Session Abstracts
(Alphabetically by first listed author)

Evans Afenya
Elmhurst College

Growth in the Bone Marrow, the Myelodysplastic Syndromes, and Hematopoietic Dynamics

We discuss the type of kinetics that govern the growth of malignant and normal hematopoietic cells in the bone marrow from theoretical and empirical viewpoints. Following this, we look at the myelodysplastic syndromes that originate from mutations in a blood-forming cell in the marrow and for which there is no known cure as an object of mathematical modeling. Consequently, by considering hematopoietic evolution in the bone marrow, a mathematical model that attempts to capture cell dynamics in this organ is derived and proposed. Analysis of the model is performed and placed within the context of addressing current clinical controversies regarding this disease.

Fusun Akman
Illinois State University

Sex Equals Multiplication: Genetic Algebras and Coalgebras

The formal language of abstract algebra can be used to study the genetic inheritance of populations as they mate (literally, multiply) according to a wide variety of rules. Genetic variation in a population is represented by a finite basis and a population is a vector of nonnegative coefficients that add up to 1; the product of populations is another population. The underlying structures are nonassociative and sometimes noncommutative algebras. Recently coproducts have been introduced into the theory in order to study compositions of past generations. This biomathematics research area is relatively unknown in the US but has a huge growth potential: incorporating selection and finding applications to genetic algorithms or DNA sequence evolution are just a few things that may be lurking in the horizon.

Rohan Attele and Tim Bell
Chicago State University

Mathematical Biology and Computational Algebra at the Sophomore Level

Changing the undergraduate mathematics curriculum to service the needs of the life sciences is a major challenge that faces the mathematical community. Non-infinitesimal algebraic techniques and computational algebra will play a significant role in this endeavor, but precisely what that is not yet quite clear. Our experience in teaching a new research oriented course in mathematical biology at Chicago State University, which, in this semester focuses on Matrix Modeling Applied to Population Dynamics (Math 251), will provide a frame work to explore some ideas and also discuss long-term research opportunities for math majors in the life sciences.

François Blumenfeld
Northwestern University

Interdisciplinarity in Teaching of Mathematics to Humanities Majors

Recent studies have looked at innovative ways to integrate mathematics more efficiently within a general curriculum. Interdisciplinarity has been found to be an effective way to garner student interest, whatever the student's major (Dartmouth's MATC) and learner-centered theory offers effective ways to achieve pedagogical integration of different disciplines.

How do you teach mathematics to an audience of (undergraduate) humanists so that it is both relevant and interesting to them? While building on concepts from "humanistic mathematics" and proposing practical developments using learner-centered tools such as problem-based learning, this paper's central argument will rest on the assumption that mathematics is epistemologically essential for the humanities, as it provides a proof-based pendant to critical and philosophical discourses while remaining abstract.

Strategies for encouraging the student to provide his/her own context to mathematical investigations will be presented, with emphasis given to the possibility of discovering unexpected relations between humanistic disciplines and mathematics by sharing knowledge and constructing a context for the mathematical problem through teamwork (problem-based learning).

Those strategies will be evaluated in the context of mathematical classroom; that is, learner-centered theories will be shown to allow for interdisciplinary questions to emerge from mathematical reflection and encourage the latter rather than interfere with the flow of the mathematics curriculum.

Duane Broline
Eastern Illinois University

Calculus According to Euler — The Early Transcendental Version

Among the many, many works of Leonhard Euler are *Introductio in analysin infinitorum*(1748) and *Instiutiones calculi differentialis* (1755). The first of these is a "precalculus" text and has been called the foremost textbook of all times. The second was an introduction to differential calculus. The methods used by Euler to establish the infinite series expansions for the elementary transcendental functions and the basic differentiation formulae for polynomial and transcendental functions will be explained.

Dwane Campbell, Keith Campbell, and Neil Campbell

Three Quintillion Perfect Magic Cubes

A perfect magic cube is a three dimensional matrix of consecutive integers that is the three dimensional analog of a pandiagonal magic square. To be considered a perfect magic cube, the integers in all its rows, columns, and pillars must add to a magic constant. The six diagonals and all broken diagonals of every square within the cube and the four triagonals and all broken triagonals of the cube must also add to that constant. There are very few perfect magic cubes described in the literature. This paper will describe a simple procedure for generating perfect magic cubes of order 8 in quantity.

Timothy D. Comar
Benedictine University

Biocalculus at Benedictine University and College of DuPage: A Collaboration Between Mathematicians and Biologists and Between Four-Year and Two-Year Institutions

Benedictine University (BU) has been offering a rigorous two-semester biocalculus sequence for research oriented majors in the biological sciences since the fall of 2003. Through a collaborative effort between BU and the nearby community college, College of Dupage (COD), the BU sequence is now being implemented COD. A team of mathematicians and biologists from both BU and COD are developing a new textbook and computer laboratory manual for the courses, recruiting students through a joint seminar, and assessing the effectiveness of these courses. We address the implementation differences between the two schools due to different student populations and institutional considerations. We also present current assessment data of the effectiveness of the courses. Our data indicate that students from both tracks have comparable calculus skills, biocalculus students are more likely to continue with the second course, and a substantial percentage of former biocalculus students become involved with research activities.

Marina Dombrovskaya
St. Louis University

Converse of Schurs Lemma

Schur's Lemma is one of the fundamental results of the theory of simple modules. It states that if M is a simple right module over a ring R, then its endomorphism ring is a division ring. However, the converse of Schur's Lemma is, in general, not true for either commutative or noncommutative rings. $\mathbb{Q}$ considered as a $\mathbb{Z}$-module is a classical counterexample to the converse of Schur's Lemma. Nevertheless, the converse of Schur's Lemma does hold for certain kinds of rings. We will describe those rings in both the commutative and the noncommutative cases.

Nerida Ellerton & Ken Clements
Illinois State University

The Case Against Nicolas Pike: a Lost Opportunity in the History of School Mathematics in the United States

Nicolas Pike (1743–1819) is sometimes credited (probably incorrectly) with being the first person born in the United States to write and have published an arithmetic textbook for use in North American schools. Pike's book, *A New and Complete System of Arithmetic Composed for the Use of the Citizens of the United States*, first appeared in 1788. "Old Pike" — as the text would become known — would be widely used in U.S. schools for several decades, at least (Cajori, 1896). Around the time of its release, Pike's text was applauded by numerous dignitaries, including George Washington. More than 100 years after "Old Pike" first appeared, however, George H. Martin (1897), maintained that Pike had missed a major opportunity to revitalize school mathematics in the United States, and that as a consequence school mathematics in the United States had languished for more than a century. Our paper examines the case against Pike, as it was presented by Martin, and also considers a defense of Pike's text that was subsequently mounted by Florian Cajori, a mathematics professor and historian. After examining the case against Pike, and the defense of Pike by Cajori (1896), we conclude that Pike's and Martin's arguments raised the age-old question of whether those seeking to change education settings should proceed cautiously, taking into account contextual constraints; or whether they should attempt more fundamental, and more radical, change.

Andrea Frazier
North Central College

Generalized Factorization in Integral Domains

Let D be an integral domain with unit group $U(D)$ and $D^\sharp = D\backslash(U(D)\cup\{0\})$; let τ be a relation on $D^\sharp$. For $a \in D^\sharp$, we define a factorization $a = \lambda a_1 \cdots a_n$ to be a τ *-factorization of* a if $\lambda \in U(D)$, $a_i \in D^\sharp$, and $a_i \tau a_j$ for $i \neq j$. Then $a \in D^\sharp$ is a τ-atom if $a = \lambda(\lambda^{-1}a)$ is the only τ-factorization of a, and we define D to be τ*-atomic* if each element has a τ-factorization into τ-atoms. Analogously, we will define properties such as τ-prime, $|_\tau$-prime (read 'divides-τ prime'), τ-ACCP, τ-UFD, etc. We discuss these definitions and some examples, along with elementary theorems.

Herb Kasube
Bradley University

Leonhard Euler : A Tercentenary Celebration of Genius

Among mathematicians in history Leonhard Euler is one of the most influential and prolific. The year 2007 marks the 300$^{\text{th}}$ anniversary of Euler's birth in Basel, Switzerland. This talk will outline Euler's life and highlight some of the speaker's favorite Euler results such as the solution to the Basel Problem: $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$.

Hemanshu Kaul
Illinois Institute of Technology

Breaking Symmetries in Graphs

We want to label vertices of a graph G in such a way that all symmetries of G are broken. Symmetries of a graph are established by its automorphisms, which identify vertices that are structurally indistinguishable. The distinguishing number of a graph G is the least number of (appropriately assigned) vertex-labels that destroy all label-preserving automorphisms of G (except the identity automorphism, of course). Next, we ask for vertex-labelings of a graph G that in addition to breaking its symmetries also give a proper coloring of G (i.e., adjacent vertices get different labels). Distinguishing chromatic number of G is the least number of colors needed for a proper coloring of G with the property that the only color-preserving automorphism of G is the identity.

For both these concepts we are interested in situations that allow us to break symmetries without using too many extra labels (or colors). When are only two labels enough (for the distinguishing number)? The distinguishing chromatic number of G needs to be at least as large as the chromatic number of G (the least number of colors needed for a proper coloring of G). When can we get away with using just one color more than the chromatic number (for the distinguishing chromatic number)? In this talk, we will discuss how cartesian products of graphs give the answer for both these questions. All terminology will be defined and discussed during the talk which should be accessible to most undergraduates.

Robert Mann and Scott Mikos
Western Illinois University

College-Readiness, Secondary Coursework, and Standardized Tests

The ACT organization has established a link between college readiness in mathematics for secondary students and the level of mathematics' courses they complete in high school. The research presented in this talk focuses on a similar trend in Illinois regarding the link between secondary coursework in mathematics, student achievement on the Prairie State Achievement Exam, and general college-readiness in mathematics. Data from a four-year study involving 11 schools and over 3000 students in Illinois will be used to establish trends in coursework, achievement scores, and college-readiness.

Vince Matsko
Quincy University

Edge Nets of the Cube

When making a paper cube, it is convenient to design a net; that is, a connected set of squares which may be cut out and folded together to form a cube. When the squares are folded together, pairs of edges from the squares come together to form edges of the cube. If one edge from each pair is removed so that the edges form a connected graph, the remaining twelve edges are called an edge net of the cube. In other words, an edge net is a connected graph with twelve edges of the same length which may be folded to make a cube.

A complete enumeration of the edge nets of the cube will be given. The enumeration involves an interesting interplay of algebra, geometry, and graph theory.

Aileen Murphy
Saint Louis University

The Post Office Metric Topology

The usual distance formula gives us a way to measure the distance between two points in the plane. This talk describes a different way to measure distances in the plane, namely, the post-office metric. Here we will explore this metric and the topology it induces on $\mathbb{R}^2$. It will be seen that sometimes even single points can have interesting properties.

Mark Pedigo
St. Louis University

One Point Compactifications

Compactness is a very desirable property for a topological space to possess. In this expository talk, we present a standard technique for extending a noncompact space to a compact space by adding a single point. We first explore the properties of the one point compactification of $\mathbb{R}$. Then, we present a more general form of one-point compactification and give some examples. Finally, we explore some of the properties of the one point compactifications.

David Rutschman and Bill Byrd
Northeastern Illinois University

Peer Lead Team Learning in Mathematics

The Mathematics Department at Northeastern Illinois University has been using the PLTL approach for its Precalculus and Calculus Enrichment Seminars since 2004. Peer Leaders are students who have taken the course successfully and who are trained to lead an active learning workshop. This presentation will tell something of the history of PLTL and report on our experience and successes to try to convince you to try PLTL at your institution! We show improved retention, better grades, and happier students.

Pete Sandberg
Judson College

Exponential Growing Exponential Functions

When teaching about exponential growth to the students in Judson's general education math course our text approaches the growth equation from two ways: a given percentage growth and a doubling time. Further, in Calculus, exponential growth usually gets modeled using the natural exponential function. So which way is the right way? This talk will explore the usages, derivations, and connections between the various ways of modeling exponential growth and decay.

Krystal Taylor
St. Louis University

The Particular Point Topology

Let X be a non-empty set, and let $p \in X$. Set $\mathcal{T} = \{A \subset X : A = \emptyset, \text{or}\, p \in A\}$. Then $(X; \mathcal{T})$ is the topological space, known as the particular point topology. In this talk, we will explore the properties of the particular point topology that are appropriate to an introductory level topology class. We begin by verifying that the particular point topology is in fact a topology. We will consider what constitutes an open set versus a closed set and we will address the topics of limit points and closures of sets. We will also determine the conditions under which a function in this topological space to itself is continuous. Additionally, we will determine whether or not this topology is Hausdorff , connected, and/or compact. Examples will be used to illustrate the ideas being presented.

Peter Turbek
Purdue University, Calumet

Creating Interactive Mathematics Web Pages

The speaker is the creator of CaluMath, a free software package that facilitates the construction of interactive web pages involving mathematics. A user-friendly web interface easily enables mathematics instructors to create their own interactive web pages and modify pages created by others. CaluMath pages employ standard Html and JavaScript, ensuring that they will not become obsolete as technology changes; however no knowledge of Html or JavaScript is required to construct CaluMath pages. Unlike many mathematics web pages, which merely check whether a user's answer is correct or not, CaluMath pages can be very intricate, prompting users with changing scenarios depending on their responses. CaluMath can be used in any grade level, from K-12 through university. Purdue Calumet is piloting CaluMath web pages in its College Algebra class, MA 153.

The talk will focus on two topics:

- An introduction to CaluMath and the creation of web pages using it.
- A demonstration of CaluMath pages targeted at various grade levels, with particular attention paid to the College Algebra pages piloted at Purdue Calumet.

The CaluMath College Algebra pages can be found here:
`http://ems.calumet.purdue.edu/mcss/psturbek/CaluMath/cas_college_algebra/MA153homepage.html`
The home page for the CaluMath project can be found at:
`http://ems.calumet.purdue.edu/mcss/psturbek/CaluMath/CaluMath_HomePage.html`

April M. Waugh
St. Louis University

The Either/Or Topology

The closed interval $X = [-1, 1]$ is a familiar mathematical object in its usual topology. The either/or topology is an unusual topology for this interval defined by $T = \{A \subset X | 0 \notin A \,\text{or}\, (-1, 1) \subset A\}$. We will explore the different features of the either/or topology including open and closed sets, connectedness, and compactness. Throughout the talk we will also see similarities and differences between the either/or and the usual topology.

Adam Weyhaupt
Southern Illinois University, Edwardsville

An Illustrated Stroll through the Forest of Minimal Surfaces

A minimal surface is a two dimensional surface which is a local minimum for area — a small deformation of a minimal surface must increase its area. Minimal surfaces have captured the attention of mathematicians since the days of Lagrange (1760) and Schwarz (1865). Triply periodic minimal surfaces, a type of minimal surface that can be built by translating a fundamental piece in three independent directions, have particularly enjoyed a resurgence of popularity, not only from mathematicians but also from chemists, biologists, and materials scientists. We will take a gentle stroll through the beautiful landscape that is the theory of minimal surfaces. Along the way, we'll pause to enjoy the view with lots of computer-generated images of these surfaces. Relatively little is known about triply periodic minimal surfaces, and we will discuss several open questions related to the field. Using an example, we'll also explore a technique for discovering more surfaces that uses a surprising combination of complex analysis, differential geometry, and (of all things) flat Euclidean polygons.
