Evolutionary dynamics of antibody affinity maturation in replica germinal centers. Probabilistic Modeling in Genomics 2023, CSHL	March 12, 2023
Evolution of antibody affinity maturation in replica germinal centers. Bay Area Population Genetics, UC Berkeley.	October 15, 2022
Reconstructing human mutation spectrum evolution over thousands of generations. Probabilistic Modeling in Genomics 2021 [virtual]	April 14, 2021
~~*Joint non-parametric inference of demography and time-calibrated mutation spectrum histories*. SMBE 2020~~ [meeting canceled due to COVID-19]	July 1, 2020
Coalescent inference of mutation spectrum histories from sample frequency spectra. TAGC 2020, ~~lightning talk~~ [converted to virtual poster Q&A due to COVID-19]	May 1, 2020

Antibody affinity maturation as a model system for sequence evolution. Nordic Institute for Theoretical Physics: Predictability and control of evolution. July 25, 2019

HONORS, AWARDS

SMBE 2023 Young Investigator Award

Probabilistic Modeling in Genomics 2018 registration award

University of Washington Graduate School international conference travel award, 2018

Cover art submission selected for May 2018 issue of *Molecular Biology and Evolution*.

SMBE 2018 Yokohama, Registration Award

WORKSHOPS AND TRAININGS

Interactions and Co-evolution between Viruses and Immune Systems Kavli Institute for Theoretical Physics, Santa Barbara	3-week program Sep 24–Oct 11, 2024
Inclusive Research Mentor-Manager Training UCSF-CCSF	4 hours per week, 5 weeks Oct 11–Nov 17, 2023
Program on Statistical Physics & Adaptive Immunity Aspen Center for Physics	2-week workshop Aug 14–25, 2023
Sensing Chemical Spaces Princeton Center for Theoretical Sciences	1-week workshop December 11-13, 2019
10th annual summer institute in statistics and modeling in infectious diseases: Evolutionary dynamics and molecular epidemiology of viruses University of Washington	Intensive course Jul 18–20, 2018

SERVICE

Peer Review: Molecular Biology & Evolution, Genetics, PLoS Comp Bio, eLife, Bioinformatics, Nature Scientific Reports, Science, Royal Society Interface

Co-organizer for Berkeley Center for Theoretical Evolutionary Genetics, Spring 2023 – Spring 2024

Organizer for departmental seminars in UW Genome Sciences. Spring 2020 – Fall 2020

Graduate student representative in UW Genome Sciences monthly faculty meetings, 2018 – 2019

UW / Fred Hutch Molecular Evolution Supergroup, organizer of ~monthly meetings, 2019 – 2020

UW Genome Sciences 1st year mentor. 2019 – 2022

UW Popgen Lunch seminar series organizer, weekly Spring 2021

OUTREACH

Imagine Science Films

- Unit still photography, B-roll camera, and scientific production assistant on the set of The Fly Room, a short film about the geneticist Calvin Bridges, which we shot in the reconstructed "fly room" of Thomas Hunt Morgan in its original location at Columbia University.
- Video editor for ISF's mixed media exhibit at the dOCUMENTA (13) art exbo in Kassel Germany
- Ambassador for the Scenes project