

# María Díaz de León Derby, PhD

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## RESEARCH INTERESTS

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Developing engineering and machine learning tools for global health. My current research focuses on portable diagnostic tools and techniques for the diagnosis of neglected tropical diseases, a group of conditions that affect one billion of the world's most vulnerable people.

## EDUCATION

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- 2018-24     **University of California, Berkeley and University of California, San Francisco**  
Ph.D. in Bioengineering  
Advised by Prof. Daniel Fletcher
- 2013-18     **Tecnológico de Monterrey, Mexico (ITESM)**  
Bachelor of Science in Mechatronics Engineering  
Mención honorífica de excelencia (first class honours with distinction) and highest GPA in cohort (96/100)

## RESEARCH EXPERIENCE

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- 2018-24     **University of California, Berkeley**  
Supervisor: Prof. Daniel Fletcher  
Development of microscopy tools and techniques for portable infectious disease diagnostics:  
1. Multi-contrast machine learning to improve schistosomiasis diagnostic performance.  
2. NTDScope: a multi-contrast, portable microscope for disease diagnostics.  
3. Rapid AI calibration to improve schistosomiasis detection at the point-of-care.  
4. Mobile phone-based microscope for COVID-19 diagnosis using CRISPR-Cas13.
- 2018-19     **Tecnológico de Monterrey, Mexico (ITESM)**  
Supervisors: Prof. Mario Moises Alvarez and Prof. Grissel Trujillo de Santiago  
Continuous 3D chaotic printing: developed a method to continuously fabricate complex microstructure at high resolution by using the chaotic flow induced by a Kenics static mixer. This work resulted in a patent and publication.
- 2017         **Daimler AG, Sindelfingen, Germany**  
Mercedes Benz Research and Development  
Internship in the field of Hybrid Drives: data analysis, development and testing. Developed a MATLAB evaluation tool for analysing sensor data obtained from test vehicles.
- 2014-16     **University of British Columbia, Canada (UBC)**  
Supervisor: Prof. Mina Hoorfar  
Development of a technique for static droplet mixing in digital microfluidics and a digital microfluidics cell-patterning system.

## MANUSCRIPTS IN PREPARATION

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- [1] **María Díaz de León Derby**, Zaina L. Moussa, Carlos F. Ng, Abdul M. Bhuiya, Joana P. Cabrera, Di-  
payan Banik, Charles B. Delahunt, Matthew D. Keller, Anne-Laure Le Ny, Jaime Garcia-Villena, Elena  
Dacal, et al. "NTDScope: A multi-contrast portable microscope for disease diagnosis". *In preparation*.

- [2] **María Díaz de León Derby\***, Jean T. Coulibaly\*, Elena Dacal\*, Kigbafori D. Silué, Daniel Cuadrado, David Bermejo-Peláez, Jaime Garcia-Villena, Lin Lin, Miguel Luengo-Oroz, Daniel A. Fletcher, Karla N. Fisher, et al. “Edge-tuning of artificial intelligence improves diagnostic performance for *Schistosomiasis haematobium* in a rural setting of Côte d’Ivoire”. *In preparation*.

## PUBLICATIONS

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- [1] **María Díaz de León Derby**, Charles B. Delahunt, Ethan Spencer, Jean T. Coulibaly, Kigbafori D. Silué, Isaac I. Bogoch, Anne-Laure Le Ny, and Daniel A. Fletcher. “Multi-contrast machine learning improves schistosomiasis diagnostic performance”. In: *medRxiv* (Jan. 2025).
- [2] Jean T. Coulibaly, Kigbafori D. Silue, **María Díaz de León Derby**, Daniel A. Fletcher, Karla N. Fisher, Jason R. Andrews, and Isaac I. Bogoch. “Rapid and Comprehensive Screening for Urogenital and Gastrointestinal Schistosomiasis with Handheld Digital Microscopy Combined with Circulating Cathodic Antigen Testing”. In: *The American Journal of Tropical Medicine and Hygiene* (June 2024).
- [3] Jean T. Coulibaly, Kigbafori D. Silue, Maxim Armstrong, **María Díaz de León Derby**, Michael V. D’Ambrosio, Daniel A. Fletcher, Jennifer Keiser, Karla Fisher, Jason R. Andrews, and Isaac I. Bogoch. “High Sensitivity of Mobile Phone Microscopy Screening for *Schistosoma haematobium* in Azaguié, Côte d’Ivoire”. In: *The American Journal of Tropical Medicine and Hygiene* 108.1 (2023), pp. 41–43.
- [4] Sita S. Chandrasekaran, Shreeya Agrawal, Alison Fanton, Aditya R. Jangid, Bérénice Charrez, Arturo M. Escajeda, Sungmin Son, Roger McIntosh, Huyen Tran, Abdul Bhuiya, **María Díaz de León Derby**, et al. “Rapid detection of SARS-CoV-2 RNA in saliva via Cas13”. In: *Nature Biomedical Engineering* 6.8 (Aug. 2022), pp. 944–956.
- [5] Parinaz Fozouni\*, Sungmin Son\*, **María Díaz de León Derby\***, Gavin J. Knott, Carley N. Gray, Michael V. D’Ambrosio, Chunyu Zhao, Neil A. Switz, G. Renuka Kumar, Stephanie I. Stephens, Daniela Boehm, et al. “Amplification-free detection of SARS-CoV-2 with CRISPR-Cas13a and mobile phone microscopy”. In: *Cell* 184.2 (2021), 323–333.e9.
- [6] Tina Y. Liu, Gavin J. Knott, Dylan C. J. Smock, John J. Desmarais, Sungmin Son, Abdul Bhuiya, Shrutee Jakhanwal, Noam Prywes, Shreeya Agrawal, **María Díaz de León Derby**, Neil A. Switz, et al. “Accelerated RNA detection using tandem CRISPR nucleases”. In: *Nature Chemical Biology* 17.9 (Sept. 2021), pp. 982–988.
- [7] Carolina Chávez-Madero\*, **María Díaz de León Derby\***, Mohamadmahdi Samandari, Carlos Fernando Ceballos-González, Edna Johana Bolívar-Monsalve, Christian Mendoza-Buenrostro, Sunshine Holmberg, Norma Alicia Garza-Flores, Mohammad Ali Almajhadi, Ivonne González-Gamboa, Juan Felipe Yee-de León, et al. “Using chaotic advection for facile high-throughput fabrication of ordered multi-layer micro- and nanostructures: continuous chaotic printing”. In: *Biofabrication* 12.3 (2020), p. 035023.
- [8] Ehsan Samiei, **María Díaz de León Derby**, André Van den Berg, and Mina Hoorfar. “An electrohydrodynamic technique for rapid mixing in stationary droplets on digital microfluidic platforms”. In: *Lab Chip* 17 (2017), pp. 227–234.
- [9] B. A. Nestor, E. Samiei, R. Samanipour, A. Gupta, A. Van den Berg, **María Díaz de León Derby**, Z. Wang, H. Rezaei Nejad, K. Kim, and M. Hoorfar. “Digital microfluidic platform for dielectrophoretic patterning of cells encapsulated in hydrogel droplets”. In: *RSC Adv.* 6 (62 2016), pp. 57409–57416.

## PATENTS

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- [1] Grissel Trujillo De Santiago, Mario Moisés Álvarez, Carlos Fernando Ceballos González, Edna Johana Bolívar Monsalve, **María Díaz de León Derby**, Carolina Chávez Madero, Daniele Tammara, and Ernesto Di Maio. “Method for printing microlayers and multilayered nanostructures ordered by chaotic flows”. WO202229721A1. Nov. 2022.

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\* denotes equal contribution.

PRESENTATIONS

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- 01/2025 **CZ Biohub Symposium: Computational Imaging Across Scales 2025**  
Talk: *Multi-contrast machine learning improves schistosomiasis diagnostic performance*
- 11/2024 **American Society for Tropical Medicine and Hygiene 2024 Annual Meeting**  
Talk: *NTDscope: a multi-contrast, portable microscope for disease diagnostics*  
Talk: *Rapid AI calibration improves schistosomiasis detection at the point-of-care*  
Poster: *Multi-contrast machine learning improves schistosomiasis diagnostic performance*
- 10/2024 **International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI) 2024**  
Talk: *A schistosomiasis dataset with bright- and darkfield images*
- 10/2023 **UC Berkeley Infectious Diseases and Immunity Seminar Series**  
Invited Talk: *Machine learning for automated identification of Schistosoma haematobium*
- 10/2023 **American Society for Tropical Medicine and Hygiene 2023 Annual Meeting**  
Poster: *Multi-Contrast and Multi-Modal Machine Learning to Automate Schistosoma haematobium Diagnostics at the Point-Of-Care*
- 03/2023 **Tropical Infectious Diseases Gordon Research Seminar**  
Poster and Talk: *Mobile Phone-based Diagnostics for Neglected Tropical Diseases: Automated Identification of Schistosoma haematobium from Urine Samples*
- 10/2022 **American Society for Tropical Medicine and Hygiene 2022 Annual Meeting: Advances in Point-Of-Care Technologies for NTDs Symposium**  
Talk: *Machine Learning for Automated Schistosomiasis Detection*
- 10/2022 **UC Berkeley/UCSF Graduate Program in Bioengineering: Annual Conference and Retreat**  
Talk: *Mobile Phone-based Diagnostics for Neglected Tropical Diseases*
- 05/2022 **Measuring Development 2022: The Role of Mobile Data in Global Development**  
Talk: *Mobile Phone-based Diagnostics for Neglected Tropical Diseases*
- 01/2022 **UC Berkeley Blum Center Health Tech Co-Lab Lab Links: An Exploration into Environmental Diagnostics**  
Invited Talk: *Mobile phone microscopy for identification of helminth eggs*
- 09/2021 **UC Berkeley Blum Center Health Tech Co-Lab Grand Opening**  
Invited Talk: *Harnessing Mobile Phones for Diagnosis of Neglected Tropical Diseases*
- 05/2021 **Conversations on Bioinspired Engineering - Seminar Series, UC Berkeley**  
Invited Talk: *Amplification-free detection of SARS-CoV-2 with CRISPR-Cas13a and mobile phone microscopy*
- 08/2018 **ACS Fall 2018 National Meeting and Exposition**  
Poster: *Continuous 3D chaotic printing: Using the chaotic flow induced by a Kenics mixer to continuously fabricate complex micro- and/or nanostructure at high resolution*
- 01/2018 **2018 Research and Development Congress at ITESM**  
Poster: *Continuous 3D chaotic printing: Using the chaotic flow induced by a Kenics mixer to continuously fabricate complex microstructure at high resolution*

TEACHING AND MENTORING

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- 2023 **Graduate Student Mentor, Berkeley Bioengineering Scholars Program**  
- Mentored one Bioengineering undergraduate student to design a gravity-assisted syringe pump to facilitate sample preparation for point-of-care diagnostics of schistosomiasis.
- 2022 **Teaching Assistant, Marine Biological Laboratory: Physiology Course**

- Mentored a graduate student on a research project where we used cultured macrophages to investigate the immune-evasion properties of eggs of *Schistosoma* parasites.
- 2021 **Graduate Student Instructor, University of California, Berkeley**
  - Course: Bioengineering 168L - Practical Light Microscopy
  - Lead Instructor: Prof. Daniel Fletcher
  - Led a laboratory section, conducted weekly office hours, and graded assignments.
- 2019-21 **Teaching Assistant, Center for Cellular Construction Workshop**
  - Helped design and teach a series of workshops on cellular engineering where high school students and teachers programmed robots that mimic cellular behaviour.

## RELEVANT SKILLS

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Software	Python (numPy, pandas, Ultralytics YOLO, OpenCV, TensorFlow, Keras, scikit-learn, Matplotlib, seaborn, etc.), MATLAB, Arduino
Fabrication	CAD (Solidworks Mechanical Design - Associate Certification), 3D printing, laser cutting, microfluidics (soft lithography and photolithography), CNC machining, milling
Microscopy	Experience using microscopy for biological imaging (fluorescence, confocal, TIRF, etc.)
Wet lab	Basic cell culture, experience working with patient samples (nasal swabs, urine, blood)

## SERVICE

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- 2018-20 **Diversity, Equity and Inclusion (DEI) Enhancement Committee, UC Berkeley-UCSF Bioengineering Association of Students (BEAST)**
  - Founding Member with five other PhD students
  - Organized and led a DEI workshop for our student body at the annual retreat
  - Recruited prospective students at 2019 SACNAS National Diversity in STEM Conference
  - Worked with the BioE Executive and Admissions Committees to increase the diversity of our program's incoming cohort of students
  - Evaluated candidates in department faculty searches for contributions to DEI
- 2020 **Visit Weekend Committee Co-Chair, UC Berkeley-UCSF Bioengineering**
  - Led the committee of students in charge of the two recruitment visits of the year, where more than 80 prospective students visited our program.

## AWARDS AND DISTINCTIONS

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2022	SACNAS National Diversity in STEM Conference Student Travel Award
2021	UC Berkeley/UCSF Bioengineering Service and DEIB Award
2020	Craven Award in Bioengineering (UC Berkeley Bioengineering)
2019	UC MEXUS-CONACYT Doctoral Fellowship
2016	Mitacs Globalink Fellowship
2016	DAAD Mexican Engineers Scholarship
2014	Emerging Leaders in the Americas Program Scholarship

## VOLUNTEER WORK

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- 2021-22 **Día de la Ingeniería/Latinx Engineering Day at the Exploratorium Museum**  
Led the bilingual exhibit "Exploración con microscopios basados en teléfonos celulares".

- 2022      **Be A Scientist graduate student mentor**  
Mentored 3 middle school students as they designed and executed science experiments.
- 2014-16    **Prepanet science and mathematics tutor**  
Tutor for an online high school system serving underprivileged Mexican students.
- 2013-16    **Team LamBot 3478 (FIRST Robotics Competition)**  
Head coach responsible for leading a group of 15 academic and industry mentors and 50 high school students from San Luis Potosí, Mexico.
- 2013-14    **FIRST Robotics Competition**  
Judge assistant, field assembly volunteer, and referee.

## LANGUAGES

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Spanish	Native
English	Native
German	Very Good Command (B2.2)
French	Intermediate