The Mathematical Association of America
New Jersey Section Meeting

held in conjunction with the 12th annual

Garden State Undergraduate Mathematics Conference

Monmouth University
Long Branch, NJ

Saturday, April 11, 2015

Abstracts and Biographies of Speakers

The Four Problems of Antiquity

David Richeson, Dickinson College

We discuss the history of four of the most famous problems in mathematics, the so-called problems of antiquity: squaring the circle, trisecting the angle, doubling the cube, and constructing regular n-gons. We know the outcome: that they are all impossible to solve using compass and straightedge. But there is a long and fascinating history of mathematicians' attempts to solve the problems using the Euclidean tools and their success at solving them by other means (using marked straightedges, conic sections, transcendental curves, and mechanical devices). Like all great mathematical problems, they pushed mathematics forward.

Dave Richeson is a professor of mathematics at Dickinson College. He studies topology, dynamical systems, and the history of mathematics. His book *Eulera's Gem: The Polyhedron Formula and the Birth of Topology* won the MAA's 2010 Euler Book Prize. He is currently editor of the MAA's undergraduate magazine, *Math Horizons*.

Heronian Tetrahedra are Lattice Tetrahedra

Susan H. Marshall, Monmouth University

In 2001, at the turn of this century, Paul Yiu published a new result about a seemingly classical object. Yiu showed that Heronian triangles (those with integer side lengths and area) can always be positioned in the plane so that all three vertices have integer coordinates. A natural question arises: does this result extend to three dimensions? Can Heronian tetrahedra (those with integer side lengths, face areas, and volume) always be positioned in space so that all four vertices have integer coordinates? We'll show that the answer is yes! The solution provides a nice arithmetic and geometric application of quaternions, and moreover, gives a splendid example of when the mathematics just works out beautifully, with a near-perfect analogy between the two- and three-dimensional cases.

Susan H. Marshall studied mathematics as an undergraduate at Wake Forest University and as a graduate student at the University of Arizona, earning her PhD in 2001. Her general interests are number theory and algebraic geometry, and she in particular likes problems in which both arithmetic and geometry play a role. She also enjoys writing about mathematics and in 2014, won both an Allendoerfer award and a Halmos-Ford award for articles published in *Mathematics Magazine* and the *American Mathematical Monthly*. She is currently an Associate Professor of Mathematics at Monmouth University.

Harmonious Equations: A Mathematical Exploration of Music

David Kung, St. Mary's College of Maryland

Mathematics and music seem to come from different spheres (arts and sciences), yet they share an amazing array of commonalities. We will explore these connections by examining the musical experience from a mathematical perspective. The mathematical study of a single vibrating string unlocks a world of musical overtones and harmonics-and even explains why a clarinet plays so much lower than its similar-sized cousin the flute. Calculus, and the related field of differential equations, shows us how our ears hear differences between two instruments-what musicians call timbre-even when they play the same note at the same loudness. Finally, abstract algebra gives modern language to the structures beneath the surface of Bach's magnificent canons and fugues. Throughout the talk, mathematical concepts will come to life with musical examples played by the speaker, an amateur violinist.

David Kung fell in love with both mathematics and music at a very early age. After flirting with (and then rejecting) a music major, he completed three degrees from the University of Wisconsin–Madison, all in mathematics, before joining the faculty at St. Mary's College of Maryland. His 12-lecture DVD course "How Music and Mathematics Relate" quickly became a best-seller for the Teaching Company. His second lecture course, on Mathematical Paradoxes, will be released later this year. Teaming with other mathematicians, he has worked to improve mathematics literacy and responsible citizenship by developing curriculum materials for a Math

For Social Justice course. He has authored many articles on topics in harmonic analysis and mathematics education, is the recipient of numerous awards including the 2006 Teaching Award from his section of the MAA, gave the 2010 Undergraduate Lecture in Mathematics at the Joint Math Meetings, and is the Director of the MAA's Project NExT.

Panel Discussion

Fostering an Undergraduate Research Program: Finding Problems and Students to Solve Them

These panelists have each led notable undergraduate research projects. During this panel discussion, they will share their experiences in successfully mentoring undergraduate research, specifically addressing the challenges of finding appropriate topics and students. Panelists are:

- Dr. Richard Bastian, Monmouth University
- Dr. Eugene Fiorini, DIMACS, Rutgers University
- Dr. Aihua Li, Montclair State University
- Dr. Hieu Nguyen, Rowan University
- Dr. Chengwen Wang, Essex County College

Abstracts of MAA-NJ Contributed Paper Sessions

Session 1: Statistics Practice and Pedagogy

Edison 115. Organizer and Presider: Dex Whittinghill, Rowan University, whittinghill@rowan.edu

1:30-1:45: **On Resistant Versions of the Standard Score**

David DiMarco (presenter, dimarcod@neumann.edu), Neumann University; B. Hollingsworth, Middle Georgia State College; R. Savitz, Neumann University

Abstract: Introducing an outlier that is very large to a data sample results in the z-scores of the other data values tending to be negative and decreasing in magnitude. This manuscript introduces variations of the z-score, which are resistant to outliers. These variations replace both the mean and standard

deviation in the usual z-score formula with corresponding resistant measures. Some of the introduced measures will be flexible, thus a user can select the measure whose properties are best suited for the application at hand.

1:50-2:05: **Percentiles, Contrast Stretching, and Image Equalization in a Statistics Course**

Eugene Galperin, East Stroudsburg University of PA, egalperin@esu.edu

Abstract: As an off-the-beaten path example that illustrates an application of percentiles to a real-life problem, we consider contrast stretching – one of the most straightforward methods of enhancing low-contrast images. In the same vein, we study image equalization as an application of transformations of random variables in order to help those students who find the topic difficult and not very intuitive. We also consider image denoising methods as a visually appealing application of MMSE estimation.

Session 2: Pathways to Mathematical Reasoning

Edison 115. Organizer and Presider: Reva Narasimhan, Kean University, rnarasim@kean.edu

2:10-2:25: **The logarithmic Spiral in Mathematics, Nature, Architecture, Design, and Music**

Jay M. Kappraff, New Jersey Institute of Technology, jay.m.kappraff@njit.edu

Abstract: I will show that mathematical reasoning often has its beginning in geometry and then progresses through the properties of numbers and series. I will demonstrate this progression through the study of logarithmic spirals generated from what I call "surgery on a right triangle" and sharing the self-similarity of the right triangle. A step-by-step development using mathematical reasoning as a compass quickly leads one from simplicity to complexity with rich application to the fields of mathematics, nature, architecture, design, and music.

2:30-2:45 Utilizing Problems of the Day in a First Course Designed for Pre-Service Elementary Teachers

Jay L. Schiffman, Rowan University, schiffman@rowan.edu

Abstract: My presentation focuses on the utilization of rich problems in a course designed for pre-service elementary teachers. Each of the problems initiating the

classes required the use of one or more of the Standards for Mathematical Practice and was new to the students, but applied previously acquired classroom knowledge. This presentation will illustrate the nature of the problems and the pathways the students in small groups explored and persevered to successfully solve them with guidance from the instructor.

Announcements

MAA-NJ Section 2015 Distinguished Service Award

The recipient of the 2015 MAA-NJ Section Sr. Stephanie Sloyan Award for Distinguished Service is **Carol Avelsgaard**, Professor Emeritus at Middlesex County College.

Carol Avelsgaard has led and served the New Jersey section of the MAA for more than a decade. Carol served as chair for the hosting committee for two MAA-NJ meetings at Middlesex County College, and has served on three of the section's four committees: the Nominating Committee, the Contributed Paper committee, and the Teaching Award Committee.

Carol chaired the MAA-NJ section from 2011-2013 and served on the section's Executive Board for twelve years. She served as Chair-Elect (2010), Past-Chair (2014), and as the Vice-Chair for Two-Year Colleges for seven years from 2003-2010.

The section is very appreciative and grateful to Carol Avelsgaard for her many contributions to MAA-NJ.

Call for Nominations for the MAA-NJ Award for Distinguished College or University Teaching

The MAA-NJ Section Distinguished Teaching Award Selection Committee is seeking nominations for the 2016 award. Please consider nominating an inspiring, respected, or influential deserving colleague for this prestigious award. Information about the nomination process and eligibility requirements are posted online http://www.maa.org/newjersey. For additional information you may

contact Zhixiong Chen (Secretary, MAA-NJ) at zchen@njcu.edu. Award nominations are due by November 20, 2015.

Call for Lunch Discussion Leaders for Fall 2015 Meeting and for Contributed Paper Session Organizers for Spring 2016 Meeting

MAA members interested in leading a lunch table discussion at the Fall 2015 meeting or organizing a contributed paper session for the Spring 2016 meeting are asked to submit the proposed topics to Theresa C. Michnowicz, New Jersey City University, tmichnowicz@njcu.edu, by September 2, 2015.

Lunch Discussion Tables - Spring 2015 Meeting

Organized by Theresa C. Michnowicz, New Jersey City University. There will be six discussion tables at lunch:

- *Diversity in Mathematics*, led by David Kung, St. Mary's College of Maryland
- *Inquiry-based Learning*, led by David Richeson, Dickinson College
- *Teaching a History of Mathematics Course*, led by Susan Marshall, Monmouth University
- *Mathematical Reasoning*, led by Revathi Narasimhan, Kean University, and Theresa C. Michnowicz, New Jersey City University
- *Department Chair Issues*, led by Dex Whittinghill, Rowan University
- *NJ-NExT Table* (for NJ-NExT fellows only), led by Grace Cook, Bloomfield College

Those who pre-registered have priority at these discussion tables.

Call for Contributed Papers for the Fall 2015 MAA-NJ Meeting

There will be one general contributed paper session at the Fall 2015 meeting. All papers will be reviewed by the selection committee. Please submit title, 3-4 line summary, and a one-paragraph abstract in MSWord to Chengwen Wang, Essex County College, wang@essex.edu, by September 2, 2015.

… continued on page 10.

Mathematical Association of America
New Jersey Section, Spring 2015 Meeting Program

8:30 – 9:15	**Registration and Coffee;** Wilson Hall Foyer (Registration closes at noon)
8:30 – 1:30	**Book Exhibits;** Wilson Hall Foyer
9:15 – 9:30	**Welcome by Laura J. Moriarty**, Provost; Wilson Auditorium
9:30 – 10:20	**The Four Problems of Antiquity;** David Richeson, Dickinson College. Presider: Jonathan Weisbrod, Burlington County College; Wilson Auditorium
10:25 – 10:40	**Business Meeting**; Wilson Auditorium
10:40 – 11:05	**Break**; Wilson Hall Foyer **NJ-NExT Session:** Inquiry-based learning; Edison 114
11:05 – 11:55	**Heronian Tetrahedra are Lattice Tetrahedra,** Susan H. Marshall, Monmouth University. Presider: Bonnie Gold, Monmouth University; Wilson Auditorium
12:00 – 1:30	**Lunch**; Club 107-109 in Magill Commons
1:00 – 2:00	**Student Poster Session**; Edison Hallway and Edison 117
1:30 – 2:45	**Panel:** Fostering an Undergraduate Research Program: Finding Problems and Students to Solve Them; Edison 116 (1:45 – 2:45) **Contributed Paper Sessions**; Edison 115 **NJ-NExT Session**: Classroom group teaching**;** Edison 114
2:30 – 3:15	**Student Talks**; Edison 115, 120, 121, 122, and 123
2:45 – 3:30	**Break;** Wilson Hall Foyer 3:30 is the deadline for door prize/silent auction entries
3:30 – 4:25	**Harmonious Equations: A Mathematical Exploration of Music;** David Kung, St. Mary's College of Maryland. Presider: Kaaren Finberg, Ocean County College; Wilson Auditorium
4:30 – 5:00	**Prizes and Awards**; GSUMC awards, door prizes, and silent auction winners (must be present to win); Wilson Auditorium
5:30	**Dinner Honoring Speakers**

Garden State Undergraduate Math Conference
Spring 2014 Program

8:30 – 9:15	**Team Registration, Student Check-in, and Breakfast;** Bey Hall: Lobby outside Young Auditorium
9:30 – 10:30	**New Jersey Undergraduate Math Competition**; Individual competition. Young Auditorium
10:30 – 12:00	**New Jersey Undergraduate Math Competition**; Team competition. Bey Hall classrooms
12:00 – 1:00	**Complimentary Student Lunch**; Bey Hall: Lobby outside Young Auditorium
1:00 – 2:00	**Student Poster Session**; Edison Hall Lobby and Edison 117
2:15 – 3:15	**Student talks**; Edison 120, 121, 122, and 123
3:15 – 3:30	**Break**; Wilson Hall Foyer
3:30 – 4:25	**Harmonious Equations: A Mathematical Exploration of Music;** David Kung, St. Mary's College of Maryland. Presider: Kaaren Finberg, Ocean County College; Wilson Auditorium
4:30 – 5:00	**Prizes and Awards**; GSUMC awards, door prizes, and silent auction winners (must be present to win); Wilson Auditorium

Dinner Honoring the Invited Speakers and Award Recipients

The Section will honor the invited speakers and award recipients at dinner following the meeting. Everyone is cordially invited.

… continued from page 7.

Governor's Report

Report of the Board of Governors meeting at JMM 2015
Bonnie Gold, MAA-NJ governor

1. Probably the biggest item approved at the January 2015 Board of Governors meeting was a change in the Departmental Membership category. Once upon a time, with a departmental membership, the department received free (or maybe reduced rate) copies of all the MAA journals and five student memberships. Then, about 15 years, ago, they changed it so you had to pay for student memberships. As a result, many institutions started simply using the departmental memberships to get journals for their library at much below the library rate. This was NOT the purpose of departmental memberships. So the proposal, brought to the Board, and approved after <u>much</u> discussion, is the following:

Features of the new Departmental Membership

- Departmental Membership includes an unlimited number of Student Memberships.
- The Departmental Membership includes one full MAA Membership.
- Instructors in the Department receive discounted WeBWorK hosting (initially $200 /year rather than $300).

Rate Structure for the Departmental Membership: Total student enrollment and PhD-granting status determines the institution's dues category.

Total Enrollment	**Dept. Dues (non-PhD)**	**Dept. Dues (PhD)**
<7,000	$500	$750
7,000 – 19,999	$700	$1000
20,000+	$900	$1500

The main concerns were the increase from the current roughly $340 to $500 for small institutions (i.e., schools with under 1000 total enrollment) might be problematic; and that for large, and especially PhD granting, institutions the cost was very high, even though they might well have a huge number of student members. On the other hand, from the MAA's perspective, the primary purpose of

this is to get students to become MAA members, and hopefully many of them will then continue as members after they graduate.

2. The budget for 2014 is now expected to show a much greater deficit than originally budgeted: from $295K to $545K. Originally it was expected that we'd run a surplus in 2015; now it's predicted to still be a deficit, though smaller: $98K. And Daniels (the MAA treasurer) is expecting, finally, a surplus in 2016, with a plan to use that surplus to build up the MAA's free reserves to 40% to 70% of operating budget within 10 years. That will insulate us from swings in the market, etc. Several reasons were given for the current large deficit: significantly fewer books were developed (and thus sold) in 2014 than usual, decreasing our income and that's expected to be up in 2015; membership continues to decline, though slowly; and integrating the AMC competitions into the main customer service operation and moving its headquarters from Nebraska (with Steve Dunbar heading it) to DC (with a new director, Mark Saul) has cost more than expected; and changes in publications expected to eventually bring in more money has cost more than expected. These last two should go away this year; hence the optimistic projection for a small deficit in 2015.

3. The MAA Centennial and the Second Century Campaign. As everyone is presumably aware, this is the centennial year for the MAA. In addition to an extended MathFest (4 days rather than 3), including a joint meeting with the Canadian Society for the History and Philosophy of Mathematics and the British Society for the History of Mathematics, sections are strongly encouraged to have some commemoration of the centennial at their spring meetings. Registration for MathFest will start a month earlier than usual, on March 1. Giving to the MAA's Second Century Campaign will help the MAA move successfully into the future.

4. The new CUPM curriculum guide will be out this spring. Only the overview will be published: the rest will be on the web, at www.maa.org/cupm. There will be space for people to add (responsible) comments. But publishing it on the web will allow more frequent updating than once every 10 – 12 years.

Respectfully submitted,
Bonnie Gold, Governor for the New Jersey section

Book Sales at the Meeting

The discounted meeting price (35% off) for MAA books also applies to books *not* currently on display. When you order books at the meeting, there are no shipping costs. We will also again offer "buy one, get one free": if you order a book at this meeting, you can also take one book from the "free" group of books.

Future MAA Meetings

MAA-NJ. The Fall 2015 MAA-NJ Section meeting will be held at Kean University, Saturday, November 14, 2015. It will be a joint meeting with NJAMTE, the New Jersey Association of Mathematics Teacher Educators. The Spring 2016 MAA-NJ meeting will be held at William Paterson University, Saturday, April 16, 2016.

MathFest. The Mathematical Association of America will hold its annual MathFest in Washington, DC from August 5 – 8, 2015. For further information, go to http://www.maa.org/mathfest/.

Joint Mathematics Meeting. The 2016 JMM will be in Seattle, WA, January 6 – 9.

NJAMTE Annual Meeting May 29 at TCNJ

The New Jersey Association of Mathematics Teacher Educators will hold its ninth annual conference at The College of New Jersey on Friday, May 29. The theme is "Assessment: It's not just tests! (Using formative assessment to improve instruction)." All mathematicians involved in the mathematical education of teachers at any level are invited (and encouraged to join NJAMTE).

25/50-year Members of the MAA: The section congratulates Michael Fischer for his 25 years of MAA membership. We congratulate Dr. Mary R. Hesselgrave, Prof. Charles R. Meehan Jr. (Brookdale Community College), and Roy C. Willits for their 50 years of membership.

Congratulations and Appreciation

MAA-NJ congratulates Hieu Nguyen from Rowan University on his election as the next Governor for the MAA-NJ section. His three-year term begins at MathFest this summer. The section also expresses its appreciation to our current Governor, Bonnie Gold from Monmouth University, for her three years of service.

The Section thanks retiring chairs Mark Korlie of Montclair State University, Bruce Bukiet of New Jersey Institute of Technology, and Yi Ding of New Jersey City University for their service as chairs of the Nominating Committee, Teaching Award Committee, and Selection Committee for Contributed Papers respectively.

MAA-NJ Committees

Awards Committee: Thomas Hagedorn (chair), The College of New Jersey; Bonnie Gold, Monmouth University; John Saccoman, Seton Hall University; Elizabeth Uptegrove, Felician College; Dexter Whittinghill, Rowan University.

Nominating Committee: Thomas Hagedorn, TCNJ; David Marshall, Monmouth University; Sarita Nemani, Georgian Court College.

Teaching Award Committee: Bruce Bukiet (chair), New Jersey Institute of Technology; Thomas Hagedorn, The College of New Jersey; Brian Hopkins, Saint Peter's University; Sarita Nemani, Georgian Court University; Tom Osler, Rowan University; Robert Wilson, Rutgers University.

Selection Committee for Contributed Papers: Srabasti Dutta, Ashford University; Theresa Michnowicz (ex-officio), New Jersey City University; Kathy Turrisi, Centenary College; Chengwen Wang (chair), Essex County College.

Organizing Committee: Zhixiong Chen, New Jersey City University; Karen Clark, The College of New Jersey; Grace Cook, Bloomfield College; Lawrence D'Antonio, Ramapo College; Kaaren Finberg, Ocean County College; Jana Gevertz, The College of New Jersey; Bonnie Gold, Monmouth University; Thomas Hagedorn, The College of New Jersey; Zachary Kudlak, Monmouth University; Theresa C. Michnowicz,

New Jersey City University; Aihua Li, Montclair State University; David Marshall, Monmouth University; Sarita Nemani, Georgian Court University; Linda Ritchie, Centenary College; Tatyana Stepanova, Raritan Valley Community College; A. David Trubatch, Montclair State University; Dirck Uptegrove, Alcatel-Lucent; Elizabeth Uptegrove, Felician College; Paul von Dohlen, William Paterson University; Jonathan Weisbrod, Burlington County College.

Hosting Committee: Richard Bastian, B. Lynn Bodner, Joseph Coyle, Bonnie Gold, Zachary Kudlak, Betty Liu, David Marshall (chair), Susan Marshall, Emanuel Palsu-Andriescu, Johnny Pang, Sandra Zak, Monmouth University.

GSUMC Committees

Organizing Committee: Amanda Beecher, Ramapo College; Lee Collins, County College of Morris; Joyati Debnath, Winona State University; Srbasti Dutta, Ashford University; Katarzyna Kowal, Ramapo College of New Jersey; Mince John, New Jersey City University; Ken McMurdy, Ramapo College of New Jersey; Tatyana Stepanova, Raritan Valley Community College; A. David Trubatch, Montclair State University (director); Jonathan Weisbrod, Burlington County College.

New Jersey Undergraduate Math Competition Committee: Katarzyna Kowal (co-director), Ramapo College of New Jersey; Tom Leong, The University of Scranton; David Molnar, Rutgers University; Ken Monks, The University of Scranton; Ken McMurdy (co-director), Ramapo College of New Jersey; Marek Slaby, Fairleigh Dickinson University.

Acknowledgments

The New Jersey Section thanks the Mathematics Department of Monmouth University for their kind hospitality in hosting the meeting. They also thank Hawkes Learning Systems, Springer, Random House, and Princeton University Press for donations for the silent auction and prizes.

The New Jersey Section offers congratulations to the GSUMC for twelve years of successful undergraduate math conferences.

The 2015 GSUMC is supported by the National Science Foundation through the MAA Regional Undergraduate Mathematics Conferences program (NSF DMS-0846477) as well as Monmouth University and the NJ section of the MAA.

The GSUMC thanks the Mathematics Department of Monmouth University for their kind hospitality in hosting the meeting.

Social Media Information

Thanks to Grace Cook, Bloomfield College, for taking on the job of social media director. Check us out!

Email: maanj.socialmedia@gmail.com
Facebook: https://www.facebook.com/maanewjersey
Instagram: https://instagram.com/maanewjersey
Twitter: https://twitter.com/maanewjersey

Join the MAA! http://www.maa.org/membership/join_main.html

MAA-NJ Section Officers

Governor	Bonnie Gold, Monmouth University
Chair	Thomas Hagedorn, The College of New Jersey
Chair-Elect	Karen Clark, The College of New Jersey
Vice-Chair for Speakers	Aihua Li, Montclair State University
Vice-Chair for Innovations	David Marshall, Monmouth University
Vice-Chair for Two-Year Colleges	Tatyana Stepanova, Raritan Valley Community College
Vice-Chair for Student Activities	A. David Trubatch, Montclair State University
Secretary	Zhixiong Chen, New Jersey City University
Treasurer	Paul von Dohlen, William Paterson University
Advance Meeting Planner	Bonnie Gold, Monmouth University
Book Sale Coordinators	Dirck Uptegrove, Alcatel-Lucent; Elizabeth Uptegrove, Felician College
Contributed Paper Organizer	Theresa C. Michnowicz, New Jersey City University
Door Prize Coordinators	Sarita Nemani, Georgian Court University; Linda Ritchie, Centenary College
GSUMC Director	A. David Trubatch, Montclair State University
Historian	Lawrence D'Antonio, Ramapo College
Liaison Coordinator	Jonathan Weisbrod, Burlington County College
Program Editor	Elizabeth Uptegrove, Felician College
Project NJ-NExT Co-Directors	Kaaren Finberg, Ocean County College; Jana Gevertz, The College of New Jersey
Social Media Director	Grace Cook, Bloomfield College
Webmasters	Paul von Dohlen, William Paterson University; Sarita Nemani, Georgian Court University
Workshop Organizer	Zachary Kudlak, Monmouth University