Pablo Cárdenas R.

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Education

Massachusetts Institute of Technology (MIT) — Cambridge, MA, USA — Ongoing (++)
PhD Candidate, Department of Biological Engineering (GPA: 5.0/5.0)

Universidad de los Andes (Uniandes) — Bogotá, Colombia — Mar, 2018
Bachelor of Science *Summa Cum Laude* in Microbiology, minor in Bioinformatics (GPA: 4.84/5.0)

Research

Department of Biological Engineering, MIT — Cambridge, MA
Graduate Research Assistant — Sep 2018 ++

- → Created an epidemiological modeling framework for pathogen population genetics and evolution.
- → Designing molecular and computational tools for transcriptional control, functional genetics, and drug discovery in the malarial parasite *Plasmodium falciparum* (Prof. Jacquin C. Niles)
- → Helped model, construct, and test a control system for managing a shared cell resource in genetic circuits (Prof. Domitilla Del Vecchio, Mechanical Engineering)
- → Designed a mathematical model to guide *in vitro* studies of the efficacy and dynamics of a synthetic probiotic system for prevention of gut dysbiosis (Prof. James J. Collins)
- → Created a bioinformatic pipeline to identify cross-reactive T cell epitopes in SARS-CoV-2 (Profs. Mauricio Calvo-Calle & Lawrence Stern, University of Massachusetts Medical School)

Department of Systems Biology, Harvard Medical School — Boston, MA
Undergraduate Researcher — Feb – Jul 2018

- → Helped develop computational workflows for analysis of single-cell imaging (Prof. Johan Paulsson)
- → Constructed and applied microfluidic systems to study bacterial physiology and persister cell formation

Eligo Bioscience — Paris, France
Research Intern in Synthetic Biology — Aug 2017 – Jan 2018

- → Created DNA constructs and bacterial strains for phage production using CRISPR-Cas9 editing
- → Screened libraries of synthetic phage candidates against bacterial strains

Mathematical and Theoretical Biology Institute, Arizona State University — Tempe, AZ
Undergraduate Researcher — Jun – Jul 2017

- → Created a 3D, spatially explicit computational model of bacterial resistance to antibiotics in a biofilm

Department of Biological Engineering, MIT — Cambridge, MA
Undergraduate Researcher — May – Aug 2016

- → Assembled CRISPR-Cas9 constructs for gene editing in the malaria parasite (Prof. Jacquin Niles)
- → Carried out a computational genome-wide scan and analysis of Cas9 and Cas12a sites in *P. falciparum*

Department of Biological Sciences, Uniandes — Bogotá, Colombia
Undergraduate Researcher — May 2015 - Aug 2017

- → Designed and experimentally tested an ODE model of phage-host dynamics (Prof. Martha Vives)
- → Applied Hidden Markov Models to identify phages in human gut metagenomes (Prof. Alejandro Reyes)

Teaching & Mentorship

Department of Biological Engineering (BE), MIT — Cambridge, MA, USA

Guest Lecturer on Evolution, Senior Design Course in Biological Engineering — **Jan 2022**

→ Prepared and taught a lecture on designing for evolution in infectious disease, course 20.380 taught by Prof. Christopher Voigt, Instructors Drs. Sean Clarke and Prerna Bhargava.

Coding Fellow, Biological Engineering Data Lab — **Mar 2019 ++**

→ Providing 1-on-1 coaching for programming and biological data analysis to undergraduates, graduate students, and postdocs at MIT as an inaugural fellow at the BE Data Lab

→ Mentored an undergraduate student in a semester-long individual project in genomics and epidemiology as an Experiential Learning Opportunity class (student: Dawit Girma)

Teaching Assistant, Principles of Molecular Bioengineering — **Sep – Dec 2019**

→ Assignment and exam design and grading, review lecture sessions, one-on-one tutoring for 40 students (Profs. Ernest Fraenkel and Alan Jasanoff)

→ Awarded best Fall 2019 teaching assistant at the MIT Department of Biological Engineering

Peer Counselor, BE Resources for Easing Friction and Stress (REFS) — **Jan 2018 ++**

→ Providing 1-on-1 confidential counseling for graduate students at MIT BE as a member of the BE REFS

→ Underwent a week-long training course on conflict coaching and support resources for grad students

→ Working with the MIT BE Department leadership and Grad Student Board to improve graduate experience

Department of Biomedical Engineering, Uniandes — Bogotá, Colombia

Teaching Assistant, Quantitative Human Physiology I and II — **Jan – Dec 2016**

→ Assignment design and grading, review sessions, and teaching main lectures during professor absences for 100 students (Prof. Juan Manuel Cordovez)

Department of Student Affairs, Uniandes — Bogotá, Colombia

Teaching Assistant, Social Practice Program — **Jul – Dec 2015**

→ Trained, guided, and evaluated 60 Uniandes students serving as tutors for low-income high school students in Bogotá (Instructors David Parga and María del Pilar Pérez)

Volunteer Tutor, Social Practice Program — **Jan – Jun 2015**

→ Provided academic tutoring and review sessions three hours a week for a group of 10 low-income high school students in Bogotá

→ Designed a semester-long tutoring curriculum to reinforce high school classes and prepare students for the ICFES-Saber 11 state exam

Department of Biological Sciences, Uniandes — Bogotá, Colombia

Teaching Assistant, Parasitology Laboratory — **Jan – Jun 2015**

→ Provided review sessions and tutoring, helped develop and grade assignments, and prepared microscope slides (Instructor Laura Tamayo and Prof. Camila González)

Association of Students with Financial Aid (ANDAR), Uniandes — Bogotá, Colombia

Co-leader, First Year Mentorship Program — **Jul 2016 – May 2017**

→ Provided individual tutoring and calculus review sessions for Uniandes students receiving financial aid

→ Designed integration and counseling activities, helped develop student housing networks

→ Coordinated up to eight teams of Uniandes students mentoring 20 incoming students receiving financial aid through their first semester

First Year Mentor & Academic tutor **Jul – Dec 2015**

→ Mentored 20 first-year students receiving financial aid through their first semester (with a second co-mentor), helping navigate access to academic, financial, and social resources when needed.

Selected publications

Peer-reviewed research: **These authors contributed equally to the work.*

Genomic epidemiological models describe pathogen evolution across fitness valleys **2022**
P. Cárdenas, V. Corredor, M. Santos-Vega
Accepted, *Science Advances*. Preprint doi: 10.1101/2021.12.16.473045

GeneTargeter: automated, in silico *design for genome editing in the malaria parasite, P. falciparum* **2022**
P. Cárdenas, L.Y. Esherick, G. Chambonnier, S. Dey, C.V. Turlo, A.S. Nasamu, J.C. Niles
The CRISPR Journal. doi: 10.1089/crispr.2021.0069

Preventing antibiotic-induced dysbiosis with an engineered live biotherapeutic **2022**
A. Cubillos-Ruiz, M.A. Alcantar, N.M. Donghia, P. Cárdenas, J. Ávila-Pacheco, J.J. Collins
Nature Biomedical Engineering. doi: 10.1038/s41551-022-00871-9

dCas9 regulator to neutralize competition in CRISPRi circuits **2021**
H.-H. Huang*, M. Bellato*, Y. Qian, P. Cárdenas, L. Pasotti, P. Magni, & D. Del Vecchio
Nature Communications; doi: 10.1038/s41467-021-21772-6.

Host resistance, genomics and population dynamics in a Salmonella *Enteritidis and phage system.* **2019**
A.V. Holguín, P. Cárdenas, C. Prada-Peñaranda, L. Rabelo Leite, C. Buitrago, V. Clavijo, ... , & M.J. Vives.
Viruses. doi: 10.3390/v11020188

Research submitted for publication:

Resolving drug selection and migration in an inbred South American Plasmodium falciparum *population with identity-by-descent analysis* **2022**
M. Carrasquilla*, A.M. Early*, A.R. Taylor, A. Knudson, D.F. Echeverry, T.J.C. Anderson, E. Mancilla, S. Aponte, P. Cárdenas, C.O. Buckee, J.C. Rayner, F.E. Sáenz, D.E. Neafsey, V. Corredor
Preprint doi: 10.1101/2022.02.18.480973

Technical reports: **These authors contributed equally to the work.*

Cheating the cheaters: spatial dynamics in the evolutionary stability of antibiotic resistance. **2018**
D. Akman*, L. Callaway III*, P. Cárdenas*, J. Nieve-Silva*, ..., L. Arreola, C. Castillo-Garsow
Technical report available from MTBI, Arizona State University.

Reviews and commentary:

Starting from scratch: a workflow for building truly novel proteins **2021**
P. Cárdenas. *Synthetic Biology* (accepted), ysab005, doi: 10.1093/synbio/ysab005

Designing for durability: new tools to build stable, non-repetitive DNA **2020**
P. Cárdenas. *Synthetic Biology, 5*(1), ysaa016, doi: 10.1093/synbio/ysaa016

Awards & Fellowships

Social Justice in Infectious Disease Award, (EEID Conference) **May 2022**
Travel award for applicants to the 2022 Ecology and Evolution of Infectious Disease Conference (Atlanta, GA) combining research and social justice in their work (lodging, food, and registration + 500 USD in travel costs)

S. & P. Eurnekian Biotechnology Fellowship, (Office of Graduate Education, MIT) **Apr 2021**
Awarded by competition to an MIT student pursuing research in biotechnology.
(1 semester tuition, insurance, stipend; ≈43,000 USD)

Teaching Assistant Excellence Award, (Department of Biological Engineering, MIT) **Dec 2020**
Best teaching assistant in the department during the Fall 2019, based on student and faculty feedback.
(1000 USD)

Summa Cum Laude (Faculty of Sciences, Uniandes) **Mar 2018**
Awarded to top 1% Faculty of Sciences historic graduates who also demonstrate strong community service.

Best *Saber Pro* Graduate National Exam, Biology (Ministry of Education, Colombia) **Nov 2017**
Awarded to nation-wide top scores on the Colombian ICFES-Saber Pro exam for university graduates.

Ramón de Zubiría Awards (4) (Uniandes) **Nov 2015–Oct 2017**
For the highest cumulative GPA in a program, won in Microbiology (1x) and Biomedical Engineering (3x).

Alberto Magno Award (Uniandes) **Oct 2013**
Given to the top ten application scores among admitted students university-wide in a semester.