Alejandro Ochoa

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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

2017   Alejandro Ochoa, Mona Singh. Domain prediction with probabilistic directional context. *Bioinf* 33(16) 2471-2478.

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.

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.

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* 88:1209-1227.

2011   Alejandro Ochoa, Manuel Llinás, Mona Singh. Using context to improve protein domain identification. *BMC Bioinformatics* 12:90.

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.

Manuscripts in Submission

2019   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

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 II: Method of moments estimators. Preprint: https://doi.org/10.1101/083923

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

Distributed software

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

2019   genio: Genetics Input/Output Functions. R.
Available on CRAN and https://github.com/OchoaLab/genio.

2019   simtrait: Simulate Complex Traits from Genotypes. R.
https://github.com/OchoaLab/simtrait.

2019   popkinsuppl: Supplement to "popkin" package. R.
https://github.com/OchoaLab/popkinsuppl.

2017-2019   popkin: Estimate Kinship and FST under Arbitrary Population Structure. R.
Available on CRAN and https://github.com/StoreyLab/popkin.

2017-2019   bnpsd: Model and Simulate Admixed Populations. R.
Available on CRAN and https://github.com/StoreyLab/bnpsd.

2014-2019   dPUC2: Domain Prediction Using Context, Version 2. Perl.
https://github.com/alexviiia/dpuc2.

2014-2019   DomStratStats: Domain Stratified Statistics (q-values and local FDRs). Perl.
https://github.com/alexviiia/DomStratStats.

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

Invited Talks

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

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 conf. Center for Statistics and Machine Learning, 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 conf. HHMI Janelia Farm, Ashburn, VA.

2010   Alejandro Ochoa, Manuel Llinás, Mona Singh. Using context to predict protein domains across diverse organisms. Recomb Systems Biology conf. 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.