Pablo Cárdenas R.

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Education

Massachusetts Institute of Technology (MIT) — Cambridge, MA, USA **Started Sep 2018–ongoing**
PhD Candidate, Department of Biological Engineering; Advisor: Jacquin C. Niles (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, Niles Lab **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, Paulsson Lab **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 under Dr. Jesús Fernández R., Eligo Bioscience **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, MTBI (now QRLSSP) **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, Niles Lab **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, CIMIC and BCEM Labs **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)

Publications

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

Genomic epidemiological models describe pathogen evolution across fitness valleys **2022**
P. Cárdenas†, V. Corredor, M. Santos-Vega
Science Advances. doi: 10.1126/sciadv.abo0173

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: **These authors contributed equally to the work.* *†Corresponding author*

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

Teaching, Mentorship, & Community

Teaching and Learning Lab (TLL), MIT — Cambridge, MA, USA

Teaching Development Fellow, MIT Teaching and Learning Lab **Sep 2022 – Jun 2023**

→ Studying and developing practices to support graduate student teaching skills through observation and workshops. Institute-wide at-large fellow with a focus on research project mentorship.

Teaching Track Certificate, MIT Teaching and Learning Lab **Jul 2022 – Nov 2022**

→ Completed courses on Subject Design, Lesson Planning, Microteaching, and Inclusive Teaching; certificate expected in 2023

→ Designed a syllabus and rehearsed a lesson plan for an original course, "Outwitting Evolution Throughout History"

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 2020 ++**

→ 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
→ Designed and conducted workshops for 10–40 students on Introductory Python, Ordinary Differential Equation Modeling, and Curve Fitting
→ Mentored an undergraduate student in a semester-long individual project in COVID-19 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

Graduate Research Assistant, Niles Lab — **Mar 2019 ++**

→ Provided parasite tissue culture and molecular cloning technique training for an incoming postdoc (Dr. Shubhra J. Saha)
→ Mentored three first-year graduate students in 6- or 8-week experimental research rotation projects, varying from experienced experimental molecular biologists to students with limited wet lab experience; students: Mirna Kheir Gouda (MIT Biological Engineering), Allison Rojas (MIT-Harvard Health Science and Technology), Alyssa Haynes (MIT Microbiology)

Peer Counselor, BE Resources for Easing Friction and Stress (REFS) — **Jan 2019 – Jan 2023**

→ Providing 1-on-1 confidential counseling for graduate students at MIT BE as a member of the BE REFS
→ Co-developed and conducted workshops on finding and joining research labs, managing expectations as a teaching assistant, graduation and job search
→ 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**

→ Designed and graded assignments, provided review sessions, and taught main lectures during two 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 and presented microscopy slides for various human pathogens (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.

Awards & Fellowships

Teaching Development Fellowship, (Teaching and Learning Lab, Vice Chancellor Off., MIT) **Jul 2022**
Awarded by competition to 21 applicants to develop training for graduate student teaching skills (2000 USD)

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 one MIT student pursuing research in biotechnology per year. (1 semester tuition, insurance, stipend; ≈43,000 USD)

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

Viterbi Graduate Fellowship, (Department of Biological Engineering, MIT) **Sep 2018**
Awarded at admission to select students in the MIT Biological Engineering PhD program. (1 semester tuition, insurance, stipend; ≈42,000 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).

Excellence Distinction (8) (Uniandes) **Mar 2014–Oct 2017**
For the highest semester GPA in a program, in Microbiology (4x), Biomedical Engineering (1x), and Biology (3x).

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