

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

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)

Awards & Fellowships

- Teaching Development Fellowship**, (TLL, Office of the Vice Chancellor, MIT) **Jul 2022**
Awarded by competition to 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 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.

Selected 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](https://doi.org/10.1126/sciadv.abo0173)
- GeneTargeter: automated, in silico design for genome editing in the malaria parasite, *P. falciparum*** **2022**
P. Cárdenas, L.Y. Esherrick, G. Chambonnier, S. Dey, C.V. Turlo, A.S. Nasamu, J.C. Niles
The CRISPR Journal. doi: [10.1089/crispr.2021.0069](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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 Perna 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 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-week 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

- 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 ICES-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.