Spring 2024 MD-DC-VA Section Meeting Abstracts

Abstracts are in chronological order. All talks are Saturday, except the workshop and banquet talk.

Workshop

Promoting community, confidence, and creativity in the classroom

Heather Russell (on behalf of MAA MD-DC-VA COMMIT) , University of Richmond

4:00-6:00, Taylor 306

For the last decade or so, my teaching energy has been focused on finding successful ways to engage students in active learning. This is still central to what I do, but lately, I have been thinking quite a bit about community. The work of Della Dumbaugh, Pamela Harris, Deanna Haunsperger, Aris Winger, Cindy Wyels, and so many others has spotlighted the importance of community in one's mathematical journey. As Deanna's Saturday Morning Address last fall discussed, community and belonging can be a source of courage and perseverance in the face of challenge. With these resources comes greater access to creativity and joy – things we wish all students can experience. This workshop will focus on techniques for building community and belonging in the classroom and beyond. To set the tone, we will begin by reflecting on the role community has played in our own mathematical lives. To get the conversation started, I will share what I have learned from the work of folks mentioned above, my amazing colleagues, and my own experiences. My intention is that this workshop will provide a space for exchanging ideas, celebrating successes, making connections, and brainstorming new directions.

Banquet Talk

Compassion in & Access to Learning Mathematics (CALM)

Hortensia Soto , Colorado State University

8:00-9:00, D-Hall, 3rd Floor, Hall of Presidents

Research indicates that students from minoritized groups are more likely to pursue STEM degrees if they can see how these fields benefit their communities and if they are in classrooms where they experience micro or macro-affirmations. In this presentation, I will share my perspectives, based on research and personal experiences, on how we can create learning environments that provide our students access to learning mathematics. I argue that we can help students see the value of mathematics by challenging them, providing a supportive learning environment, and creating a space where they have a voice in their learning.

First and Second-Order Necessary Conditions for Nonsmooth Set-Constrained Scalar Minimization Problems

Elena Constantin, University of Pittsburgh at Johnstown
8:20-8:40, EnGeo 1202

Our goal is to give some necessary optimality conditions for a set-constrained minimization problem with nonsmooth locally Lipschitz data. Our conditions are formulated by means of generalized derivatives of the objective function and generalized tangential directions to the arbitrary constraint set. Our results are used to solve problems to which the classical optimality results such as the Second Derivative Test and the method of Lagrange multipliers are not applicable.

Digital Image Processing in College Mathematics

Eugene Galperin, East Stroudsburg University
8:20-8:40, EnGeo 1204

We discuss the use of basic and advance digital image processing methods to provide meaningful context for reviewing key topics of the college mathematics curriculum, to help students gain confidence in using concepts and techniques of applied mathematics, to increase student awareness of recent developments in mathematical sciences, and to help students prepare for graduate studies.

A sampling of inquiry opportunities in a complex-themed transition to advanced mathematics course

Bob Sachs, George Mason University
8:20-8:40, EnGeo 1207

Multiple inquiry opportunities arise for students in the setting of a complex-themed transition to advanced mathematics course. Some are proofs but others are investigations or guided reinvention. I will highlight a few topics that have spurred a lot of student interest in my course and describe their "meta" value for later coursework.

Introduction to Large Scale Geometry

Kevin Sinclair, Shenandoah University
8:20-8:40, EnGeo 1208

Traditional topology and geometry often concerns themselves with what we call small-scale structures that allow us to look into the idea of continuity and open sets among other things. Large scale geometry, on the other hand, defines itself in a way that is almost the exact opposite and utilizes what is called a coarse structure in order to look at properties about the entire space. In this talk, we will introduce the basic ideas of large scale geometry and coarse structures, and define more useful equivalencies that allow us to study large scale properties in a more topological fashion.

How the Legalization of Marijuana Affects Alcoholism: A Mathematical Approach for Co-abuse

Ana Vivas, James Tipton, Sujan Pant, Norfolk State University
8:20-8:40, EnGeo 1209

There is plenty of literature using mathematical models to analyze the dynamics of alcohol addiction or marijuana addiction individually. However, the literature surrounding the co-abuse of alcohol

and marijuana, to the authors' knowledge, is sparse. As the use of marijuana becomes socially acceptable and legalized in many states, related data for the co-abuse is not available. Since multiple health organizations show several studies, where the co-abuse of alcohol and marijuana is at the top of health concerns in the United States the necessity of developing mathematical models to contribute to the analysis of alcohol-marijuana co-abuse is imminent. A mathematical model for the dynamics of the co-abuse of alcohol and marijuana is presented in this work, by using a system of ordinary differential equations under certain assumptions for the whole population. The Basic reproduction number and stability results for the free-disease equilibrium are included, as well as numerical simulations with parameters for the Virginia population.

Mobility and Crime in Baltimore City

Natalie Brownlowe, Towson University
8:20-8:40, EnGeo 2208
(student talk)

This study investigates the correlation between mobility and crime in Baltimore City through various statistical analyses and spatial methods. Chi-square and K-means cluster analyses confirm significant associations between crime clusters and the pandemic. Exploring the linear regression for each crime and cluster we investigate the relationship between mobility and crime. Overall, this study emphasizes the importance of understanding mobility dynamics in crime prevention strategies.

Automorphic Forms, Elliptic Curves, and Galois Representations

Henry Pratt, St. Mary's College of Maryland
8:20-8:40, EnGeo 2210
(student talk)

Automorphic forms are functions from a topological group to the complex field, and are invariant under the group action of a discrete subgroup of the topological group. As they generalize modular forms, they are able to carry properties of those functions, like their Galois representations, along their relation to elliptic curves through the modularity theorem. In this paper, we investigate those Galois representations and their relation with elliptic curves in hopes to provide an overview of this technical topic.

Explaining the Math of Queer Relationship Dynamics

Edison Hauptman, University of Pittsburgh
8:45-9:05, EnGeo 1202

The Stable Marriage Problem is often introduced by considering one group of men and one group of women, and then asking if there is a way to pair up the men and women such that no two people prefer one another to their current partners. In this expository talk, I will introduce the problem from a new angle, explain how it changes when we include the experiences of queer people, and discuss some applications.

Middle School Math Modeling Outreach
Greg Hartman, Meagan Herald, Karen Bliss, Virginia Military Institute
8:45-9:05, EnGeo 1204

Recently, VMI successfully held its second Middle School Math Modeling outreach day for local eighth grade students. We will describe why we decided to do this outreach, the logistics of the event from start to finish, and the positive feedback we've received. We'll also share how the event has grown beyond VMI and invite other schools to host similar events of their own.

Multivariable Calculus with CalcPlot3D
David Clark, Randolph-Macon College
8:45-9:05, EnGeo 1207

Are you looking for a 3-D graphing utility for your multivariable calculus course? One option is CalcPlot3D, a free, web-based application that was designed with pedagogy in mind. I tried CalcPlot3D for the first time in the fall, and will present a variety of examples I used in class, as well as an overview of the application's plentiful features. PLEASE BRING A LAPTOP IF POSSIBLE; your phone will work in a pinch, though.

Concordance of knots in 3-dimensional manifolds
Ryan Stees, University of Virginia
8:45-9:05, EnGeo 1208

Concordance is a 4-dimensional notion of equivalence between knots in 3-dimensional manifolds. After giving some definitions, we will discuss an open question related to the number of equivalence classes.

Finitely Additive Measures in Number Theory
Charles Samuels, Christopher Newport University
8:45-9:05, EnGeo 1209

An ancient set of questions in number theory attempt to study the concept of a prime inside of rings other than the integers. The ring of algebraic integers over the $\mathbb{Q}$ is a particularly prickly object to examine in this way. With the assistance of a 2009 article of Allcock and Vaaler, we discuss how finitely additive measures can be used to answer new questions about the "primes" of this ring. All necessary background on primes and measures will be provided.

Data Into Action: Adventures in Data Science Consulting
Shelby Hendrickson, Kailey Johnson, Elizabeth Porter, Hood College
8:45-9:05, EnGeo 2208
(student talk)

Organizations know their decisions should be "data driven," but turning messy data into answers is a complicated process. In this talk, we discuss our work to analyze data collected by the Hood College Career Center to improve student engagement with the center and successfully connect students and employers.

Exploring Probabilities in Bingo and its Variations

Matt Gunn, Randolph-Macon College
8:45-9:05, EnGeo 2209
(student talk)

How many numbers must be called before you can expect to get bingo? What about if you were playing multiple boards, different patterns, or different sized boards? These questions and many more will be explored through theory and simulation. We will begin with a discussion of the development of a probability distribution for the number of calls required before a standard bingo win on a single board. We will expand our investigation to games involving multiple boards and variations. The theoretical probability distributions will be compared to results obtained from a Python simulation.

Elliptic Curve Cryptography

Thomas Karnell, St. Mary's College of Maryland
8:45-9:05, EnGeo 2210
(student talk)

The mathematics of cryptography forms a powerful toolbox used to protect the secrecy of written information from unintended audiences. One fascinating development in the field has been the introduction of elliptic curves, which have led to strengthened versions of other analogous cryptographic schemes. This talk will cover the basics of cryptography, elliptic curves, and their intersection.

A Tribute to Mathematician Evelyn Boyd Granville: 1924-2023

Bonita Saunders, National Institute of Standards and Technology (NIST)
9:10-9:30, EnGeo 1202

On June 27, 2023, Dr. Evelyn Boyd Granville passed away peacefully at her home in Silver Spring, MD at the age of 99. Granville was just the second African American woman to obtain a Ph.D. in mathematics in the U.S. This talk presents some highlights of her life and provides some thoughts on why she was able to constantly re-invent herself, flourishing in academia, as well as private industry and government, where she made significant contributions to NIST and to NASA's space program.

Utilizing a Mastery-Based Grading Method in a Foundational Math Class

Amy Tucker, Stevenson University
9:10-9:30, EnGeo 1204

Alternative grading practices have proven to be effective in helping students to focus more on mastering the course material rather than grades. Foundational math students in MATH 005#, Foundations of Quantitative Reasoning, at Stevenson University need to achieve a C in the course to take any 100-level math course. To help students focus on the content needed to be successful in their upper level courses rather than grades, a mastery-based grading system was implemented starting in Spring 2023. In this talk, we will look at student data comparing mid-term and final grades before and after implementation of the alternative grading system.

Using Gateway Tests to Assess Computational Skills in Linear Algebra

Katie Quertermous, James Madison University

9:10-9:30, EnGeo 1207

Gateway tests are tests of routine computational skills, such as differentiation, designed to ensure that students develop sufficient proficiency with these specific skills. Typically a high score is required in order to pass the gateway, but multiple attempts with new versions of the test are allowed. A variety of institutions use gateway tests in calculus and precalculus courses. In Fall 2023, I implemented a row reduction gateway test in my linear algebra course. Spoiler Alert: It worked really well! In this talk, I'll talk about the motivation for the test, how it was designed and implemented, student outcomes from two semesters of use, and ideas for an additional gateway test in future semesters. There will also be time for attendees to brainstorm how they might use gateway tests in other courses beyond calculus.

Hilbertian Neutral Geometry without the SAS Axiom

Elizabeth Brown, James Madison University

9:10-9:30, EnGeo 1208

Hilbert's Foundations of Geometry is the definitive statement of Euclidean geometry in modern terms. His definition of angle there is more general than the standard measure of radians. Neither the definition nor the angle axioms intrinsically insist on standard notions like the existence of right angles, supplementarity, or linear sums of angles; these properties are consequences of the Side-Angle-Side axiom.

In this talk we offer a model of neutral geometry without SAS–following Hilbert's axioms–in which the converse holds: in that context, linearity of angle summation and the existence of right angles imply the Side-Angle-Side condition.

Understanding the Obesity Epidemic: A Mathematical Model for the Dynamics between Insulin and Glucose.

Sujan Pant, James Tipton, Suresh Subedi, Kubilay Dagtoros, Ana Vivas, Norfolk State University

9:10-9:30, EnGeo 1209

This work explains a mathematical model for the dynamics between insulin and glucose, using parameter values according to the American diet. The main interest is to create awareness of the obesity epidemic. Regular high consumption of sugar and carbohydrates in the American diet affects the body with insulin resistance; more than half of the population in the states suffers from this condition. Some epidemiologists describe insulin resistance as a hidden epidemic; if not treated on time, an individual can develop type 2 diabetes, Alzheimer's disease, heart disease, metabolic syndrome, fat liver, high blood pressure, some types of cancer, and obesity, among other diseases. The majority of these diseases affect predominantly the most vulnerable populations: minority communities, the same communities that use social services such as "food and health" assistance programs; this cycle cannot be broken without solid regulations from the top government institutions.

Further Improvements to the Upper Bound for the Site Percolation Threshold of the Square Lattice
Samuel Oberly, Johns Hopkins University
9:10-9:30, EnGeo 2208
(student talk)

The upper bound for the site percolation threshold of the square lattice is decreased, continuing a series of recent improvements after a gap dating back to 1995. The bound is obtained by using the substitution method. New computational reductions and implementation improvements make calculations for site models more efficient and thus capable of handling larger regions. The site percolation model on a self-matching lattice is compared to the square lattice site percolation model in a two-stage process.

Analyzing Momentum in Tennis
Luis Urias Miranda, Shenandoah University
9:10-9:30, EnGeo 2209
(student talk)

Novak Djokovic's defeat to Carlos Alcaraz in the finals of Wimbledon 2023 gave not just a spectacle to worldwide viewers, but additionally a wealth of data to explore how this result came to be. In exploring this, we examine factors determining "momentum". We employed Convolutional Neural Networks (CNNs) to predict the next player to win a point, game, set, or match using a dataset. With CNNs, we can quantify momentum and investigate factors leading to competitive success. We further analyzed the developed CNNs using techniques like SHapley Additive exPlanations (SHAP) to determine which variables have the greatest influence over model predictions.

Elliptic Curves over Finite Fields of Characteristic Two
Lauren Cooney, Chloe Garnish, St. Mary's College of Maryland
9:10-9:30, EnGeo 2210
(student talk)

Elliptic curves have deep relations to various fields of mathematics such as cryptography, number theory, and complex analysis. The particular case where the base field has characteristic two is unique for a variety of reasons. This talk provides an overview of some of the underlying algebraic concepts involved in studying such elliptic curves, such as field extensions, irreducibility in polynomial rings, and group operations. This allows us to explore the inner workings of elliptic curves over finite fields of characteristic two.

Invited address

Ada Lovelace: The Making of a Computer Scientist
Adrian Rice , Randolph Macon College
9:45-10:50, EnGeo 2301

Ada Lovelace is widely regarded as an early pioneer of computer science, due to an 1843 paper about Charles Babbage's Analytical Engine, which, had it been built, would have been a general-purpose computer. Her paper contains an account of the principles of the machine, along with a table often described as ‘the first computer program’. However, over the years, there has been considerable disagreement among scholars as to her mathematical proficiency, with opinions

ranging from ‘genius’ to ‘charlatan’. This talk presents an analysis of Lovelace's extant mathematical writings and will attempt to convey a more nuanced assessment of her mathematical abilities than has hitherto been the case.

Invited address

A Neural Network Approximation of the Proximal Operator of the L-infinity Norm

Kathryn Linehan , University of Virginia
2:15-3:15, EnGeo 2301

Proximal operators are common building blocks in convex optimization. In this talk, we will explore properties of the proximal operator of the L-infinity norm, leading to an algorithm for its computation. We will compare this algorithm to computation of the proximal operator using the Moreau decomposition. In the second part of the talk, we present an approximation of the proximal operator using a neural network. A novel aspect of the network is that it accepts vectors of varying lengths due to a feature selection process that uses moments of the input data. We present results on the accuracy of the approximation, feature importance, and computational efficiency of the approach.

Using Single-Elimination Tournaments as a Voting Method

Chris Hellings, University of Virginia
3:30-3:50, EnGeo 1202

Various methods of voting have been proposed as alternatives to the widely used plurality voting system. We investigate a new ranked-choice method based on using single-elimination tournaments to decide the winner of an election. In this approach, candidates face off against each other in all possible bracket-style tournaments (as in the NCAA basketball tournament). We describe the method, compare it to other existing methods, and discuss its properties.

Specifications Grading in a Liberal Arts Math Class

Melanie B Butler, Mount St. Mary's University
3:30-3:50, EnGeo 1204

In this talk, I will give details and lessons learned from implementing specifications grading in a liberal arts math class over six sections in three semesters. Practical tips and student reactions will be included.

Rethinking Precalculus

Spencer Hamblen, McDaniel College
3:30-3:50, EnGeo 1207

After successfully remodeling our developmental mathematics courses over the last 5 years, I recently attempted to apply these methods to our MAT 1107 course. This course is a single-course bridge from our developmental math course to Calculus. This talk will discuss the many, many lessons I learned attempting to implement an inquiry and project-based model in a more traditional mathematics course.

The Power Series No One Tells you About, with Special Guest Star: The Fibonacci Sequence

Mike O'Leary, Jay Zimmerman, Liz Goode, Towson University

3:30-3:50, EnGeo 1208

Students in Calculus 2 learn about some "standard" power series, however there are several other interesting series. Rational functions have particularly interesting power series and are related both to rational numbers and to the Fibonacci series. Another class of power series are related to functional equations. Areas for future undergraduate student investigation are provided.

Wallpaper Groups in Origami Structures

Sara Chari, St. Mary's College of Maryland

3:30-3:50, EnGeo 1209

Origami is the art of folding paper into various patterns without cutting or tearing the paper. By viewing the paper as a complex plane, we record all intersection points to construct mathematical origami sets. Additionally, we include the various lines to create a repeating pattern that can be viewed as a wallpaper group. There are 17 wallpaper groups up to isomorphism, so we determine which such groups can be constructed in this way, depending on the rotations and reflections present in the given pattern.

The Connections Between Consistent Maps and Measures

Lucas Aberg, Christopher Newport University

3:30-3:50, EnGeo 2209
(student talk)

As part of an effort to establish dual representation theorems for certain number theoretic vector spaces, a 2022 article of Samuels developed an object called a consistent map. Roughly speaking, a consistent map plays the role of a measure on the set of places of $\overline{\mathbb{Q}}$. While every measure on this space gives rise to a consistent map in a canonical way, we prove that not every consistent map arises in this fashion. All relevant background on primes and places will be provided.

Enhancing Grant Efficiency: Innovations in Database Management at SMCM

Shameer Rao, St. Mary's College of Maryland

3:30-3:50, EnGeo 2210
(student talk)

In the field of grant management, efficiency, accuracy, and streamlined processes are critical for the success and operational excellence of institutions. The Office of Research and Sponsored Programs (ORSP) at SMCM has implemented a custom-built Relational Database Management System (RDMS) using Microsoft Access, aimed at addressing these essential needs within the SMCM Community. The upcoming presentation will detail how the ORSP database has significantly improved grant processing by enhancing efficiency, reducing errors, and making the system more user-friendly.

The design of the ORSP database primarily focuses on speeding up the data entry process, which in turn reduces the administrative workload on individuals. This shift allows users to dedicate more attention to the core aspects of grant management. With its user-friendly interface, the database aids in the efficient handling and editing of grant information, crucially minimizing errors. This

aspect is particularly vital in a sector where the accuracy and integrity of data are paramount.

The presentation will delve into the database's key features and how they contribute to its effectiveness in managing grants at SMCM. Features such as automated data validation and customizable reporting tools will be highlighted. The tangible benefits observed since the database's implementation, including time savings, improved data accuracy, and increased user satisfaction, will be discussed.

In summary, the ORSP database exemplifies the impact specialized RDMS solutions can have on simplifying administrative processes. The presentation intends to share the journey, challenges, and successes encountered in developing the database, to inspire other institutions to adopt similar technologies to achieve operational excellence in grant management.

The Minton Invitational: Community Building and Sports Analytics

Michael Weselcouch, Roanoke College

3:55-4:15, EnGeo 1202

This semester, I organized a semester long ping pong tournament at Roanoke College for the Math, Computer Science, and Physics students. Using real game data, we ranked the players using techniques discussed in our Linear Algebra class. In this talk I will explain the rating system we used and the project that our linear algebra students complete. I'll then explain the set up of the tournament as well as the various student projects that arose it.

IBL and DEI in Intro Stats

Kelly Bubp, Frostburg State University

3:55-4:15, EnGeo 1204

I will describe how I incorporate both inquiry-based learning (IBL) and diversity, equity, and inclusion (DEI) in my general education introductory statistics course. I will discuss three course components that simultaneously support both IBL and DEI: 1. the general course structure, 2. the "Learning about Learning" assignments, and 3. an example activity on diversity in sports.

A geometric approach to deriving trig function calculus with (and better for) students

Paul Warne, Debra Warne, James Madison University

3:55-4:15, EnGeo 1207

We develop a highly visual and geometrically motivated process for establishing continuity and differentiability of trigonometric functions in a way that helps to reinforce important insights and visual connections of geometry, right-triangle and unit circle trig, slope, the Cartesian plane, and the intuitive definition of the derivative. Students, and instructors, may find this more relevant than the broadly standard development for the sine and cosine functions used in most calculus textbooks.

Irrational Bases for Natural Numbers

Stephen Lucas, James Madison University
3:55-4:15, EnGeo 1208

Perhaps surprisingly, in 1957 George Bergman showed that every natural number can be represented in base golden ratio with a finite number of digits. We extend this to show that there are in infinite number of irrationals that can represent natural numbers with a finite number of digits.

Detecting AI-generated writings

Abigail Basener, Virginia Military Institute
3:55-4:15, EnGeo 2209
(student talk)

Recently generative language models make it harder to distinguish between student work and cheating. There are detection models that can be used to decide if writing is generated or not, however, these models rarely describe their exact methodology. In this study, we describe specific techniques to build an accurate detection model using machine learning techniques such as trees and deep learning. Once we have a detector, we look at how it works to better understand what differentiates human and generated writing using model inference techniques such as predictor importance, partial dependence plots and Shapley values. We find some words that are more common in generated or human writing and that generated writing tends to have more homogeneous characteristics with less variation than human writing.

Building & Exploring A Scalable Graph Network

Kiara Alexander, Erin Bozman, Emily Waters, Paola Mareno, Vicki', 'Poku, Eldana Teklemariam, Andrew Chow, James Madison University
3:55-4:15, EnGeo 2210
(student talk)

How do companies like Facebook, LinkedIn, Google, or Amazon manage their massive amounts of data? How can they integrate data from various sources while keeping information clear and concise? How can organizations computationally leverage the relationships that exist between users and their data? Graph networks are an intuitive visual tool that help to understand complex relationships in data. They transform the data into an alternative structure simplifies the processing of large data tables and break it up into manageable chunks. The objective of our project is to build a dynamic networking platform that visualizes and analyzes the connections and relationships among students based on the classes they take together. Our data and tech team is broken-up into five groups: front-end, back-end, scaling and automation, dashboard and management, and research and development. Front-end developers design the graphical user interface which is legible, aesthetically pleasing, and inclusive for all users. Backend engineers manage the database systems that store, process, and retrieve the diverse data related to students and their courses. The scaling and automation team investigate leveraging cloud databases to expand our platform while maintaining meaningful connections among members. Dashboards summarize essential information about the members of the network, the network itself, and valuable key metrics, providing user-friendly interfaces that allow individuals to visualize and interact with the data in a beneficial manner. The research and development team uses the mathematical graph structure of our network to analyze the connectivity of our system. Our dashboard will be underpinned by both a relational and a graph database.

Preliminary Report on Counterattack Data in Women's NCAA D-1 Volleyball

Caleb Adams, Radford University
4:20-4:40, EnGeo 1202

In this talk, the speaker will present preliminary results of a statistical analysis of a team's metric reflecting the offensive counterattack following an opponent's out-of-system attack. Data originates from video of matches played by a team in the Atlantic Coast Conference (NCAA Division I Women's Volleyball). The evolution of the metric used will be discussed as well as how data is gathered and analyzed. Examined is the type of attack defended, the quality of the counterattack, and the effectiveness of the counterattack. The results presented will be used as a baseline for analyses conducted on other teams in NCAA Division I to determine if there is a correlation between effective counterattacking and match outcome.

Buffon's Needle and How the Ants Went Marching Home

Ray Cheng, Old Dominion University
4:20-4:40, EnGeo 1204

We'll review Buffon's Needle Problem, and then explore some related ideas and themes. We'll conclude by looking at a surprising connection to the behavior of ants. No ants will be harmed during this presentation.

AI-Driven Gamification of Math Concepts

Rebin Muhammad, Montgomery College
4:20-4:40, EnGeo 1207

In this talk, we will explore the application of LLM in math class, like ChatGPT, in creating interactive mathematical games (Gamification of Math Concepts.) . Our focus spans a variety of topics, including pre-calculus, calculus, and linear algebra. We initially developed these simple games for community college students but can be used for students at various educational levels.By integrating these AI tools, we aim to not only make complex mathematical concepts more accessible but also significantly boost student engagement.

Mathematical Modeling of Natural Killer Cells

Haihsin Huang, Virginia Military Institute
4:20-4:40, EnGeo 2209
(student talk)

Current research has sparked interest in understanding the contribution of natural killer (NK) cells and their role in the resolution of viral infections, including influenza infections, commonly referred to as the flu. Despite their significance, NK cells' precise mechanisms, immune functions, and their correlation with cytokines like interferon gamma (IFNg) remain unclear. We aim to model immune dynamics and discover potential mechanisms underlying IFNg production during infections. Our study integrates immunology and mathematics to investigate the roles of NK cells, T cells, and IFNg in influenza infections by utilizing data from the University of Tennessee's Department of Pediatrics. This model will allow the exploration of possible mechanisms related to IFNg production during an infection.

Predicting Planned Pooling Patterns

Josh Makela, Kae Birch, Diego Gonzalez, Claire Jones, Lauren Wiermanski, James Madison University

4:20-4:40, EnGeo 2210

(student talk)

We mathematically analyze the striking visual effect known as planned pooling that arises in knit and crochet patterns when working back and forth with variegated yarn dyed at consistent intervals. Our main result identifies three desirable planned pooling pattern families and provides formulas for choosing row lengths to obtain those patterns.