

Alejandro Ochoa

Duke Center for Statistical Genetics and Genomics
Department of Biostatistics and Bioinformatics
Fitzpatrick Center for Interdisciplinary Engineering, Medicine and Applied Sciences (CIEMAS)
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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

- 2023 Rachel Kate Cason, Eileen T Chambers, Tiffany Tu, Megan Chryst-Stangl, Kinsie Huggins, Brandon M Lane, **Alejandro Ochoa**, Annette M Jackson, Rasheed Gbadegesin. Genetic risk variants for childhood nephrotic syndrome and corticosteroid response. *Frontiers in Pediatrics*. 11:1248733. PMID [37868272](https://pubmed.ncbi.nlm.nih.gov/37868272/).

- 2023 Yiqi Yao, **Alejandro Ochoa**. Limitations of principal components in quantitative genetic association models for human studies. *eLife*. 79238. PMID [37140344](#).
- 2023 Zhuoran Hou, **Alejandro Ochoa**. Genetic association models are robust to common population kinship estimation biases. *Genetics*. iyado30. PMID [36843304](#).
- 2021 Brandon M Lane, Megan Chryst-Stangl, Guanghong Wu, Mohamed Shalaby, Sherif El Desoky, Claire Middleton, Kinsie Huggins, Amika Sood, **Alejandro Ochoa**, Andrew F Malone, Ricardo Vancini, Sara Miller, Gentzon Hall, So Young Kim, David Howell, Jameela A Kari, Rasheed Gbadegehin. CLVS1, a candidate gene for steroid sensitive nephrotic syndrome, regulates podocyte oxidative stress and endocytosis. *JCI Insight*. 7(2) e152102. PMID [34874915](#).
- 2021 Brian I Shaw, **Alejandro Ochoa**, Cliburn Chan, Chloe Nobuhara, Rasheed Gbadegehin, Annette M Jackson, Eileen T Chambers. HLA Loci and Recurrence of Focal Segmental Glomerulosclerosis In Pediatric Kidney Transplantation. *Transplant Direct*. 7(10) e748. PMID [34476293](#).
- 2021 Young-Sook Kim, Graham D Johnson, Jungkyun Seo, Alejandro Barrera, Thomas N. Cowart, William H Majoros, **Alejandro Ochoa**, Andrew S Allen, Timothy E Reddy. Correcting signal biases and detecting regulatory elements in STARR-seq data. *Genome Res*. 31(5) 877-889. PMID [33722938](#).
- 2021 **Alejandro Ochoa**, John D Storey. Estimating F_{ST} and kinship for arbitrary population structures. *PLoS Genet*. 17(1) e1009241. PMID [33465078](#).
- 2017 **Alejandro Ochoa**, Mona Singh. Domain prediction with probabilistic directional context. *Bioinf*. 33(16) 2471-8. PMID [28407137](#).
- 2016 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](#).
- 2015 **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](#).
- 2013 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](#).
- 2011 **Alejandro Ochoa**, Manuel Llinás, Mona Singh. Using context to improve protein domain identification. *BMC Bioinformatics*. 12:90. PMID [21453511](#).
- 2007 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

- 2019 **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>
- 2016 **Alejandro Ochoa**, John D Storey. F_{ST} and kinship for arbitrary population structures I: Generalized definitions. Preprint: <https://doi.org/10.1101/083915>

ACKNOWLEDGMENTS

- 2019 Irineo Cabreros, John D Storey. A Likelihood-Free Estimator of Population Structure Bridging Admixture Models and Principal Components Analysis. *Genetics*. 212(4) 1009-29. PMID [31028112](#).

- 2016 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](#).
- 2014 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

MAJOR PACKAGES

- 2021-2023 simfam: Simulate and Model Family Pedigrees With Structured Founders. R, C++. Available on [CRAN](#) and <https://github.com/OchoaLab/simfam>.
- 2019-2023 genio: Genetics Input/Output Functions. R, C++. Available on [CRAN](#) and <https://github.com/OchoaLab/genio>.
- 2019-2023 simtrait: Simulate Complex Traits from Genotypes. R. Available on [CRAN](#) and <https://github.com/OchoaLab/simtrait>.
- 2017-2023 popkin: Estimate Kinship and FST under Arbitrary Population Structure. R, C++. Available on [CRAN](#) and <https://github.com/StoreyLab/popkin>.
- 2017-2023 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>.

MINOR PACKAGES

- 2021-2023 simgenphen: Simulate Genotypes and Phenotypes. R. <https://github.com/OchoaLab/simgenphen>.
- 2021-2023 genbin: R wrappers for binaries in genetics. R. <https://github.com/OchoaLab/genbin>.
- 2020-2023 ligera: Light GENetic Robust Association. R, C++. <https://github.com/OchoaLab/ligera>.
- 2019-2022 popkinsuppl: Supplement to "popkin" package. R. <https://github.com/OchoaLab/popkinsuppl>.

PAPER REPOSITORIES

- 2021-2023 bias-assoc-paper: Kinship bias association project. R, bash, LaTeX, markdown. <https://github.com/OchoaLab/bias-assoc-paper>.
- 2019-2023 pca-assoc-paper: PCA association project. R, bash, LaTeX, markdown. <https://github.com/OchoaLab/pca-assoc-paper>.
- 2019-2023 data: Instructions for real data processing shared across projects. R, bash, Perl, markdown. <https://github.com/OchoaLab/data>.

2019 human-differentiation-manuscript: Human differentiation analysis. R, bash, markdown.
<https://github.com/StoreyLab/human-differentiation-manuscript>.

Invited Talks

2023 *HCHS/SOL (Hispanic Community Health Study / Study of Latinos) Genetics Special Interest Group (Virtual)*. Department of Biostatistics, Harvard University, Cambridge, MA. 2023-06-21.

2023 *NIH Centers for Excellence in Genomics Science (CEGS) Virtual Outreach Meeting*. The Jackson Laboratory, Bar Harbor, ME. 2023-04-20.

2023 *American Mathematical Society (AMS) 2023 Spring Southeastern Sectional Meeting*. Georgia Institute of Technology, Atlanta, GA. 2023-03-19.

2022 *BERD Core Seminar*. Department of Biostatistics and Bioinformatics, Duke University, Durham, NC. 2022-08-26.

2022 *Latinx in the Mathematical Sciences Conference 2022 (LatMath2022)*. Institute for Pure and Applied Mathematics, University of California, Los Angeles, Los Angeles, CA. 2022-07-08.

2022 *Duke University Program in Genetics and Genomics (UPGG) retreat*. Suite 4, Durham, NC. 2022-06-11.

2021 *Orientation for MB and PhD students*. Department of Biostatistics and Bioinformatics, Duke University, Durham, NC. 2021-08-19.

2021 *Statistics seminar*. Department of Mathematics and Statistics, Washington State University, Pullman, WA. 2021-03-10.

2021 *Master of Biostatistics Virtual Visit Day*. Department of Biostatistics and Bioinformatics, Duke University, Durham, NC. 2021-02-19.

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

2019 *Duke 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

- 2022 Zhuoran Hou, **Alejandro Ochoa**. Genetic association models are robust to common population kinship estimation biases. *American Society of Human Genetics (ASHG) Annual Meeting*. Convention Center, Downtown, Los Angeles, CA.
- 2022 **Alejandro Ochoa**, Yuncheng Duan, Revathy Venukuttan, Shannon Clarke, Timothy Reddy. Development of Genomic Resource Modules for a Diverse Workforce. *NIH Centers for Excellence in Genomics Science (CEGS) Annual Meeting*. The Mary Duke Biddle Trent Semans Center for Health Education, Duke University, Durham, NC.
- 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

DUKE UNIVERSITY

- 2022-2023 Human Genetics. (Co-Lecturer Spring 2022-2023)
- 2021-2023 UPGEN 778A-F Mini course: Genetic population structure and relatedness (Fall 2021-2023)
- 2019-2023 SIBS lecture on genetic association studies (Summer 2019, 2021-2023)
- 2019 BIOS 900 Current Problems in Biostatistics. Special lecture on kinship and F_{ST}
- 2019 BIOS 710 Statistical Genetics and Genetic Epidemiology. Special lecture on kinship and F_{ST}

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 2014-2017)
- 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

CURRENT TRAINEES - PRIMARY ADVISER

- 2020-now Tiffany Tu. PhD. Graduate rotation, Dissertation adviser. Ochoa Laboratory. Computational Biology and Bioinformatics Program, Duke University.
- 2022-now Ratchanon "RP" Pornmongkolsuk. PhD. Graduate rotation, Dissertation adviser. Ochoa Laboratory. University Program in Genetics and Genomics, Duke University.
- 2022-now Zhuoran Hou. PhD. Graduate rotation, Dissertation adviser. Ochoa Laboratory. Department of Biostatistics and Bioinformatics, Duke University.
- 2023-now Danielle Mensah. Undergraduate. Research Independent Study. Ochoa Laboratory. Department of Computer Science, Duke University.

CURRENT TRAINEES - SECONDARY ADVISER

- 2019-now Xue "Scarlett" Zou. PhD. Dissertation committee. Allen Laboratory. Computational Biology and Bioinformatics Program, Duke University.
- 2021-now Cymfenee Dean-Phifer. PhD. Graduate rotation, Dissertation committee. Goldberg Laboratory. Computational Biology and Bioinformatics Program, Duke University.
- 2022-now Changxin Wan. PhD. Dissertation committee. Ji Laboratory. Computational Biology and Bioinformatics Program, Duke University.
- 2023-now Bide "Peter" Chen. PhD. Dissertation committee. Goldberg Laboratory. University Program in

Genetics and Genomics, Duke University.

- 2023-now Jinting Justin Liu. Master's. Master's project committee. Majoros Laboratory. Department of Biostatistics and Bioinformatics, Duke University.
- 2023-now Gabriel Kennedy. PhD. Dissertation committee. Goldberg Laboratory. University Program in Genetics and Genomics, Duke University.
- 2023-now Anvita Kulshrestha. PhD. Dissertation committee. Ashley-Koch Laboratory. University Program in Genetics and Genomics, Duke University.

PAST TRAINEES - PRIMARY ADVISER

- 2019-2020 Yiqi Yao. Master's. BCTIP internship, Master's project adviser. Ochoa Laboratory. Department of Biostatistics and Bioinformatics, Duke University. Now Senior Business Analyst at BenHealth.
- 2019-2022 Amika Sood. Postdoctoral. Postdoctoral adviser. Ochoa Laboratory. Department of Biostatistics and Bioinformatics, Duke University. Now Staff Scientist at Complex Carbohydrate Research Center (CCRC), The University of Georgia.
- 2020-2021 Zhuoran Hou. Master's. BCTIP internship. Ochoa Laboratory. Department of Biostatistics and Bioinformatics, Duke University. Now PhD Student at Duke University, BB.
- 2020-2022 Jiajie Shen. Master's. Research, Master's project adviser. Ochoa Laboratory. Department of Biostatistics and Bioinformatics, Duke University.
- 2021-2022 Emmanuel Mokel. Undergraduate. Research Independent Study. Ochoa Laboratory. Department of Statistical Science, Duke University.

PAST TRAINEES - SECONDARY ADVISER

- 2009 Neo Christopher Chung. PhD. Graduate rotation. Llinás Laboratory. Quantitative Computational Biology Program, Princeton University. Now Adjunct Faculty at University of Warsaw.
- 2010 Jeremy Bigness. PhD. Graduate rotation. Singh Laboratory. Quantitative Computational Biology Program, Princeton University. Now PhD Student at Brown University.
- 2011 Sebastian Nasamu. Undergraduate. Summer project. Llinás Laboratory. Department of Molecular Biology, Princeton University. Now Post-doctoral Research Fellow at Johns Hopkins Bloomberg School of Public Health.
- 2019 Yuncheng Duan. PhD. Graduate rotation. Ochoa Laboratory. Department of Biology, Duke University. Now PhD Student at Duke University, Allen Lab.
- 2019-2020 Shengyu Li. Master's. Master's project committee. Allen Laboratory. Department of Biostatistics and Bioinformatics, Duke University. Now PhD Student at Duke University, CBB.
- 2020-2022 Iman Hamid. PhD. Dissertation committee. Goldberg Laboratory. University Program in Genetics and Genomics, Duke University. Now Scientist at Variant Bio.
- 2020-2021 Bobby Boone IV. Master's. Master's project committee. Landstrom Laboratory. Department of Biostatistics and Bioinformatics, Duke University. Now Biostatistician II at University of Utah Health.
- 2020-2023 Brandon M. Lê. PhD. Dissertation committee. Ashley-Koch Laboratory. University Program in Genetics and Genomics, Duke University.
- 2020-2023 Rachel Cason. Resident physician. Scholarship Oversight Committee, Master's project committee. Gbadegesin Laboratory. Department of Pediatrics, Duke University.
- 2021-2022 Valerie Gartner. PhD. Dissertation committee. Wray Laboratory. University Program in Genet-

ics and Genomics, Duke University.

- 2021-2022 Hongyu Du. Master's. Master's project committee. Allen Laboratory. Department of Biostatistics and Bioinformatics, Duke University.
- 2021-2022 Krista Pipho. PhD. Dissertation committee. Goldberg Laboratory. University Program in Genetics and Genomics, Duke University.
- 2021-2022 Weiliang "Frank" Tian. Master's. Master's project committee. Soderling Laboratory. Department of Biostatistics and Bioinformatics, Duke University.
- 2023-2023 Grace E. Rhodes. PhD. Graduate rotation. Ochoa Laboratory. Department of Biostatistics and Bioinformatics, Duke University.

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.