

# Math



# Times

*Department of Mathematics*

*Spring 2005*

## Letter from the Department Chair

Randy McCarthy became our Director of Undergraduate Studies in August, replacing Graham Evans, who retired after serving admirably in that role for five years. In the Fall, the Executive Committee asked the Undergraduate Affairs Committee to examine our multivariable and vector calculus courses. Together, the committee and McCarthy have proposed a major revision of the calculus sequence. The design takes into account the needs of students in the College of Engineering, and offers them a new course which surveys the first two semesters of calculus, relating the mathematical results in a meaningful way to engineering methodologies and applications.

On April 14 we held a symposium to honor the work of Kuo-Tsai (Chester) Chen, who was a professor in our department until his death in 1987, and whose important work on iterated integrals has become increasingly appreciated by the mathematical community. Richard Hain of Duke University, a former doctoral student of Chen, delivered an address on his earlier work concerning the deRham theorem for the fundamental group, and Alexander Goncharov, of Brown University, explained how iterated integrals and standard conjectures in algebraic geometry about motives would lead to irrationality and independence results for values of the zeta function.

With the end of the hiring season approaching, we have recruited the following four new assistant professors.

Jozsef Balogh is a combinatorist interested in stability questions in extremal graph theory, cardinality of hereditary combinatorial structures, bootstrap percolation on different boards, and applications of graph theory to theoretical computer science.

Eduard Kirr's work treats existence and stability of coherent structures in equations from mathematical physics, their coupling with radiation under perturbations, and the theory and numerical simulation of waves in inhomogeneous and random media.

Christopher Leininger studies low dimensional topology and geometry. Specifically, his current research focuses on mapping class groups, Teichmüller theory, knot theory and three-manifolds, and hyperbolic geometry.

Christian Rosendal is a logician who works in the descriptive set theory of ergodic theory, dynamical systems and model theory, and has long term interests in the isomorphic theory of Banach spaces.

We have also recruited the following two new postdoctoral associates for two or three year terms.

Zoi Rapti is interested in dynamical systems and their applications to partial differential equations, and she has studied crossovers in several physically-motivated nonlinear Schroedinger-type equations.

Krzysztof Krupinski is interested in model theory and its connections with topology and algebra. He is experienced in model theory of fields, stability, and simplicity theory and profinite structures.

I value your support and welcome your feedback. We all thank you for helping to sustain the excellence of the department and for helping to preserve its unique position in American and international mathematics.

Daniel R. Grayson  
Chair, Department of Mathematics

*The Math Times* is published twice a year by the Department of Mathematics at the University of Illinois at Urbana-Champaign. The *Math Times* is available via the web in pdf format at [www.math.uiuc.edu/mathtimes/](http://www.math.uiuc.edu/mathtimes/). If you would like to receive e-mail notification when a new issue is released, please send an e-mail to [mathtimes@math.uiuc.edu](mailto:mathtimes@math.uiuc.edu). Hardcopies of the newsletter will be mailed upon request.

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## Summer 2005 Research Experiences

The Department of Mathematics will host two 8-week summer Research Experiences for Undergraduates (REU) programs, for 6 students each over the next 5 years. Funding for these REUs comes from a grant recently obtained through the National Science Foundation Workforce in the Mathematical Sciences Program. Topics will include Evolutionary Game Theory (R. Muncaster), Geometric Group Theory (K. Whittlesey), Number Theory (S. Ahlgren, A.J. Hildebrand), Harmonic Analysis (J. Rosenblatt), and Visualization in Virtual Environments (G. Francis).

This summer's REUs will run from June 13 through August 6, 2005 on the topics of Geometric Group Theory and Phase Retrieval Problems. For descriptions of these REU programs, consult <http://www.math.uiuc.edu/REU/>.

Participating students join the working environments of faculty mentors, their postdocs, graduate students and collaborators. Students work on individual or small group projects in their mentor's current research area. We provide tutorials in the required math, in LaTeX and other subject-specific computer packages. Students learn to search the literature, give good lectures, and to communicate their solutions in public seminars and clear pre-prints. We coach their expository skills, referee their paper drafts, help the students submit their work to journals when appropriate, and encourage them to give talks at mathematical meetings that include undergraduate research.

## Donaldson-Thomas Workshop held

The UIUC Mathematics and Physics Departments jointly hosted a workshop on Donaldson-Thomas invariants, March 17–20, 2005. Over 60 people participated in this workshop, which was supported by the UIUC and the National Science Foundation via Sheldon Katz's NSF Focused Research Group grant. Katz was complemented on the organizing committee by Rahul Pandharipande (Princeton University) and Richard Thomas (Imperial College, London).

Donaldson-Thomas invariants are numerical invariants of three dimensional algebraic varieties which are analogous to Donaldson invariants from the theory of four manifolds. These invariants are the latest in a series of new geometric invariants inspired by string theory. Most of the recent progress in this area has been in mathematics rather than physics, a state which was reflected in the talks.

One of the major open problems is the conjecture that Donaldson-Thomas invariants are equivalent to Gromov-Witten invariants. The proof of a supporting subconjecture was announced at the workshop. Many UIUC graduate students attended the workshop, providing an opportunity for them to be immersed in high-level mathematics for a few days.

## Online giving now available

Today, more than ever, the Department of Mathematics relies on the financial support of its alumni and friends. And now we've made giving even easier with online giving! Visit the department's homepage at [www.math.uiuc.edu](http://www.math.uiuc.edu) and click the 'Give Online' icon. A complete list of available funds with descriptions can be found there. There are many different ways that you can support the department in its educational and research missions through student fellowships and scholarships, prizes and awards for undergraduate and graduate students, support for the library, or funds for maintaining Altgeld Hall. Giving in support of these and other important missions truly makes a difference by promoting excellence in the UIUC Department of Mathematics.

## Retirements

A retirement reception honoring Larry Dornhoff, Phillip Griffith, and Heinrich Lots was held May 1, 2005, at the Levis Faculty Center, Urbana.

**Larry Dornhoff** was born in 1942 and grew up on a Nebraska farm. He completed his Ph.D. thesis at the University of Chicago in 1966 and was Instructor at Yale 1966–1968. At Illinois he was Assistant Professor 1968–1974 and then Associate Professor. In 1986 he received two campus grants almost simultaneously, and became manager of a Novanet (PLATO) classroom in 110 Altgeld and a PC classroom in 108 Altgeld. Both rooms will remain computer classrooms, providing Linux and Windows service. He plans to travel some and pursue interests in history, folk music and the Internet.



Larry Dornhoff

**Phillip Griffith**, Professor and Director of Graduate Studies, will retire in July 2005. He joined the department in 1970 and has served as the Director of Graduate Studies since 2000. Professor Griffith received his Ph.D. from the University of Houston in 1968. He was a postdoctoral fellow at University of Chicago 1968–1970. He was awarded a Sloan Foundation Fellowship for the years 1971–1973, and he was a visitor at University of Aarhus, Denmark, 1972–1973. He was an Associate in the Center for Advanced Study from 1981–1982, and he was co-organizer, along with Robert Fossum, for the NSF sponsored “Special Year in Commutative Algebra” for AY 1983–1984. In Spring 1985 Professor Griffith visited the University of South Carolina under the auspices of their EPSCORE NSF program, and in 1987 he was a visiting member of the MICRO program in Commutative Algebra at MSRI in Berkeley, California. He has served on numerous department committees during his tenure with the department and is currently serving a 3-year term as a member of the American Mathematics Society Nominating Committee. Ten students have completed their Ph.D. under his direction.



Phillip Griffith

Professor Griffith’s main research interests were focused on extensions of abelian groups early in his career, and for most of the last thirty years his research interests have been centered around the study of homological methods in commutative algebra. He and Professor E. Graham Evans carried out a successful program in the theory of syzygies in the decade of the 1980s. He has been an author (or co-author) on 58 mathematics articles/monographs. Professor Griffith’s term as Director of Graduate Studies was greatly enhanced by virtue of the Department’s commitment to excellence under the NSF-sponsored VIGRE program.

The Commutative Algebra Conference, honoring the contributions of Phillip Griffith, will be held at the Department of Mathematics on the University of Illinois at Urbana-Champaign campus September 16–18, 2005. The purpose of this conference, which is open to those working in Commutative Algebra, is to bring together young and established researchers in the field to explore and exchange ideas. The program is centered around the contributions and influence of Phillip Griffith.

**Heinrich Lotz** has been a faculty member in the Department of Mathematics since 1969, and was promoted to Associate Professor with tenure in 1975, and to Professor in 1984. He received his Ph.D. from the University of Tuebingen, with a dissertation containing deep results on the spectral theory of positive linear operators. His later work in functional analysis involved Banach spaces, Banach lattices, spectral theory, and ergodic theory. His doctoral students have included Donald Cartwright, Si-Kit Chung, Chongsung Lee, Denny Leung, and Byung Moon.



Heinrich Lotz

## Model collection archived

Because of the project this spring to restore the third floor atrium of Altgeld Hall to its original wood floor, John Sullivan and George Francis (Department of Mathematics), and Kalev Leetaru (Research Programmer, National Center for Supercomputing Applications) moved all the models out of their cases and into Room 317 Altgeld Hall. Faculty members in geometry served as curators of the models providing an opportunity for visitors to learn more about the models.

The models were also photographed and archived in digital form by Kalev Leetaru, as part of his ongoing Campus History <http://uihistories.ncsa.uiuc.edu/> and Campus Photographic Preservation <http://uiphotos.ncsa.uiuc.edu/> projects. Each of the 175 models were photographed in a variety of poses to capture their full appearance. These images are currently available online at [http://uiphotos.ncsa.uiuc.edu/cgi-bin/page?page=mathcollection\\_subjectlisting.html](http://uiphotos.ncsa.uiuc.edu/cgi-bin/page?page=mathcollection_subjectlisting.html). Work is ongoing to make the images available as part of a special website detailing the contents of the model collection and allowing visitors to explore the models and the math behind them.

The Math Library has made scanned copies of the original model catalogs available, which will be integrated into the site to allow visitors to see the original descriptions of each model, look at their equations and supporting information, and even perform searches of the entire collection.

Besides making the models more available to the public, another key purpose of the upcoming website is to make a photographic time capsule of the model collection to preserve it for the future. The collection,



Models on display in 317 Altgeld Hall. Photo by Kalev Leetaru.

consisting mostly of string and plaster models, dates from the early 1900's, and many of the models are in rapidly deteriorating shape. Some of the string models have decayed to the point where it is almost impossible to determine what they originally looked like. By photographically capturing the models while they are still largely intact, there will be a record for future restoration efforts.

## Achievements

### Results of 2004 Putnam Contest

A total of 3733 students from 515 colleges and universities in the United States and Canada participated in the sixty-fifth annual William Lowell Putnam Competition, held December 4, 2004. The team contest was won by MIT, followed by Princeton, Duke, Waterloo, and Caltech. The UIUC Putnam team consisting of Wing Ko, Maria Boca, and David Klempner, placed 34th.

The Putnam Contest, which Time Magazine called "the world's toughest math test", consists of 12 challenging math problems, to be solved over a period of 6 hours. Each problem is worth 10 points, for a maximal total score of 120. The difficulty of this competition is attested by the fact that, out of the 3733 contestants, none achieved a score of 110 or higher; only ten scored 80 or more; and only one third of all contestants had a score of 10 points or more, the equivalent of a single problem solved correctly.

Locally, the contest was well attended, with 17 students from the University of Illinois participating. The highest scorers among local participants were Wing Ko (38 points/rank 228), Zane Shi (32/267), Vishal Doshi (22/467), David Klempner (22/467), Maria Boca (21/508), Muneaki Nakamura (20/596). David Kaplan (19/686).

### 2005 UIUC Undergraduate Math Contest

The UIUC Undergraduate Math Contest is a math problems contest for undergraduates, held every year in the spring semester and modeled after the William L. Putnam Competition.

This year's contest took place April 16, 2005, and featured one of the most competitive fields in recent history, with several past winners, all members of last year's UIUC Putnam team, and other top performers on the Putnam entered. The result was a four-way tie for First Place between David Grayson, a freshman in Engineering and Physics, David Klempner, a senior in Electrical Engineering, Jay Rauchenstein, a junior in Computer Science, and Zane Shi, a sophomore in Physics.

For more information, including contest problems and solutions, and a listing of winners of past UIUC Undergraduate Math Contests, visit the UIUC Math Contests webpage, <http://www.math.uiuc.edu/contests.html>.

**Dianna Armstrong**, Academic Advisor and Teaching Associate in the Department of Mathematics since 1981, is the **2004–2005 recipient of the LAS Academic Professional Award**. Over the last twenty years, incoming freshmen have been sorted, advised and registered primarily by Dianna so effectively that those of us who don't recall the period before her taking on these duties are hardly even aware of the work and difficulties required to do it. She is our department's good will ambassador to incoming freshmen and their parents every summer. She administers the enrollments of these courses and teaches the TA's so that they are ready on the first day of classes to provide the kind of excellence in the classroom she demands of herself. She created a special feature to our program to keep a pre-calculus class available late into the semester for students who need to drop their first semester calculus course. Another activity that Dianna does is to monitor our honors courses. These are not simply James Scholar courses. These are math courses reserved for strong students which cover the material at a deeper level than the non-honors sections. In order to be invited, a freshman has to meet particular criteria which Dianna monitors and then sends out invitations to the students to enroll in these honors courses. Last summer she mailed over 500 invitations. Dianna works closely with other colleges on campus. She has agreements with deans in CBA, Engineering, FAA, ACES and others to aid their particular programs.



Dianna Armstrong

**Professor John P. D'Angelo** received the 2004–2005 **LAS Dean's Award for Excellence in Undergraduate Teaching** and also received Honorable Mention for the Campus Award for Excellence in Undergraduate Teaching. Prof. D'Angelo's excitement in the classroom is infectious. His commitment to teaching has combined with his enthusiasm to earn him a place on the Incomplete List of Teachers Rated Excellent at least 14 times. Always pushing to erase the line between teaching and research, he has supervised several Research Experiences for Undergraduates, worked with talented high school students, and helped create the department's program known as Research Experiences for Graduate Students (REGS). Prof. D'Angelo is the co-author of an undergraduate text book, the author of two more advanced books, and the author of over 40 research articles. He was awarded the prestigious Bergman Prize in 1999 for his research in the field of several complex variables. He was named a University Scholar, UIUC, in 1986, and has been appointed as an Associate in the Center for Advanced Study for 2005–2006. Prof. D'Angelo joined the Department of Mathematics faculty at Illinois in 1978.



John D'Angelo

**Micah James** is the recipient of the **2004–2005 LAS Award for Excellence in Undergraduate Teaching for Graduate Teaching Assistants**. Micah is a fifth year graduate student studying algebraic number theory with Professor Leon McCulloh. Micah has consistently maintained a reputation as an effective and caring instructor of high quality. Micah's teaching experience is remarkable for its breadth, both in the variety of courses taught and in the styles of instruction employed. Micah has appeared on the Incomplete List of Instructors Ranked as Excellent by their Students during six of the eight semesters in which ICES forms were administered in his classes. Micah received TA Instructional Award in 2003, awarded by the Department of Mathematics for excellence in teaching by graduate students in the department. Micah has made a sustained effort to incorporate new technological advances into his courses as appropriate, and on several occasions has been entrusted by the department with the responsibility to administer trials of proposed course management software in his sections. Most recently, he has served the department on several committees related to its educational mission.



Micah James

## Achievements

Each spring, the department presents awards for outstanding achievement to graduate and undergraduate students.

### Graduate Student Awards

#### Stephanie Treneer

Awarded the **Bateman Fellowship in Number Theory** for 2005–2006. She is the fourth recipient of this award which is given to a graduate student actively working on his/her thesis in number theory at UIUC. Treneer is in her fifth year of graduate study and is writing her thesis under the direction of Scott Ahlgren. She has recently proved a very nice result regarding the arithmetic properties of the coefficients of certain non-holomorphic modular forms. Her method is quite general, and applies to many classes of forms which have been studied extensively in the past by ad-hoc means. Stephanie is an active member of the number theory group at UIUC, and she has given a number of conference and seminar talks on her work.



Stephanie Treneer

#### Jinjia Li

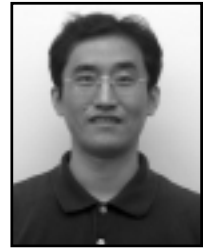
Received the **Irving Reiner Memorial Award** which is awarded to a graduate student in recognition of outstanding scholastic achievement in the field of algebra. Jinjia is a sixth year graduate student working with Professor Sankar Dutta. Jinjia's work is centered on Serre's Conjecture on Intersection Multiplicity and related problems. In his work on asymptotic behavior of length of homology of complexes of finitely generated free modules over a local ring, Jinjia showed that the lengths behave in the expected manner when tensored with finitely generated modules of codimension less than or equal to 2; however there are counterexamples in codimension greater than 2. This was a rather surprising result. In his next piece of work, he used one such counterexample to provide a counterexample to a sufficient condition for non-negativity of intersection multiplicity over local complete intersections when both intersecting modules have finite projective dimension. In another piece of work, Jinjia came up with a new characterization of modules of finite projective dimension over local complete intersection rings.



Jinjia Li

#### Jae-Seong Cho

Recipient of the **Kuo-Tsai Chen Prize** which is given in recognition of outstanding scholastic achievement by a graduate student whose research interests lie in the area of the relationship between geometry and analysis or the relationship between algebra and analysis. Jae-Seong was born in Korea in 1970, and attended Seoul National University, from which he received a degree in Math in 1996 and then a Master's degree in 1998. He started the Ph.D. program there, with Chung Kyu Han as his advisor. They published one joint paper. Han visited UIUC in 2000, and Cho came along. Cho loved the program here at UIUC and decided to begin his graduate studies anew here in 2001. His advisor at UIUC is John D'Angelo. Cho's thesis involves an algebraic version of an algorithm invented by J. J. Kohn for finding subelliptic multipliers. Cho's research interests are in commutative algebra, several complex variables, and singularities of complex varieties. He will receive his Ph.D. in Spring 2006.



Jae-Seong Cho

#### Jennifer Vandenbussche and Yelda Aydin

Awarded the **Brahana TA Instructional Award**.

Jennifer Vandenbussche's academic advisor is Douglas B. West. After having spent two years teaching in a public school in New York state and one year studying at the University of Georgia, this is her second year at Illinois. Having just completed her comps, Jennifer hopes to be able to begin focusing on research in her area of combinatorics.



Jennifer Vandenbussche

Yelda Aydin is currently actively engaged in research in partial differential equations and evolutionary game theory. Her advisor is Prof. Robert Muncaster, and she hopes to finish her Ph.D. within the next year.

The Brahana TA Instructional Award was established in 2005 with funding from the H. Roy Brahana Fund. It is presented to graduate teaching assistants for exemplary teaching. A committee of faculty, graduate and undergraduate students determines the winners. Awards are based on classroom



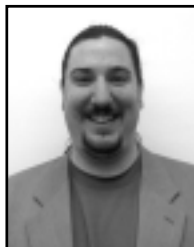
Yelda Aydin

observation, comments from students, and a written report by the nominees describing their teaching goals. Two graduate students can be awarded the Brahana TA Instructional Award each year.

**Thomas Carty and Nicholas Dzhelepov**

Awarded the **Department TA Instructional Award.**

Tom Carty is completing his fifth year and is studying under Prof. Robert Muncaster in discrete time dynamical systems and evolutionary game theory. Next year, he will be employed by the UIUC Department of Mathematics as a full-time instructor and working to complete his doctoral research.



Thomas Carty

Nicholas Dzhelepov works in noncommutative algebra. In particular, he studies group algebras and quadratic forms over the field with two elements and their applications to coding theory. This year Nick also serves as a SORF Board member. His advisor is Gerald Janusz.



Nicholas Dzhelepov

The TA Instructional Award was established in 1979. It is presented to graduate teaching assistants for exemplary teaching. A committee of faculty, graduate and undergraduate students determines the winners. Awards are based on classroom observation, comments from students, and a written report by the nominees describing their teaching goals. As of 2005, up to two graduate students can be awarded the Department TA Instructional Award each year.

## Undergraduate Student Awards

**Hueyfang Chen**

Received the **Major Award in Actuarial Science.** In addition to graduating with highest distinction, Hueyfang also passed the first four national actuarial examinations prior to her senior year – a very rare, and perhaps even unique, accomplishment. After graduation, she will be taking an actuarial position with the international consulting firm Towers Perrin.



Hueyfang Chen

**Seth Case**

Received the **Major Award in Mathematics.** He has completed a mathematics program (Graduate Prep option) with highest distinction earning A's in essentially every course including some of our core graduate courses. Seth is described as “quick to grasp new material” and “very good at problem solving.” He was a participant in Kim Whittlesey’s summer REU on geometric group theory in 2004.



Seth Case

**Abbey Rechner**

Received the **Major Award in Teaching of Mathematics.** Abbey will not only be graduating with highest distinction in the teaching option, she will have also done this while satisfying the Graduate Prep option as well and taking all of the math courses required in our Actuarial Sciences program.



Abbey Rechner

—undergraduate awards continue on page 8.

Mathematics as an expression of the human mind reflects the active will, the contemplative reason, and the desire for aesthetic perfection. Its basic elements are logic and intuition, analysis and construction, generality and individuality.

— Courant

## Achievements

### Undergraduate Awards

#### Wing Ho Ko

Received the **H. Roy Brahana Prize in Mathematics** which is awarded to a graduating senior in any discipline with a distinguished undergraduate career in mathematics. Wing is a graduating Physics major who joined our honors sequence in the middle and quickly was recognized as the best student in the program at that time. He went on to take several more of our most demanding math courses never earning a grade less than an A. Wing has been praised for having both a strong mathematical intuition and a clear, disciplined mind. For the last two years Wing was the top-scoring student on the Illinois team that participated in the William Lowell Putnam Competition.



Wing Ho Ko

#### Holly Krieger

Received the **Emily Mann Peck Scholarship in Mathematics** which is awarded to outstanding undergraduate students majoring in mathematics based not only on high academic achievement but also for demonstrating characteristics that exemplified Dr. Peck's life and career: high personal standards of ethics and scholarship, passion for teaching, well-rounded eclectic interest in life and a passion for the arts.



Holly Krieger

Besides having done very well in our honors sequence, Holly has also been one of our undergraduate TA's this year. She is working toward graduate school in

mathematics but this has not prevented her from developing a well rounded background including biology, Italian, psychology and CS.

#### Maria Boca and Ian Shipman

Maria Boca and Ian Shipman received the **Elizabeth R. Bennett Scholarship in Mathematics** which is awarded to one or two juniors or sophomores in mathematics based upon a student's GPA and strength of courses.



Maria Boca

Maria recently earned A+ in both math 418 and 448 this past fall. She has taken courses from the honors sequence, she was a member of the UIUC Putnam team this year, and will be doing an REU this summer with Joseph Rosenblatt.

Ian switched to math from engineering last year and has done exceedingly well while taking a demanding sequence of courses. He is praised not only for his performance in the classroom, but also for his "exceptionally inquisitive mind" which is often witnessed by the advanced topics he teaches himself.



Ian Shipman

### Mileti awarded Sacks Prize

Joseph Mileti has been awarded the 2004 Sacks Prize. Mileti who currently holds a postdoctoral appointment at the University of Chicago, received his Ph.D. in 2004 from the University of Illinois at Urbana-Champaign, under the supervision of Carl Jockusch. His thesis, *Partition theorems and computability theory*, was cited by the Prizes and Awards Committee as containing a "penetrating computability theoretical analyses of Ramsey-type theorems, an important feature of which is an ingenious completely new proof of the Canonical Ramsey Theorem whose ideas allowed a deep effective analysis of this theorem."

The Sacks Prize is awarded for the most outstanding doctoral dissertation in mathematical logic; it was established to honor Professor Gerald Sacks of MIT and Harvard for his unique contribution to mathematical logic, particularly as adviser to a large number of excellent Ph.D. students. The Prize became an Association for Symbolic Logic Prize in 1999. The Sacks Prize consists of a cash award plus five years free membership in the ASL.

### After Math: News from alumni

**Matt Miller** (Ph.D. 1979) served as Associate Director of MSRI in Fall 2004. He began his term as Associate Secretary of the AMS for the SE region this past February. In January 2005 he became Graduate Director at the University of South Carolina. He received his Ph.D. in 1979 under the direction of Professor Phillip Griffith.

Send items for the After Math news section to [mathtimes@math.uiuc.edu](mailto:mathtimes@math.uiuc.edu) or by mail to 263 Altgeld Hall, 1409 W. Green St., Urbana, IL 61801.



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## Faculty News

**Scott Ahlgren** has been named a 2004–2005 Helen Corley Petit Scholar in the College of Liberal Arts and Sciences, which is given for extraordinary accomplishment during the tenure probation period.

**Robert Ghrist** has received a 2004 Presidential Early Career Award for Scientists & Engineers (PECASE).

**John D'Angelo** has been appointed an Associate in the Center for Advanced Study for fall 2005 where he will do research and expository writing on CR Geometry. From July 25–August 5, 2005, he will be leading a Research Experience for Graduate Students at MSRI in Berkeley, CA.

**Robert Bauer** received an Arnold O. Beckman award for his proposal to the Research Board “Random Growth Processes in the Plane, Self-Avoiding Curves, and Quantum Gravity.” It provided him with a 50% research assistant during the past year. He studied conformally invariant measures describing phase boundaries of, for example, macroscopic clusters in percolation or the Ising model, with a particular emphasis on associated moduli diffusions.

In December 2004–January 2005, **Aimo Hinkkanen** visited Massey University, Auckland, New Zealand, and attended the New Zealand Mathematics Research Institute Conference in Napier, on the theme Geometry: Interactions with Algebra and Analysis. This spring, Professor Hinkkanen was elected a Foreign Member of The Finnish Academy of Science and Letters.

**Derek Robinson** gave a talk at the Zassenhaus Group Theory Conference held at Auburn University in Montgomery, Alabama, March 18–20, 2005. Professor Robinson was honored at the conference for his research achievements in group theory.

**Julian Palmore** will participate in a Wilton Park conference in May on "strengthening transatlantic cooperation on missile defences", a conference cosponsored by the U.S. Department of State. This is his seventh trip to England for meetings at Wilton Park, sponsored by the British Foreign and Commonwealth Office. As North American editor of Defense and Security Analysis Palmore edited a special issue on terrorism that appeared this past December. At the invitation of the

campus honors program Palmore will teach a CHP interdisciplinary seminar (CHP395) in fall 2005. The course is about "Creativity and discovery in mathematics and the sciences". In August 2005, he will speak at the 13th conference on finite and infinite dimensional complex analysis to be held at Shantou University, China.

This past fall, emeritus professors **Paul T. Bateman** and **Harold G. Diamond** published a book, *Analytic Number Theory: An Introductory Course*, based on notes they distributed to generations of graduate students in the department. The book applies methods of analysis such as transforms and tauberian theorems to problems of number theory. Some of the areas studied are counting functions of prime numbers, multiplicative arithmetic functions, and sieves. An example of a topic treated in the book is the result of Dirichlet on quadratic excess. Like many problems in number theory, it is quite easy to state, but was not so easy to solve. For  $p$  a fixed prime number, a positive integer  $n$  is called a *quadratic residue modulo  $p$*  if  $p \nmid n$  and  $n$  is congruent to some square modulo  $p$ . For example, the quadratic residues modulo  $3 \equiv 5^2, 4, 5 \equiv 4^2, \text{ and } 9$ . Dirichlet's theorem asserts that for  $p$  a prime congruent of 3 modulo 4, there are more quadratic residues in the interval  $(0, p/2)$  than in the interval  $(p/2, p)$ . For  $p = 11$ , all but one of the quadratic residues lie in  $(0, p/2)$ .

**Jerry Uhl** gave a 2-day series of talks at the University of the Virgin Islands on the Mathematica-based courses taught at Illinois and in the NetMath Internet distance education program. Last fall, NPR sent a reporter to Urbana to interview Jerry Uhl on the subject of AP calculus. The interview was spirited but the high powers at NPR decided to shelve it because they didn't want to put NPR in the position of questioning the worth of AP calculus. Jerry Uhl gave a plenary address at the annual meeting of the Michigan section of the MAA. His topic was a new course he is writing whose goal is to salvage the interests of precalculus students who have left mathematics because they don't connect with standard precalculus courses.

# Teaching Math At A Distance

## A Brief History of Distance Education in the Mathematics Department

By Tony Peressini

The Mathematics Department at the University of Illinois has always been steadfastly committed to on-campus, face-to-face delivery of its courses using the lecture-discussion style of instruction, right? Well, maybe we have had a renegade now and then who tries something different but it never lasts, right? Wrong!

Our department has actually been actively and continuously involved in off-campus delivery of mathematics courses for nearly seventy-five years. During that period, the methods of delivery and the style of instruction in the distance delivery of mathematics courses have evolved through an interesting sequence of “periods”, each with its own challenges and innovations. These periods can be arranged in chronological order roughly as follows:

**1. The Mail-olithic Period (1934–Present);** The University of Illinois Correspondence Course Program began in 1934 and our department was there! (I refer to this period as the “mail-olithic” period because the exchange of homework assignments and exams by US Mail between the instructor and the student or exam proctor has always been the cornerstone of correspondence course study.

The first three courses that our department offered by correspondence in 1934 were Algebra, Trigonometry and Analytic Geometry. The instructor listed for all three courses was J. W. “Pete” Peters. Tuition for the algebra and analytic geometry courses was \$25 each and only \$10 for the trigonometry course. By 1943, the list of mathematics correspondence course offerings had expanded to include semester courses in Differential Calculus and Integral Calculus. The instructors listed for these courses were O.K. Bower, Beulah Armstrong, and Henry Miles, father of current faculty member Joe Miles. By 1953, correspondence course offerings in ordinary and partial differential equations were added and carried the course numbers of Math 341 and Math 342 that were used for their campus counterparts until last year when we upgraded the course numbers.

After 1953, the correspondence course program in mathematics was primarily the responsibility of one faculty member in the department, first Leonard Steimley, then Clarence Phillips, then for over 20 years (1979–2003) by Hiram Paley, and currently Margit Messmer. One interesting group served by our correspondence course program in mathematics were the inmates of the Illinois State Prison System! Some of them enrolled in a progression of courses from remedial to advanced mathematics. Perhaps the top of the line in our correspondence course offerings was a combinatorics course taught by Paul Bateman for an inmate who was a former U of I student.

**2. The Fly-olithic Period (Circa 1955–1980)** Math faculty including Ray Langebartel, Don Sherbert, Peter Braunfeld and I were flown in small University-owned airplanes to various locations around the state once each week to conduct a three-hour class (usually 6:30–9:30 p.m.) and then fly back home by midnight.

Some of the planes used for this purpose were old planes donated to the University by alumni and Illinois industries. The most exciting of these was an old Twin Beech (pictured below). That plane was the subject of a number of hair-raising experiences for the “flying professors” and their skillful University pilots. Don Sherbert of our department has a very nice article *Winging It* in the March–April 2005 issue of the *Illinois Alumni* magazine that recounts some of his scary weather and equipment-related experiences in that aircraft. His article is currently available in the mailroom. There is also a very funny story about the pilot’s “relief tube” in that aircraft. Ask me about it sometime because the high editorial standards of *Math Times* do not allow me to provide the details here.

Although “getting there and back” was sometimes more exciting than we would have liked, we found our off-campus teaching very rewarding. Nearly all of our students were graduate engineers or high school and community college mathematics teachers who were very appreciative of the opportunity to take credit courses in mathematics near their home and work.



Professors and pilot at the Rockford Airport in 1967. Preparing for a return flight to Champaign are, from left, Donald Sherbert (mathematics), Ray Langebartel (mathematics), the late William Stanley (education), pilot Bert Henne, the late Tom Murrell (computer engineering), and Extension field representative Leon Mayer.

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**3. The Phone-olithic Period (Circa 1975–1988)** This period was based on a remarkable device called the Electronic Blackboard which was developed as a joint venture between the U of I College of Engineering and Bell Laboratories. It was the first distance education device that allowed interactive voice and graphic communication among multiple remote locations both on-campus and off-campus.

The Electronic Blackboard system used two telephone lines and a central telephone hub to distribute the voice and graphics between a special blackboard and a TV monitor at each location. You could lecture at the blackboard using standard chalk and a special eraser. Your students at the remote locations could hear your voice as they watched a TV monitor that displayed the information that you wrote on the board. The students were located in rooms with the same equipment so they were able to ask questions by switching on a microphone. They could even do a calculation on the electronic blackboard in their viewing room and you would see it on your monitor. The Internet in all of its current glory has not achieved that level of voice and graphic interactivity for teaching mathematics or other technical subjects!

**4. The Tape-olithic Period (Circa 1985–1999)** During this period, courses were videotaped in special classrooms on campus, usually with a campus section of the course. The tapes were sent to various distance education centers where students would meet in the evenings to review and discuss the tapes. Those off-campus students who were able to go to a distance education center in their area at the scheduled time for the campus section participated in the class by using the Electronic Blackboard System. (A number of large companies had their own Electronic Blackboard Systems.) During the first part of this period, the Electronic Blackboard system was used to provide evening review and problem sessions at the off-campus centers.

It was interesting to teach courses on-campus that were also attended by off-campus students via the Electronic Blackboard because my off-campus students were typically mature graduate engineers while the on-campus students were young undergraduates. Questions from the off-campus students were typically more insightful than those of the typical undergraduate. A camaraderie usually developed between the on-campus and off-campus students because the Electronic Blackboard was usually activated 10 minutes before the beginning of class. When I arrived at the classroom, I would often find several undergraduates talking with the off-campus students. The undergraduates liked the fact that the off-campus students asked a lot of good questions.

**5. The C&M-olithic Period (Circa 1985–1993)** This pioneering computer-based distance education system was developed by Jerry Uhl and his Whiz Techs in the UIUC Mathematics Department. The content, illustrative examples and homework were (and still are) delivered as Mathematica notebooks to the participating schools. The distance education version of Calculus & *Mathematica* began with a pre-Internet delivery system based on a local area network linking the C&M lab to high schools via an 800-number telephone hub. At first, homework was exchanged between the students and the schools by mail and later by e-mail and finally via the Internet.

Instructional support for the high school students taking C&M at a distance was provided by their on-campus instructors and undergraduate mentors who were “graduates” of the C&M program. At first, a teacher at the participating high school served only as a local coordinator to administer exams and quizzes but did not participate in the actual instruction. Later, these local coordinators participated in regional or campus workshops to qualify as instructors. However, C&M instructors retained control over the grading of homework and exams.

Because the C&M Distance Education Program predated the Internet and then grew up with it, the C&M Whiz Techs developed most of the features of modern course management systems such as WebCT before these commercial systems became available.

**6. The Modern Period (Circa 1993 to the present)** During this period, fully on-line or combined on-line/campus mathematics courses were developed for delivery with full instructional support via the Internet to individual students at their homes, their dorms or at work. Included among these are the NetMath Program operated by Jerry Uhl and Debra Woods, the Math Teacher Link Program operated by Tom Anderson, Debra Woods and me, and the math courses offered through the Office of Continuing Engineering Education (OCEE).

Currently, graduate engineers may complete approved masters degree programs in any of the departments in our College of Engineering. I teach an on-line version of Math 488: *Advanced Mathematics For Engineers* regularly in the OCEE Program. The students are typically highly motivated individuals with company and family responsibilities that preclude coming to campus for a year or more to complete a masters program. In a similar way, the NetMath and Math Teacher Link distance education programs serve the needs of many very capable and highly motivated students and teachers who would not otherwise have these educational and professional development opportunities. Several young pre-engineering students used NetMath to complete all their math requirements for their engineering degrees while they were still in high school.

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## Editorial: Distance education only choice for some students

by Michael Raschke

I had some thoughts about the conference I went to at Montana State University College of Technology in Great Falls, MT on August 26–27 of this year (2004). When the attendees talked about administrative and teacher support for internet learning, something started to form in my mind. As I told the audience, my choice became one of go to school and get sick or do school from home and get sick doing fun things if and when I chose.

The traditional classroom setting is a very good method. I enjoyed it. I would do it over distance if I could, because I love the interaction. Had it not been for Illinois and other universities taking the plunge to offer distance courses, I would not be where I am today. Simply put, I am physically incapable of sustaining campus attendance without adverse health effects. My health deteriorates to the point that attendance is halted completely.

It's definitely not about replacing one form of instruction for another. It's about enabling people who otherwise would not have a snowball's chance in a metal works factory of getting an education to have the opportunity to achieve. They say two heads are better than one. The traditional classroom inevitably excludes some of us who have much to contribute. With distance technologies, we are able to have a purpose, a voice, and a contribution without which our lives have difficulty in a variety of areas—one of which is a purpose.

For all the administrators out there who are worried about replacing the typical classroom, please consider giving those of us with disabilities, chronic ailments, and other challenges that make traditional classroom attendance impossible a chance to be productive, learn, and grow as individuals. And if you're still dead set against distance education, let me give you a question to ponder: Is denying educational opportunity to people because of their inability to attend class fair?

For years, I heard "you can improve your life with education." If we deny education to those who cannot attend class simply because they cannot come to a class room, then we are denying them the ability to improve. Think about it for a minute. If you couldn't improve your situation without an education and you couldn't get one because you couldn't attend class, then what would you experience? What would you feel?

I sincerely doubt that the traditional classroom will be replaced or made obsolete in my lifetime. There are so many people who want that experience that it will be

there. If people flat out refused to go to campus, then it wouldn't be a question anymore. The point is that there will always be those that thrive on campus and those that thrive off-campus. The educational community should try to find a positive balance between these two broad types of learners. Distance education is here and it isn't going away.

As with all things, there are good and bad distance courses, philosophies, and schools. Just because it's distance doesn't make it good or bad. One challenge lies in creating distance courses that maintain the standards of success that have been used in successful classroom courses.

As businesses begin to embrace telecommuting, are purely campus students ready for remote employment? Are purely distance students ready for face-to-face meetings and non-remote work environments? At some point, a combination of both may be the best approach to prepare students for the variety of employment and employer opportunities that are available or will be available soon. However, we must always take into consideration the fact that some people cannot attend campus classes.

Thank you for giving me and the numerous other students out there access to college math courses. And to the countless others who strive for distance courses: thank you.

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*Michael Raschke has worked for the University of Illinois NetMath Program since 1999. He is a general studies major at Indiana University in Bloomington. Indiana University offers a distance program where students can complete an entire four year degree program from home. The majority of Raschke's courses come from mathematics and accounting with a healthy rounding off of core classes. His goal is to finish a college degree by the time he turns 30.*

*Raschke is 25 years old and has lived in Montana for about 16 years. His health deteriorated rapidly and he had a sinus surgery towards the end of 7th grade. He finished 7th grade through 12<sup>th</sup> grade entirely by distance—a rare accomplishment. He is used to chronic sinusitis, health down times, and other things that upset an otherwise normal college pace. Taking past histories and achievements into account, Raschke says his 30th birthday may well be a celebration of life and a college degree.*

*He enjoys puzzles, board games, hiking, swimming, movies, music, and playing piano.*