

# Pablo Cárdenas R.

Cambridge, MA, USA (citizen of Colombia, F1 visa status)

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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 Perna 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.**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* **2022***population with identity-by-descent analysis*

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)

*Genomic epidemiological models describe pathogen evolution across fitness valleys* **2022**

P. Cárdenas, V. Corredor, M. Santos-Vega

Preprint doi: [10.1101/2021.12.16.473045](https://doi.org/10.1101/2021.12.16.473045)

**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)

## 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.*