

# 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 **Started Sep 2018—ongoing**

PhD Candidate, Department of Biological Engineering; Advisor: Jacquin C. Niles (GPA: 5.0/5.0)

**Universidad de los Andes (Unianandes)** — 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

**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, Unianandes** — 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<sup>†</sup>, 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. Esherick, G. Chambonnier, S. Dey, C.V. Turlo, A.S. Nasamu, J.C. Niles<sup>†</sup>.  
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<sup>†</sup>.  
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<sup>†</sup>.  
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<sup>†</sup>  
Viruses. doi: [10.3390/v11020188](https://doi.org/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<sup>†</sup>, V. Corredor<sup>†</sup>  
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 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.*