

# Alejandro Ochoa

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Department of Biostatistics and Bioinformatics  
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<https://ochoalab.github.io/>

## Education

- 2013 PhD in Molecular Biology, Princeton University  
Dissertation: *Protein domain prediction using context statistics, the false discovery rate, and comparative genomics, with application to Plasmodium falciparum*  
Advisers: Mona Singh (Computer Science) and Manuel Llinás (Molecular Biology)
- 2006 BS in Biology and Mathematics, Massachusetts Institute of Technology

## Awards & Honors

- 2020 Whitehead Scholar, Whitehead Charitable Foundation. For Duke junior faculty with exceptional potential for research and research training in the biomedical sciences.
- 2008 NSF Graduate Research Fellowship. Computational Biology.
- 2008 Ford Foundation Diversity Fellowship Predoc. Comp. (Declined, listed as Honorable Mention.)
- 2006 MIT Department of Biology Merck Prize. Awarded to a graduating senior for outstanding research and academic performance in biophysics or bioinformatics.
- 2001 Mexican Math Olympiad Gold Medal. Awarded to top 15 competitors nationally.

## Employment

- 2018-now *Assistant Professor*, Duke Center for Statistical Genetics and Genomics, Department of Biostatistics and Bioinformatics, Duke University
- 2013-2018 *Postdoctoral Research Associate* at John D Storey's group, Lewis-Sigler Institute for Integrative Genomics, and Center for Statistics and Machine Learning, Princeton University

## Publications

### JOURNAL ARTICLES

- 2021 **Alejandro Ochoa**, John D Storey. Estimating  $F_{ST}$  and kinship for arbitrary population structures. *PLoS Genet.* 17(1) e1009241. PMID [33465078](https://pubmed.ncbi.nlm.nih.gov/33465078/).
- 2017 **Alejandro Ochoa**, Mona Singh. Domain prediction with probabilistic directional context. *Bioinf.*

33(16) 2471-8. PMID [28407137](#).

Simon A Cobbold, Joana M Santos, **Alejandro Ochoa**, David H Perlman, Manuel Llinás. Proteome-wide analysis reveals widespread lysine acetylation of major protein complexes in the malaria parasite. *Sci Rep*. 2016;6:19722. PMID [26813983](#).

**Alejandro Ochoa**, John D Storey, Manuel Llinás, Mona Singh. Beyond the *E*-value: stratified statistics for protein domain prediction. *PLoS Comput Biol*. 11 e1004509. PMID [26575353](#).

Moriah L Szpara, Derek Gatherer, **Alejandro Ochoa**, Benjamin Greenbaum, Aidan Dolan, Rory J Bowden, Lynn W Enquist, Matthieu Legendre, Andrew J Davison. Evolution and diversity in human herpes simplex virus genomes. *J Virol*. 88:1209-27. PMID [24227835](#).

**Alejandro Ochoa**, Manuel Llinás, Mona Singh. Using context to improve protein domain identification. *BMC Bioinformatics*. 12:90. PMID [21453511](#).

Gevorg Grigoryan, **Alejandro Ochoa**, Amy E Keating. Computing van der Waals energies in the context of the rotamer approximation. *Proteins*. 68(4) 863-78. PMID [17554777](#).

#### MANUSCRIPTS IN SUBMISSION

Brian I Shaw, **Alejandro Ochoa**, Cliburn Chan, Chloe Nobuhara, Rasheed Gbadegesin, Annette M Jackson, Eileen T Chambers. HLA Loci and Recurrence of Focal Segmental Glomerulosclerosis In Pediatric Kidney Transplantation. Submitted.

Young-Sook Kim, Graham D Johnson, Jungkyun Seo, Alejandro Barrera, William H Majoros, **Alejandro Ochoa**, Andrew S Allen, Timothy E Reddy. Detecting regulatory elements in high-throughput reporter assays. Preprint: <https://doi.org/10.1101/2020.08.07.241901>

Yiqi Yao, **Alejandro Ochoa**. Testing the effectiveness of principal components in adjusting for relatedness in genetic association studies. Preprint: <https://doi.org/10.1101/858399>

**Alejandro Ochoa**, John D Storey. New kinship and  $F_{ST}$  estimates reveal higher levels of differentiation in the global human population. Preprint: <https://doi.org/10.1101/653279>

**Alejandro Ochoa**, John D Storey.  $F_{ST}$  and kinship for arbitrary population structures I: Generalized definitions. Preprint: <https://doi.org/10.1101/083915>

#### ACKNOWLEDGMENTS

Irineo Cabrereros, John D Storey. A Likelihood-Free Estimator of Population Structure Bridging Admixture Models and Principal Components Analysis. *Genetics*. 212(4) 1009-29. PMID [31028112](#).

Prem Gopalan, Wei Hao, David M Blei, John D Storey. Scaling probabilistic models of genetic variation to millions of humans. *Nat Genet*. 48(12) 1587-90. PMID [27819665](#).

Anton V Persikov, Mona Singh. De Novo Prediction of DNA-Binding Specificities for Cys2His2 Zinc Finger Proteins. *Nucleic Acids Res*. 42(1) 97-108. PMID [24097433](#).

## Distributed software

ligera: Light GENetic Robust Association. R, C++.

<https://github.com/OchoaLab/ligera>.

human-differentiation-manuscript: Human differentiation analysis. R, bash, markdown.

<https://github.com/StoreyLab/human-differentiation-manuscript>.

2019-2020 genio: Genetics Input/Output Functions. R, C++. Available on [CRAN](#) and <https://github.com/OchoaLab/genio>.

2019-2020 simtrait: Simulate Complex Traits from Genotypes. R. <https://github.com/OchoaLab/simtrait>.

2019-2020 popkinsuppl: Supplement to "popkin" package. R. <https://github.com/OchoaLab/popkinsuppl>.

2017-2020 popkin: Estimate Kinship and FST under Arbitrary Population Structure. R, C++. Available on [CRAN](#) and <https://github.com/StoreyLab/popkin>.

2017-2020 bnpsd: Model and Simulate Admixed Populations. R. Available on [CRAN](#) and <https://github.com/StoreyLab/bnpsd>.

2014-2020 dPUC2: Domain Prediction Using Context, Version 2. Perl, C. <https://github.com/alexviia/dpuc2>.

2014-2020 DomStratStats: Domain Stratified Statistics (q-values and local FDRs). Perl. <https://github.com/alexviia/DomStratStats>.

2014-2019 RandProt: High-order Markov random models for protein sequences. Perl. <https://github.com/alexviia/RandProt>.

## Invited Talks

2020 *University Program in Genetics and Genomics (UPGG) seminar*. Room 147, Nanaline Duke building, Duke University, Durham, NC. 2020-02-18.

2019 *Computational Biology and Bioinformatics (CBB) retreat*. Holiday Inn Resort, Wrightsville Beach, NC. 2019-09-28.

2019 *Computational Biology and Bioinformatics (CBB) seminar*. French Family Science Center, Duke University, Durham, NC. 2019-02-04.

2019 *4th Mexico Population Genomics Meeting*. Amoxcalli Complex, Faculty of Sciences, University City, National Autonomous University of Mexico, Mexico City, DF, Mexico. 2019-01-11.

2018 Population Biology seminar, Department of Biology, Duke University, Durham, NC. 2018-09-27.

2018 Department of Biostatistics and Bioinformatics, Duke University, Durham, NC. 2018-02-21.

2018 Department of Biostatistics, Johns Hopkins University, Baltimore, MD. 2018-01-22.

2017 Department of Biology, University of Richmond, Richmond, VA. 2017-11-10.

2017 *Princeton Research Day*. Princeton University, Princeton, NJ. 2017-05-11.

2017 Department of Genetics, University of North Carolina, Chapel Hill, NC. 2017-02-13.

2016 *New York Area Population Genomics Workshop 2016*. Princeton University, Princeton, NJ. 2016-01-21.

2015 *Probabilistic Modeling in Genomics conference*. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY. 2015-10-15.

2013 *Telepresentation for Yun Song's group*. UC Berkeley, Berkeley, CA. 2013-04-17.

2013 *Biological sequence analysis and probabilistic models conference*. HHMI Janelia Farm, Ashburn, VA. 2013-03-25.

2013 NCBI, NIH, Bethesda, MD. 2013-02-25.

2012 *Recruiting conference*. Department of Computer Science, Princeton University, Princeton, NJ. 2012-03-01.

2004 Rotary Club Paso del Norte, Ciudad Juarez, CHIH, Mexico. 2004-08-26.

## Conference posters

- 2020 **Alejandro Ochoa**, John D Storey. New kinship and  $F_{ST}$  estimates applied to the global human population. *American Society of Human Genetics (ASHG) Annual Meeting*. Virtual.
- 2019 **Alejandro Ochoa**, John D Storey. Relatedness and Differentiation in Arbitrary Population Structures. *4th Mexico Population Genomics Meeting*. Amoxcalli Complex, Faculty of Sciences, University City, National Autonomous University of Mexico, Mexico City, DF, Mexico.
- 2018 **Alejandro Ochoa**, John D Storey. Relatedness and Differentiation in Arbitrary Population Structures. *Probabilistic Modeling in Genomics*. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY.
- 2018 **Alejandro Ochoa**, John D Storey. Relatedness and Differentiation in Arbitrary Population Structures. *Population, Evolutionary and Quantitative Genetics Conference*. Madison Concourse Hotel, Madison, WI.
- 2016 **Alejandro Ochoa**, John D Storey, Srikanth Gottipati, Shashank Rohatagi, Andrew Forbes, Deborah Profit, Raymond Sanchez, Margaretta Nyilas, William Carson. Mixed Effects Modeling of Placebo Response Across 8 Placebo-controlled Aripiprazole Trials Spanning 20 Years in Acutely Relapsed Schizophrenia Patients. *Neuroscience Education Institute Psychopharmacology Congress*. Broadmoor Convention Center, Colorado Springs, CO.
- 2016 Srikanth Gottipati, **Alejandro Ochoa**, Shashank Rohatagi, Andrew Forbes, Deborah Profit, Raymond Sanchez, Margaretta Nyilas, William Carson. Canonical Loadings of PANSS Subscales Show Differential Placebo and Aripiprazole Drug Responses in Schizophrenia Patients. *Neuroscience Education Institute Psychopharmacology Congress*. Broadmoor Convention Center, Colorado Springs, CO.
- 2015 **Alejandro Ochoa**, John D Storey.  $F_{ST}$  generalized for arbitrary population structures. *John W. Tukey 100th Birthday Celebration conference*. Center for Statistics and Machine Learning, Princeton University, Princeton, NJ.
- 2013 **Alejandro Ochoa**, John D Storey, Manuel Llinás, Mona Singh. Forget the  $E$ -value: family-based  $q$ -values for protein domain prediction, and empirical error detection. *Biological sequence analysis and probabilistic models conference*. HHMI Janelia Farm, Ashburn, VA.
- 2010 **Alejandro Ochoa**, Manuel Llinás, Mona Singh. Using context to predict protein domains across diverse organisms. *Recomb Systems Biology conference*. Columbia University, New York, NY.

## Teaching

### PRINCETON UNIVERSITY

- 2017 Intro to Genomics and Comp Bio. Quant Comp Bio, Comp Sci. (Co-Lecturer Fall 2017)
- 2016-2017 Discussion Leader. Summer Undergraduate Research Program (Summer 2016, 2017)
- 2014-2017 Statistical Treatment of Data. Mol Bio, Quant Comp Bio. (Workshop Fall 2014, 2015, 2016, 2017)
- 2011 Intro to Genomics and Comp Mol Bio. Mol Bio, Comp Sci. (TA Fall 2011)
- 2008 Core Laboratory. Mol Bio. (TA Spring 2008)

### MASSACHUSETTS INSTITUTE OF TECHNOLOGY

2005

Calculus. OME Project Interphase (TA Summer 2005)

2003-2004 Multivar Calculus and Diff Eqs. OME Seminar XL (Tutor Fall 2003, Spring 2004)

2003-2004 Calculus. MITE2S Program (TA Summer 2003, 2004)

## Mentoring

2019 Yiqi Yao (Duke), Master's student, Ochoa lab. Theoretical and empirical evaluation of genetic association study approaches.

2011 Sebastian Nasamu (MIT), summer student, Llinás lab. Cloned DNA of malaria protein domains, purified proteins, used protein-binding microarrays to test for DNA binding.

2010 Jeremy Bigness (Princeton), graduate rotation, Singh lab. Built HMMs of ortholog proteins.

2009 Neo Chung (Princeton), graduate rotation, Llinás lab. Wrote scripts to analyze sequencing data.

## Research experience

2013-2018 Postdoctoral Research, Storey Lab, Princeton. Developed new definitions and tools to study arbitrary population structures. Also applied GWAS and mixed effects modeling to longitudinal psychiatric drug clinical trials.

2007-2013 Graduate Research Thesis, Singh Lab and Llinás Lab, Princeton. Developed probabilistic models and statistical methods that improve protein domain prediction. Studied the *Plasmodium falciparum* proteome, focusing on the AP2 transcription factors. Used experimental techniques (cloning, protein purification and protein-binding microarrays) to test predicted AP2 domains for DNA binding.

2007 Graduate Rotation, Tavazoie Lab, Princeton. Cloned an RNA aptamer for a phage display assay.

2006-2007 Graduate Rotation, Singh Lab, Princeton. Analyzed protein interactions predicted from the presence of interacting domain pairs.

2006 Graduate Rotation, Troyanskaya Lab, Princeton. Built and analyzed a potential "gold standard" of Gene Ontology terms integrated from predictions of multiple sources, in *Saccharomyces cerevisiae* and *Homo sapiens*.

2005-2006 Undergraduate Research Assistant, Keating Lab, MIT. Analyzed full-atom computational protein designs using modified van der Waals potentials.

## Extracurricular University Activities

2006-2010 Latino Graduate Student Association, Princeton University. Board member: Technology Specialist 2007-2010 (handled website, email list, photos, calendar).

2002-2006 Association of Puerto Rican students, MIT. Regular member.

## Outreach

2017 Panelist at HISPA Latinos in College Conference. Princeton University.

2010 Ivy-plus recruiting fair at University of Puerto Rico (4 campuses) for Princeton.

2008-2011 Science and Engineering Expo. HHMI and Princeton University.  
2007 Helped local high school students with college personal statements. PUPP, Princeton University.

## Languages

English. Native proficiency.

Spanish. Native proficiency.

French. Fluent reading and writing, conversational speaking.