MARIANA MATUS, PhD

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Computational biologist and entrepreneur working at the intersection of genomics and public health.

Education

Massachusetts Institute of Technology Cambridge, MA, USA PhD in Computational and Systems Biology, GPA: 4.8/5.0 June, 2018

Thesis title: "Analysis of fecal biomarkers to impact clinical care and public health."

Research areas: Human microbiome; Wastewater-based epidemiology.
Coursework includes: Computational and Systems Biology; Statistical Learning and Data Mining; Machine Learning; Regulation of Gene Expression

Wageningen University and Research Centre Wageningen, Netherlands MSc in Biotechnology January, 2012
Thesis title: "Mechanisms of promoter propagation in prokaryotes."

Universidad Nacional Autónoma de México Morelos, Mexico BSc in Genome Science May, 2009
Thesis title: "Survival assays of *Rhizobium etli* in sterile soil and its relation to the biosynthesis of the osmoprotectant trehalose."

Work Experience

Biobot Analytics Cambridge, MA, USA CEO and Cofounder June 2018 - Present

- Set the company direction and strategy
- Lead scientific and technology team
- Fundraising, including participation in Y Combinator, and other accelerator programs

Sample press coverage:

March 2022, CNBC; "Two years into the Coronavirus Pandemic, Fauci hopes the world will not forget lessons from a 'catastrophic experience.'" https://www.cnbc.com/2022/03/14/fauci-warns-not-to-forget-pandemics-catastrophic-experience.html

January 2022; The New York Times; "In sewage, clues to Omicron's surge"
https://www.nytimes.com/2022/01/19/health/covid-omicron-wastewater-sewage.html

October 2021; Bloomberg; "MIT offshoot that detects virus in wastewater raises $20 million"
https://www.bloomberg.com/news/articles/2021-10-22/mit-offshoot-that-detects-virus-in-wastewater-raises-20-million

June 2018; STAT News; “Scientists can track the spread of opioids in sewers. But do cities want to know what lies below?” https://www.statnews.com/2018/06/26/wastewater-epidemiology-biobot-opioids/

Massachusetts Institute of Technology Cambridge, MA, USA Graduate Researcher in Prof. Eric Alm’s lab September 2012 - June 2018

Co-founded the MIT Underworlds Project in collaboration with MIT Senseable City Lab and the Kuwait Institute for Scientific Research. Participated in securing $4M USD in grant funding from the Kuwait Foundation for Scientific Advancement. Biobot Analytics is a spin-off of the research.

Press release: http://news.mit.edu/2015/real-time-urban-epidemiology-from-wastewater-1102

Personal highlight: http://news.mit.edu/2015/student-profile-mariana-matus-0915

Collaborated with Prof. Dominick Mueller’s lab in the Max Delbruck Center for Molecular Medicine (Berlin, Germany) to publish a high impact scientific article that studied the link between high salt ingestion, the gut microbiome and high blood pressure.
Press release: http://news.mit.edu/2017/gut-microbes-can-protect-against-high-blood-pressure 1115

University of Cambridge Cambridge, UK Research Intern in Prof. Alison Smith’s lab September 2011 - December 2011 Studied biofuel production in microalgae and how to optimize the ratio of carbon to nitrogen. My work included literature review, mathematical modeling, and cultivating microalgae to test models. The European Union Erasmus Mundus Fellowship sponsored my internship.

Wageningen University and Research Centre Wageningen, Netherlands Graduate Researcher with Dr. Mark van Passel January 2011 - August 2011 Worked with Dr. Mark van Passel to study how regulatory elements (promoters) evolve in bacterial genomes, including a computational analysis and experimental work. My research work was published in a high-impact scientific journal.
Press release: https://resource.wur.nl/en/show/Genetic-variety-through-mobile-switch.htm

Teaching Experience

Massachusetts Institute of Technology Cambridge, MA, USA Instructor, MIT REDX: Rethinking Engineering Design and Execution January 2015

Massachusetts Institute of Technology Cambridge, MA, USA Teaching Assistant, Biology GIR January - June 2014

Massachusetts Institute of Technology Cambridge, MA, USA

Teaching Assistant, MIT Skoltech Initiative June - September 2013

Highlighted Awards

2021 Fast Company Most Innovative Companies, #3 in biotech and #16 overall
2020 C&EN Trailblazing Women in Chemistry Award, nominated by Nobel prize awardee Prof. Jennifer Doudna

Extended List Awards

2022 GovTech 100
2021 Newsweek's America's Greatest Disruptors: Enterprising Idealists
2021 GovTech 100
2020 Entrepreneur's Most Powerful Women
2018 Lee Kuan Yew Global Business Plan Competition Finalist
2018 MIT China Future City Lab Competition Winner
2017 MIT Graduate Women of Excellence Award
2017 MIT IDEAS Global Challenge Winner
2017 MIT DesignX Winner
2012 MIT Computational and Systems Biology Fellowship
2011 European Union Erasmus Mundus Fellowship
2010 Mexican National Science Council (CONACYT) Fellowship for Graduate Studies Abroad
2008 Mexican National Science Council (CONACYT) Fellowship for Undergraduate Researchers

Professional Associations

American Chemical Society (ACS), 2018-present
Co-organizer of "Wastewater-based Epidemiology Symposium" at the ACS National Meeting in 2019
Medical Development Group of Boston, 2015-present
American Society of Microbiology (ASM), 2015-present
The New York Academy of Sciences, 2015-present

Publications, Wastewater Epidemiology

Wei Lin Lee, Maxim Imakaev, Federica Armas, Kyle A. McElroy, Xiaoqiong Gu, Claire Duvallet, Franciscus Chandra, Hongjie Chen, Mats Leifels, Samuel Mendola, Róisín Floyd-O'Sullivan, Morgan M. Powell, Shane T. Wilson, Karl L. J. Berge, Claire Y. J. Lim, Fuqing Wu, Amy Xiao, Katya Moniz, Newsha Ghaeli, **Mariana Matus**, Janelle Thompson, Eric J. Alm. "Quantitative SARS-CoV-2 Alpha Variant B.1.1.7 Tracking in Wastewater by Allele-Specific RT-qPCR." *Environ. Sci. Technol. Lett.* (2021)

Nour Sharara, Noriko Endo, Claire Duvallet, Newsha Ghaeli, **Mariana Matus**, Jennings Heussner, Scott W. Olesen, Eric J. Alm, Peter R. Chai, Timothy B. Erickson. "Wastewater network infrastructure in public health: Applications and learnings from the COVID-19 pandemic." *PLOS Global Public Health.* (2021)

Timothy B. Erickson, Noriko Endo, Claire Duvallet, Newsha Ghaeli, Kaitlyn Hess, Eric J. Alm, **Mariana Matus**, Peter R. Chai. " 'Waste Not, Want Not' — Leveraging Sewer Systems and Wastewater-Based Epidemiology for Drug Use Trends and Pharmaceutical Monitoring." *Journal of Medical Toxicology.* (2021)

Claire Duvallet, Fuqing Wu, Kyle McElroy, Noriko Endo, Maxim Imakaev, Amy Xiao, Jianbo Zhang, Róisín Floyd-O'Sullivan, Morgan Powell, Samuel Mendola, Francis Cruz, Tamar Melman, Eric Alm, Timothy Erickson, Newsha Ghaeli, Peter Chai, **Mariana Matus**. "Nationwide trends in COVID-19 cases and SARS-CoV-2 wastewater concentrations in the United States." *In review.* (2021)

Katelyn S. Foppe, Elizabeth B. Kujawinski, Claire Duvallet, Noriko Endo, Timothy B Erickson, Peter R Chai, **Mariana Matus**. "Analysis of 39 drugs and metabolites, including 8 glucuronide conjugates, in an upstream wastewater network via HPLC-MS/MS." *Journal of Toxicology B.* (2021)

Fuqing Wu, Amy Xiao, Jianbo Zhang, Katya Moniz, Noriko Endo, Federica Armas, Mary Bushman, Peter R Chai, Claire Duvallet, Timothy B Erickson, Katelyn Foppe, Newsha Ghaeli, Xiaoqiong Gu, William P Hanage, Katherine H Huang, Wei Lin Lee, **Mariana Matus**, Kyle A McElroy, Steven F Rhode, Stefan Wuertz, Janelle Thompson, Eric J Alm. "Wastewater Surveillance of SARS-CoV-2 across 40 US states." *Water Research.* (2021)

Claire Duvallet, Bryan D Hayes, Timothy B Erickson, Peter R Chai, **Mariana Matus**. "Mapping Community Opioid Exposure Through Wastewater-Based Epidemiology as a Means to Engage Pharmacies in Harm Reduction Efforts." *Preventing Chronic Disease* (2020).

Noriko Endo, Newsha Ghaeli, Claire Duvallet, Katelyn Foppe, Timothy B Erickson, **Mariana Matus**, Peter R Chai. "Rapid assessment of opioid exposure and treatment in cities through robotic collection and chemical analysis of wastewater." *Journal of Medical Toxicology* (2020).

Fuqing Wu, Jianbo Zhang, Amy Xiao, Xiaoqiong Gu, Wei Lin Lee, Federica Armas, Kathryn Kauffman, William Hanage, **Mariana Matus**, Newsha Ghaeli, Noriko Endo, Claire Duvallet, Mathilde Poyet, Katya Moniz, Alex D. Washburne, Timothy B. Erickson, Peter R. Chai, Janelle Thompson, Eric J. Alm. "SARS-CoV-2 titers in wastewater are higher than expected from clinically confirmed cases." *Msystems* 5, no. 4 (2020).

Fuqing Wu, Amy Xiao, Jianbo Zhang, Katya Moniz, Noriko Endo, Federica Armas, Richard Bonneau, Megan A Brown, Mary Bushman, Peter R Chai, Claire Duvallet, Timothy B Erickson, Katelyn Foppe, Newsha Ghaeli, Xiaoqiong Gu, William P Hanage, Katherine H Huang, Wei Lin Lee, **Mariana Matus**, Kyle A McElroy, Jonathan Nagler, Steven F Rhode, Mauricio Santillana, Joshua A Tucker, Stefan Wuertz, Shijie Zhao, Janelle Thompson, Eric J Alm. "SARS-CoV-2 titers in wastewater foreshadow dynamics and clinical presentation of new COVID-19 cases." *medRxiv* (2020).

Mariana Matus, Claire Duvallet, Newsha Ghaeli, Melissa Kido Soule, Krista Longnecker, Ilana Brito, Carlo Ratti, Elizabeth B. Kujawinski, Eric Alm. "Untargeted detection of human health and activity markers in residential wastewater through microbiome sequencing and metabolomics." *bioRxiv* (2019). Dai, C.L., et al. "Multi-site sampling and risk prioritization reveals the public health relevance of antibiotic resistance genes found in wastewater environments." *bioRxiv* (2019)

Foppe, K. et al. Poster: Wastewater-based epidemiology to combat the opioid crisis. *The Association of Public Health Laboratories (APHL)* St Louis, MO (2019)

Mariana Matus & Nicole Raimundo. Presentation: "Assessing the scope of opioid use and overdose risk in residential communities through a novel wastewater epidemiology system: Learnings from the Town of Cary, NC." *Opioid data to action. Combating addiction through innovation. Indiana University School of Social Work, Indianapolis.* (2019)

Mariana Matus et al. Poster: "Biobot Analytics: A novel wastewater analysis technique to quantify opioid use in communities." *American College of Medical Toxicology 2019 Annual Scientific Meeting. San Francisco, CA.* (2019)

Publications, Other Work

Wilck, N., Matus, M.G., et al. (2017) Salt-responsive gut commensal modulates T_H17 axis and disease. *Nature.* https://www.nature.com/articles/nature24628

Press release: http://news.mit.edu/2017/gut-microbes-can-protect-against-high-blood-pressure-1115

Matus, M.G. et al. (2012) Promoter propagation in prokaryotes. *Nucleic Acids Research*. https://academic.oup.com/nar/article/40/20/10032/2414736

Press release: https://resource.wur.nl/en/show/Genetic-variety-through-mobile-switch.htm

Expert Revisions of Scientific Publications

(2019) American Chemistry Society Book:Wastewater Based Epidemiology: Estimating Community Drug Consumption
Title: "Detection of Stimulant Drugs in Conventional Wastewater Treatment Plants in Northeastern United States"

(2019) American Chemistry Society Book:Wastewater Based Epidemiology: Estimating Community Drug Consumption
Manuscript ID: bk201800748c
Title: "Wastewater-Based Epidemiology to Determine Temporal Trends in Illicit Stimulant Use in Seattle"

(2017) Journal: Environmental Science & Technology
Title: "Coupling Mechanism between Microbial Communities and Biological Metabolization of Organics in Urban Sewer System"