

Ivan Ramirez-Zuniga

Assistant Professor
Department of Mathematics
Department of Epidemiology and
Biostatistics

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EDUCATION

University of Pittsburgh
Ph.D., Mathematics

East Tennessee State University
M.S., Mathematics

University of Costa Rica
B.S., Mathematics

POSITIONS HELD

Assistant Professor
Department of Mathematics, The University of Texas at Tyler
📅 August 2024–Present

Assistant Professor (courtesy appointment)
Department of Epidemiology and Biostatistics, The Health Science Center at The University of Texas at Tyler
📅 August 2024–Present

Postdoctoral Associate
Department of Medicine, Laboratory for Systems Medicine, University of Florida
📅 January 2024–July 2024

- Developed mathematical models of the immune response to invasive aspergillosis. Methods: ordinary differential equations and numerical simulations in MATLAB and Python.

Research Consultant
School of Public Health, Boston University
📅 2022–2023

- Provided research consulting services involving data cleaning, interpretation, statistical analysis, and mathematical modeling. Methods included numerical simulations, statistical modeling, t-tests, ANOVA, linear and multiple regression, linear mixed-effects regression, generalized additive models, and probabilistic modeling.

Postdoctoral Scholar
Department of Pediatrics, University of Tennessee Health Science Center
📅 September 2020–September 2023

- Developed mathematical models of influenza virus infection and secondary bacterial coinfection. Methods: delay differential equations, ordinary differential equations, mechanistic modeling, parameter estimation, bootstrap methods, and numerical simulations.
- Performed data cleaning and statistical analysis of metabolomics data from virus-infected and coinfecting mice. Methods: statistical modeling, t-tests, ANOVA, principal component analysis, linear and multiple regression, hierarchical clustering, and classification algorithms.

RESEARCH INTERESTS

Mathematical biology, mathematical immunology and immunometabolism, mathematical modeling of infectious diseases and inflammatory responses, epidemiology, population dynamics, parameter estimation, optimal control, uncertainty quantification, data science, and machine learning.

PUBLICATIONS

- L. Sordo Vieira, D. Cruz, **I. Ramirez-Zuniga**, C. Atkinson, B. Mehrad, and R. Laubenbacher. "Mathematical Modeling of the Complement System: a Scoping Review." *Bulletin of Mathematical Biology*, accepted, 2026.
- **I. Ramirez-Zuniga**, W. B. MacLeod, C. Chikoti, G. Kwenda, R. Lapidot, C. J. Gill, and A. M. Smith. "Sequential Respiratory Syncytial Virus and Bacterial Infections in the Nasopharynx of Zambian Infants and Mothers." *The Pediatric Infectious Disease Journal*, 44(8):717–727, 2025.
- A. P. Smith, L. C. Lane, **I. Ramirez-Zuniga**, D. J. Moquin, P. Vogel, and A. M. Smith. "Increased Virus Dissemination Leads to Enhanced Lung Injury But Not Inflammation During Influenza-Associated Secondary Bacterial Infection." *FEMS Microbes*, 3, 2022.
- **I. Ramirez-Zuniga**, J. E. Rubin, D. Swigon, G. Clermont, and H. Redl. "A Data-driven Model of the Role of Energy in Sepsis." *Journal of Theoretical Biology*, 533, 2022.
- **I. Ramirez-Zuniga**, J. E. Rubin, D. Swigon, and G. Clermont. "Mathematical Modeling of Energy Consumption in the Acute Inflammatory Response." *Journal of Theoretical Biology*, 460:101–114, 2019.
- R. Brady, C. Puelz, **I. Ramirez-Zuniga**, K. Larripa, and M. S. Olufsen. "A Coupled Model Exploring the Cardiovascular Response to an Acute Inflammatory Event." *Proceedings of the 5th International Conference on Computational and Mathematical Biomedical Engineering (CMBE)*, 1:336–339, 2017.

Theses and Dissertations

- **I. Ramirez-Zuniga**. "Mathematical Modeling of Energy Consumption in the Acute Inflammatory Response During Sepsis." Doctoral Dissertation, University of Pittsburgh, 2020.
- **I. Ramirez-Zuniga**. "Mathematical Modeling of Immune Responses to Hepatitis C Virus Infection." Master's Thesis, East Tennessee State University, 2014.

AWARDS

- Department of Mathematics Faculty Teaching Award, University of Texas at Tyler, April 2026.
- NIH/NIAID Diversity Supplement (A1139088), 2020–2023, supplement to R01 award, PI: Dr. Amber Smith.
- Andrew Mellon Predoctoral Fellowship, University of Pittsburgh, 2019–2020.
- Arts and Sciences Graduate Fellowship, University of Pittsburgh, 2014–2015.

TEACHING EXPERIENCE

Assistant Professor

Department of Mathematics, The University of Texas at Tyler

📅 2024–Present

Courses Taught (Undergraduate Level):

- MATH 4380 Modeling and Numerical Analysis, Fall 2026.
- MATH 2312 Precalculus, Fall 2026.
- MATH 2312 H029 Honors Precalculus, Fall 2026.
- MATH 2413 Calculus I, Fall 2024, Fall 2025.
- MATH 2414 Calculus II, Spring 2025, Spring 2026.
- MATH 3305 Differential Equations, Summer 2025.

Courses Taught (Graduate Level):

- MATH 5399 Independent Study, Summer 2025.
- MATH 5381 Applied Mathematics I, Fall 2025.
- MATH 5382 Applied Mathematics II, Spring 2026.

Instructor/Teaching Assistant

Department of Mathematics, University of Pittsburgh

📅 2014–2020

Courses Taught as Instructor:

- MATH 0120 Business Calculus, Summer 2019.
- MATH 0240 Calculus III, Summer 2018.
- MATH 0230 Calculus II, Summer 2017.
- MATH 0290 Differential Equations, Summer 2015.

Courses Taught as Teaching Assistant:

- MATH 0031 Algebra, Summer 2020.
- MATH 0450 Introduction to Analysis (Honors), Spring 2019.
- MATH 0220 Calculus I, Fall 2015, Spring 2017, Fall 2018.
- MATH 0230 Calculus II, Fall 2015, Fall 2016, Fall 2018.
- MATH 0290 Differential Equations, Spring 2018.
- MATH 1360 Math Modeling, Fall 2016.
- MATH 0240 Calculus III, Summer 2016.
- MATH 0280 Introduction to Matrices and Linear Algebra, Spring 2016.

Instructor/Teaching Assistant

Department of Mathematics, East Tennessee State University

📅 2013–2014

Courses Taught as Instructor:

- MATH 1920 Calculus II, Spring 2014, Summer 2014.
- MATH 1910 Calculus I, Fall 2013.

Courses Taught as Teaching Assistant:

- MATH 1920 Calculus II, Summer 2014.

Instructor

Department of Mathematics, Universidad de Costa Rica

📅 2009–2012

Courses Taught:

- MA 1005 Differential Equations, Spring 2011, Spring 2012, Fall 2012.
- MA 2210 Applied Differential Equations, Fall 2011, Fall 2012.
- MA 0230 Calculus for Economics, Fall 2011.
- MA 1001 Calculus I, Spring 2009, Spring 2010.
- MA 1002 Calculus II, Fall 2009, Fall 2010.
- MA 1004 Linear Algebra, Spring 2009, Spring 2010.

Instructor

Colegio Científico Costarricense (STEM High School)

📅 2010–2012

Courses Taught:

- MA 0125 Precalculus.
- MA 1001 Calculus I.
- Mathematical Reasoning.

ADVISING

- **Undergraduate Research Mentoring, Department of Mathematics, UT Tyler**
 - Stephen Daniels and Alexander Vargas, *Modeling Immune Response to Bacterial Infections*, Spring 2026.
- **Senior Capstone Projects, Department of Mathematics, UT Tyler**
 - Tristan Frazier, *Modeling Disease Outbreaks with Compartmental Models*, Spring 2025.
- **Master's Thesis Advising, Department of Mathematics, UT Tyler**
 - Md. Timorul Islam, co-advised with Dr. Regan Beckham, 2025–2026.
 - Bryan Barrios, 2025–Present.
- **Informal Research Mentoring**
 - Joel Onime, University of Kentucky, *Parameter Identifiability*, Summer 2026.
 - Sanay Sambhitab Salvi, UT Austin, *Modeling Bacterial Interactions*, Summer 2025.

PRESENTATIONS

Oral Presentations

- *A Mechanistic Model of Inflammation in Invasive Pulmonary Aspergillosis: Linking Heme, Complement (C5a), and Tissue Injury*. SIAM Conference on the Life Sciences (LS26), Cleveland, OH, July 2026.
- *Advances in Statistical and Mechanistic Modeling of Infectious Diseases*. Department of Mathematics Colloquium, University of Texas at Tyler, October 2025.

- *Modeling Within-Host Pathogen Dynamics*. Department of Mathematics Colloquium, University of Texas at Tyler, October 2024.
- *Surviving the Zombie Apocalypse with Math*. Undergraduate Mathematics Seminar, University of Texas at Tyler, October 2024.
- *Modeling the Energy Requirements of an Acute Immune Response During Sepsis*. Laboratory for Systems Medicine, University of Florida, virtual, January 2024.
- *Modeling the Dynamics of Alveolar Macrophages and Interferon Gamma During Influenza Infection*. SIAM Conference on Applications of Dynamical Systems (DS23), Portland, OR, May 2023.
- *Modeling the Energy Consumption During an Acute Inflammatory Response and Sepsis*. SIAM Conference on the Life Sciences (LS22), virtual, July 2022.
- *A Data-driven Mathematical Study of the Role of Energy in Sepsis*. Society for Mathematical Biology Annual Meeting (SMB21), virtual, June 2021.
- *A Data-driven Mathematical Study of the Role of Energy in Sepsis*. SIAM Conference on Applications of Dynamical Systems (DS21), virtual, May 2021.
- *A Data-driven Mathematical Study of the Role of Energy in Sepsis*. Joint Mathematics Meetings (JMM), Denver, CO, January 2020.
- *Mathematical Modeling of Energy Consumption in the Acute Inflammatory Response*. Biology and Medicine Through Mathematics Conference (BAMM), Virginia Commonwealth University, Richmond, VA, May 2019.
- *Mathematical Modeling of Energy Consumption in the Acute Inflammatory Response*. AMS Microconference on Parameter Estimation, Minneapolis, MN, August 2018.
- *Mathematical Modeling of Energy Consumption in the Acute Inflammatory Response*. SIAM Conference on the Life Sciences (LS18), Minneapolis, MN, August 2018.
- *Sensitivity Analysis and Optimal Control Treatment of Hepatitis C Virus Dynamics*. Appalachian Student Research Forum, East Tennessee State University, Johnson City, TN, April 2014.

Poster Presentations

- *Sequential Interactions Between RSV and Pneumococcus in the Nasopharynx of Zambian Infants and Mothers*. ReSViNET Conference, Lisbon, Portugal, February 2023.
- *A Data-driven Mathematical Study of the Role of Energy in Sepsis*. Summit on the Rules of Life, Mathematical Biosciences Institute (MBI), Columbus, OH, June 2019.
- *Mathematical Modeling of Energy Consumption in the Acute Inflammatory Response*. Research Training Group in Mathematical Biology Workshop, *Parameter Estimation for Mechanistic Biological Models*, NC State University, Raleigh, NC, July 2018.
- *Mathematical Modeling of Energy Consumption in the Acute Inflammatory Response*. Workshop on Host-Pathogen Dynamics, Mathematical Biosciences Institute (MBI), Columbus, OH, February 2018.
- *Mathematical Modeling of Energy Consumption in the Acute Inflammatory Response*. SIAM Conference on the Life Sciences, Boston, MA, July 2016.
- *Proyecto 6x4 UEALC*. Week of Methods to Reduce Dimension in Data Analysis, Centro de Investigación en Matemáticas (CIMAT), Guanajuato, Mexico.

Coauthored Presentations Delivered by Collaborators

- *Towards Complement-based Therapeutics: Opportunities for (Discrete) Mathematical Modeling*. Presented by Daniel Cruz, Society for Mathematical Biology Annual Meeting, Graz, Austria, 2026. Joint work with Luis Sordo Vieira, Daniel Cruz, Ivan Ramirez-Zuniga, Carl Atkinson, Borna Mehrad, and Reinhard Laubenbacher.
- *The Effects of Hematopoiesis on Chronic Critical Illness Following Sepsis*. Presented by Youngmin Park, SIAM Conference on the Life Sciences (LS26), Cleveland, OH, July 2026. Joint work with Vincent Holmlund, Bryan Bailey-Feliciano, Kaylah Adams, Jing Pan, Ivan Ramirez-Zuniga, and Youngmin Park.
- *Mathematical Modeling to Capture Exacerbation Dynamics in Disease Progression of COPD*. Presented by Marisa Renardy, SIAM Conference on the Life Sciences (LS26), Cleveland, OH, July 2026. Joint work with Marisa Renardy, Ivan Ramirez-Zuniga, Alexander P. Hoover, Nicholas Cogan, and Isaac Klapper.

Panel Participation

- Panelist, Bioinformatics and Biostatistics Panel Discussion, ACM Chapter, University of Texas at Tyler, October 2024.
- Panelist, Graduate Programs Panel Discussion, Texas Undergraduate Mathematics Conference (TUMC), October 2024.

PROFESSIONAL SERVICE

Conference and Scientific Organization

- Co-organizer, Minisymposium *Computational Modeling in Biological and Physiological Systems*, SIAM Texas–Louisiana Sectional Meeting, 2026.
- Co-organizer, Minisymposium *Advances in Mechanistic Models of Immune Responses and Inflammation*, SIAM Conference on the Life Sciences (LS26), 2026.

- Scientific Committee Member, *Simpósio Internacional de Métodos Matemáticos Aplicados a las Ciencias (SIMMAC)*, 2024.

Editorial and Refereeing Service

- Co-editor, *Frontiers in Applied Mathematics and Statistics*, Research Topic: *Integrating Modeling Methods for Quantifying Uncertainty in Infectious Disease Models*, 2025–Present.
- Reviewer, *SIAM Journal on Applied Mathematics: Life Sciences (SIALS)*, 2026–Present.
- Reviewer, *PLOS Computational Biology*, 2021–Present.

UNIVERSITY SERVICE

University of Texas at Tyler

- Chair, COMAP Committee, Department of Mathematics, 2026–Present.
- Member, Curriculum Committee, Department of Mathematics, 2025–Present.
- Member, Putnam Exam Committee, Department of Mathematics, 2024–2026.
- Member, Mathematics Education Committee, Department of Mathematics, 2024–2025.

CONFERENCES AND WORKSHOPS ATTENDED

- **Conference:** Joint Mathematics Meetings (JMM), Washington, DC, January 2026.
- **Workshop:** Uncertainty Quantification for Mathematical Biology, ICERM, Providence, RI, May 2025.
- **Workshop:** 5th Workshop on Viral Dynamics, virtual, October 2021.
- **Conference:** Joint Mathematics Meetings (JMM), Baltimore, MD, January 2019.
- **Conference:** Parameter Estimation and Uncertainty Quantification for Dynamical Systems, University of Pittsburgh, Pittsburgh, PA, March 2017.
- **Workshop:** Mathematics Research Communities—Mathematics in Physiology and Medicine, Snowbird, UT, June 2016.
- **Summer School:** Joint CAMBAM–MBI–NIMBioS Summer School in Nonlinear Dynamics in Biological Systems, McGill University, Montreal, Canada, June 2015.
- **Workshop:** Parameter Estimation for Dynamic Biological Models, NIMBioS, May 2014.
- **Conference:** SEARCDE, University of Tennessee, Knoxville, TN, September 2013.
- **Conference:** Society for Mathematical Biology Annual Meeting, Knoxville, TN, 2012.
- **Summer School:** Escuela de Matemáticas de América Latina y el Caribe (EMALCA), University of Costa Rica, 2012.
- **Conference:** Simposio Internacional de Métodos Matemáticos Aplicados a las Ciencias (SIMMAC), University of Costa Rica, 2012.
- **Conference:** Simposio Internacional de Métodos Matemáticos Aplicados a las Ciencias (SIMMAC), University of Costa Rica, 2008.
- **Conference:** Simposio Internacional de Métodos Matemáticos Aplicados a las Ciencias (SIMMAC), University of Costa Rica, 2006.

CERTIFICATIONS

- HIPAA, Privacy Rule (PA), UTHSC, 2023.
- HIPAA, Violations and Penalties, UTHSC, 2022.
- Diversity Certificate Program, UTHSC, 2021.
- Erdős Data Science Boot Camp, The Erdős Institute, 2021.