



THE FOURTEENTH INTERNATIONAL

SYMPOSIUM ON **BEER**

2021

Intercollegiate Biomathematics Alliance

Biomathematics & Ecology: Education & Research

Online

November 12-14, 2021



Center for Collaborative Studies in Mathematical Biology

Intercollegiate Biomathematics Alliance

Scholarship, Teaching, and Advanced Research Development

Welcome to the 14th Annual Symposium on Biomathematics and Ecology Education and Research (BEER).

I am extremely happy that you are joining us as either new or returning participants of BEER. I am indeed grateful to see the BEER family finding a way to get together again even virtually during these uncertain times.

Organizing BEER-2020 during the most trying days of COVID-19 pandemic was certainly a challenge and a learning process for us. Hosting BEER-2020 on Zoom was a success but we the BEER Crew felt that hosting the meeting on Zoom lacked that personal touch that BEER meetings are know for. The unifying theme of our organizational meetings was to hold the meeting as close as possible to the pre-COVID BEER gatherings. As a result, we decided to use Gather.Town Virtual Hall to host BEER-2021 where the participants can experience the in-person nature of BEER meetings from their computers. We used Gather.Town rather successfully during 2021 IBA's signature undergraduate workshop, CURE-2021. Feel free to visit the Poster Sessions to interact with our rising undergraduate research stars during BEER-2021.

Once again, I lucked out and ended up working with an amazing organizing team. Thanks to their tireless efforts and personal sacrifices, we were able to put together BEER-2021. My co-organizers deserve all the credit here: Erin Estes is chiefly responsible for setting up the BEER Hall. I am indebted to Drs. Padmanabhan (Padhu) Seshaiyer, Anuj Mubayi, and Aditi Gosh for making sure that the BEER-2021 symposium lives up to its reputation.

Once again, welcome to BEER-2021.

Olcay Akman
Program Chair

e-BEER 2021 Schedule

Friday, November 12	12:00PM-1:30PM	Approaches and Diversity in Applied Mathematics Interface - Health and Data Science: Lessons learned from COVID-19 Pandemic <i>Carmen Caiseda, Megan Powell, Teresa Ramirez, & Suzanne Sindi</i>
	1:30PM-2:00PM	Break
	2:00PM-4:00PM	Poster Session I
	7:00PM-8:00PM	The Role of Mathematics in 21st Century Medicine <i>Dr. Reinhard Laubenbacher</i>
	8:00PM-8:30PM	Q&A Session
Saturday, November 13	9:00AM-10:00AM	Undergraduate Research in Mathematical Modeling <i>Dr. Glenn Ledger</i>
	10:00AM-10:30AM	Q&A Session
	10:30AM-12:00PM	Poster Session II
	12:00PM-1:00PM	Lunch Break
	1:00PM-2:00PM	Minisymposium I
	2:00PM-3:00PM	Minisymposium II
	3:00PM-3:30PM	Break
	3:30PM-4:30PM	Minisymposium III
Sunday, November 14	9:00AM-10:00AM	Career and Professional Development Workshop
	10:00AM-11:00AM	Minisymposium IV
	11:00AM-12:00PM	Minisymposium V
	12:00PM-1:00PM	Lunch Break
	1:00PM-1:30PM	Closing Remarks

Note: All times listed are Eastern Standard Time—USA

Keynote Presentation

*The Role of Mathematics in
21st Century Medicine*

Reinhard Laubenbacher,

University of Florida,

Department of Medicine

Friday, November 12, 2021

7:00PM - 8:00PM (EST-USA)

Plenary Presentation

*Undergraduate Research in
Mathematical Modeling*

Glenn Ledder,

University of Nebraska - Lincoln,

Department of Mathematics

Saturday, November 13, 2021

9:00AM - 10:00AM (EST-USA)



We hope you enjoy the
Symposium on Biomathematics Ecology
Education and Research

[Symposium Website](#)

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Panel Session

*Approaches and Diversity in Applied Mathematics
Interface - Health and Data Science:
Lessons Learned from COVID-19 Pandemic*

Panelists:

Dr. Carmen Caiseda, Inter American University of Puerto Rico, Department of Natural Sciences and Mathematics

Dr. Megan Powell, University of North Carolina - Asheville, Department of Mathematics

Dr. Teresa Ramirez, American Physiological Society

Dr. Suzanne Sindi, University of California - Merced, Applied Mathematics Department

Moderator:

Dr. Aditi Ghosh, Texas A&M University - Commerce, Department of Mathematics

Friday, November 12, 2021

12:00 - 1:30 PM (EST-USA)

Keynote Presentation

The Role of Mathematics in 21st Century Medicine

Dr. Reinhard Laubenbacher

The discovery of the circulation of blood through the body was widely considered one of the greatest medical discoveries of the seventeenth century, resulting in a fundamental revision of physiology. The Scottish physician Archibald Pitcairne, in a sequence of publications beginning in 1688, proposed a mathematical explanation of circulation, a *Principia medicinae*, that mirrored Newton's *Principia mathematicae*, published the year before, with the beating heart playing the role of gravity. Pitcairne insisted that only mathematical statements were admissible about things we cannot see. Both mathematics and medicine have come a long way since Pitcairne's proposal, and we are closer now to his vision of a mathematical foundation of medicine. This talk will present some examples of a mathematical formulation of an important problem in medicine, serving as signposts along the road to Pitcairne's vision. They are examples of efforts toward the creation of so-called medical digital twins, a key modeling technology on our way to precision medi-

Q&A Session

8:00PM-8:30PM

Plenary Presentation

Undergraduate Research in

Mathematical Modeling

Dr. Glenn Ledder, BIO-SIGMAA

There is widespread agreement that a research experience is an invaluable part of an undergraduate career. This poses a problem in mathematics, where many research areas require a graduate-level understanding of the mathematical background. In contrast, research in mathematical modeling requires far less background knowledge while providing scope for creativity on problems of broad interest. It is even possible to find challenging research projects for talented students at a very early stage in their undergraduate careers. I have mentored well over 100 undergraduate students in research projects, individually, in groups, and even in a classroom setting, with students ranging from those who are more than ready for graduate school down to those who have just been admitted to college. Some of this experience can be passed on through conversation. This talk will comprise two parts. In the first part, I will present basic principles for undergraduate research in mathematical modeling. In the second part, I will discuss agent-based models, which are accessible to entry-level undergraduates and can be used as tools for a variety of research projects with biological themes.

Q&A Session

10:00AM-10:30AM

Poster Session I

<p style="text-align: center;">(1) <i>Simulating Gene Regulatory Networks to Estimate Stochastic Transition Variation</i></p> <p style="text-align: center;">Jose Arbelo, Julieth Lopez Castiblanco, Olcay Akman</p>	<p style="text-align: center;">(2) <i>R Shiny's Self-Organizing Map</i></p> <p style="text-align: center;">Zury Betzab Marroquin, Joshua Walsh, Trenton Wesley, Christopher Hay-Jahans</p>
<p style="text-align: center;">(3) <i>Age-dependent Ventilator-Induced Lung Injury</i></p> <p style="text-align: center;">Quintessa Hay</p>	<p style="text-align: center;">(4) <i>Poliomyelitis Virus vs Smallpox: an ordinary differential equation model comparison</i></p> <p style="text-align: center;">Kate McGough</p>
<p style="text-align: center;">(5) <i>Reconstructing mathematical models with chaotic attractors via genetic algorithms</i></p> <p style="text-align: center;">Luis Ramirez Islas, Paul Valle</p>	<p style="text-align: center;">(6) <i>3-Dimensional Agent-based Model of Neural Activity in the Central Nucleus of the Amygdala During Pain</i></p> <p style="text-align: center;">Carley Reith, Rachael Neilan, Benedict Kolber</p>
<p style="text-align: center;">(7) <i>Mathematical Modeling of Breast Cancer Cell MCF-7 Growths due to Curcumin Treatments</i></p> <p style="text-align: center;">Hildana Assefa, Kana Kassa, Widodo Samyono</p>	<p style="text-align: center;">(8) <i>Mathematical Modeling and Analysis of COVID-19 Epidemic with Vaccination</i></p> <p style="text-align: center;">Caitlin Seibel, Tina Huang, Jackson Reisman, Erika Martínez Salinas, Viswanathan Arunachalam, Moatlhodi Kgosimore, Anuj Mubayi, Padmanabhan Seshaiyer, Allen Sehunelo</p>
<p style="text-align: center;">(9) <i>Sentiment Analysis of Radicalization on Social Media</i></p> <p style="text-align: center;">Anna Singley, Olcay Akman</p>	

Poster Session II

<p>(10) <i>Mathematical Model for understanding the spread of COVID-19 in Saudi Arabia with access to vaccination</i></p> <p>Maha Alshabrawi</p>	<p>(11) <i>Mathematical model describing the behavior of biomass, acidity, and viscosity as a function of temperature in the shelf life of yogurt</i></p> <p>Manuel Alvarado, Paul Valle,</p>
<p>(12) <i>Reproduction Number for Covid-19 Pandemic on a College Campus</i></p> <p>Elizabeth Amona</p>	<p>(13) <i>Species Abundance Distributions and the Canon of Classical Music</i></p> <p>Noelle Atkin</p>
<p>(14) <i>Statistical modeling of SARS-Cov-2 mutation in the U.S.</i></p> <p>Yuru Jing, Angela Antonou</p>	<p>(15) <i>Using Parameter Estimation for Mathematical Model Predicting Pediatric SCD Pain</i></p> <p>Quindel Jones</p>
<p>(16) <i>Chemoimmunotherapy treatment strategies on a mathematical model of cancer evolution</i></p> <p>Sandra M. Lopez, Yolocuauhtli Salazar, Paul Valle</p>	<p>(17) <i>Neural network controller vs pulse control to achieve complete eradication of cancer cells in a mathematical model</i></p> <p>Joel A. Quevedo, Sergio A. Puga, Paul Valle</p>
<p>(18) <i>Modeling, Analysis, and Control of Student Loan Debt using Epidemiological Models</i></p> <p>Kavya Ravishankar, Padmanabhan Seshiayer</p>	

Minisymposium I

	1:00PM - 1:30PM	1:30PM - 2:00PM
Room A	<p><i>Algebraic Design of Experiments for Regulatory Network Identification</i></p> <p>Elena Dimitrova</p>	<p><i>Building model prototypes from time-course data</i></p> <p>David Murrugarra, Alan Veliz-Cuba</p>
Room B	<p><i>The Impacts of Stochasticity in a Freshwater Ecosystem Model with Alternative Stable States</i></p> <p>Gina Salerni, Erin Estes, Christopher Stieha</p>	<p><i>Prey Toxicity, Prey Refuge Use, and Stochasticity Increase Algal Blooms in a Phytoplankton-Zooplankton Mathematical Model</i></p> <p>Naomi Cedeño, Erin Estes, Christopher Stieha</p>
Room C	<p><i>Basal Sprout Centered Management of Vector-Borne Tree Diseases</i></p> <p>Kelly Buch</p>	<p><i>Biocontrol of the emerald ash borer: an adapted Nicholson-Bailey model</i></p> <p>Michael Kerckhove, Shuheng Chen</p>
Room D	<p><i>Estimation Analysis for the SEIR Model With Stochastic Perturbation for the COVID-19 Outbreak in Bogotá</i></p> <p>Viswanathan Arunachalam, Andrés Ríos-Gutiérrez</p>	<p><i>Estimation of parameters of epidemiological models under a non-parametric approach and its application for COVID-19 in Bogotá D.C.</i></p> <p>Andrés Ríos-Gutiérrez, Viswanathan Arunachalam, Soledad Torres</p>

Minisymposium II		
	2:00PM - 2:30PM	2:30PM - 3:00PM
Room A	<p><i>Identification of control targets in Boolean networks via computational algebra</i></p> <p>Alan Veliz-Cuba</p>	<p><i>Modeling the Pancreatic Cancer Microenvironment in Search of Control Targets</i></p> <p>Daniel Plaughter</p>
Room B	<p><i>An integral projection model for gizzard shad that includes density-dependent age-0 survival</i></p> <p>James Peirce, Greg Sandland</p>	<p><i>Incorporating Chlorophyll-a Levels into an Integral Projection Model of Gizzard Shad (<i>Dorosoma cepedianum</i>) in the Upper Mississippi River</i></p> <p>Raquel Castromonte, Greg Sandland, James Peirce</p>
Room C	<p><i>Modeling the Spread of Curly Top Disease in Tomato Crops</i></p> <p>Rachel Frantz</p>	<p><i>The impact of fungicide treatment on the dynamics of Cocoa Black Pod disease</i></p> <p>Bismark Oduro</p>
Room D	<p><i>A mathematical model of the immune system response to COVID-19</i></p> <p>Ephraim Agyingi, Nathan Klein</p>	<p><i>Modeling, Analysis and Simulation of COVID-19 interaction dynamics between local community in Saudi Arabia and visiting sub-population</i></p> <p>Manal Badgaish, Padmanabhan Seshaiyer</p>

Minisymposium III		
	3:30PM - 4:00PM	4:00PM - 4:30PM
Room A	<p><i>Various notions of canalization – a review</i></p> <p>Claus Kandelka</p>	<p><i>Hierarchy Establishment from Nonlinear Social Interactions and Metabolic Costs: an Application to the Harpegnathos saltator</i></p> <p>Jordy Cevallos-Chavez, Carlos Bustamante Orellana, Yun Kang</p>
Room B	<p><i>Using Integral Projection Models to Study Silver Carp Management Practices</i></p> <p>Cameron Coles</p>	<p><i>Ecological Dynamics on Large Metapopulation Graphs</i></p> <p>Daniel Cooney</p>
Room C	<p><i>Connecting People to Food: A Network Approach to Alleviating Food Deserts</i></p> <p>Anna Sisk</p>	<p><i>Understanding the dynamics of human reliance and trust on automation</i></p> <p>Carlos Bustamante Orellana, Lucero Rodriguez, Jordy Cevallos-Chavez, Yun Kang</p>
Room D	<p><i>Mathematical Modelling and simulation using an efficient PINNs algorithm to understand spread of infection in enclosed spaces</i></p> <p>Long Nguyen, Arkaprov Ghosal, Rudra Nagalia, Padmanabhan Seshaiyer</p>	<p><i>How within-host priority effects between specialist and generalist pathogens affect disease risk</i></p> <p>Jing Jiao, Michael Cortez</p>

Career and Professional Development Workshop

Dr. Padmanabhan Seshaiyer

Sunday, November 14, 2021

9:00 - 10:00 AM (EST-USA)

In this workshop, participants will engage actively in learning about competencies, frameworks and practices needed to be successful in the workforce, whether it is industry or academia. The session is open to both students at undergraduate, graduate and post-doctoral levels as well as faculty at different stages of their career. The interactive session will also engage participants to also learn about fostering an inclusive culture for research and education in mathematical biology. We also hope to share upcoming funding opportunities for both students and faculty and give pointers to prepare competitive proposals and applications.

Minisymposium IV		
	10:00AM - 10:30AM	10:30AM - 11:00AM
Room A	<p style="text-align: center;"><i>Image-Based Microbiome Profiling Differentiates Gut Microbial Metabolic States</i></p> <p style="text-align: center;">Sarwesh Rauniyar</p>	<p style="text-align: center;"><i>An agent-based model of pain-related neurons in the amygdala</i></p> <p style="text-align: center;">Rachael Neilan, Benedict Kolber</p>
Room B	<p style="text-align: center;"><i>Interpolating missing data and comparing performance of common interpolation techniques from a 30-year water quality dataset</i></p> <p style="text-align: center;">Wako Bungula, Danelle Larson, Killian Davis, Richard Erickson, Amber Lee, Casey McKean, Frederick Miller, Alaina Stockdill, Enrika Hlavacek</p>	<p style="text-align: center;"><i>Topology and Ecology: Deducing States of the Upper Mississippi River System</i></p> <p style="text-align: center;">Killian Davis</p>
Room C	<p style="text-align: center;"><i>Optimal Control Techniques in Addiction Modeling</i></p> <p style="text-align: center;">Leigh Percy, William Strickland, Suzanne Lenhart</p>	<p style="text-align: center;"><i>A Comparison between the Effects of Empirical and Theoretical Knockouts on the Structure of Social Networks</i></p> <p style="text-align: center;">Karina Morales, Christopher Stieha</p>
Room D	<p style="text-align: center;"><i>Stability of Explicit and Implicit Discrete Epidemic Models: Applications to Swine Flu Outbreak</i></p> <p style="text-align: center;">Elvan Akin</p>	<p style="text-align: center;"><i>Machine learning-based risk factor analysis and prevalence prediction of intestinal parasitic infections</i></p> <p style="text-align: center;">Ahmet Ay</p>

Minisymposium V		
	11:00AM - 11:30AM	11:30AM - 12:00PM
Room A	<p style="text-align: center;"><i>Rippled Almost Periodic Behavior in an Epilepsy Model</i></p> <p style="text-align: center;">David Chan, Candace Kent</p>	<p style="text-align: center;"><i>A neutral model of 100 million years of chromosome inversions in the yeast genus Lachancea</i></p> <p style="text-align: center;">Brian Clark</p>
Room B	<p style="text-align: center;"><i>Allee effects plus noise induce population dynamics resembling binary Markov highs and lows</i></p> <p style="text-align: center;">Luis Gordillo</p>	
Room C	<p style="text-align: center;"><i>Model-based evaluation of the implementation of STI screening among men who have sex with men in Tokyo</i></p> <p style="text-align: center;">Nao Yamamoto</p>	<p style="text-align: center;"><i>Effect of human behavior on the evolution of viral strains during an epidemic</i></p> <p style="text-align: center;">Asma Azizi</p>
Room D	<p style="text-align: center;"><i>A Quantum Mechanics Approach for the Dynamics of an Immigration, Emigration Fission Model</i></p> <p style="text-align: center;">Leon Arriola</p>	<p style="text-align: center;"><i>An Extension of Euler's Polyhedron Theorem</i></p> <p style="text-align: center;">Joy D'Andrea</p>

Closing Remarks

Drs. Olcay Akman, Aditi Ghosh, Anuj Mubayi,
& Padmanabhan Seshaiyer

Sunday, November 14, 2021

1:00PM-1:30PM

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[Symposium Website](#)

[Presentation Information](#)

[Virtual Conference Hall](#)

Password: BEER-XIV

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