Department NEWS

Faculty NEWS

Markus Banagl was awarded a three-year National Science Foundation grant to study topological invariants of singular spaces. He participated in a workshop on "Exotic Homology Manifolds" in Oberwolfach, Germany last summer.

Wlodek Bryc was awarded a U.S.-Polish Collaborative Research Grant from the National Science Foundation. He will be working with Marek Bozejko of Wroclaw University.

Jim Deddens' paper "Indoor particles and symptoms among office workers" (*Epidemiology* 2002) was honored as runner up for best paper of the year. He is spending September and October this year at the Institute of Risk Assessment at the University of Utrecht (Netherlands).

Chuck Groetsch was keynote speaker at the Pacific NW Section Meeting of the Mathematical Association of America. He was recently promoted from Associate Editor to Co-Editor of the *Journal of Integral Equations and Applications*.

Dave Herron organized the joint Finnish-American workshop "Future Trends in Geometric Function Theory," held in Jyväskylä, Finland last June. This workshop was funded in part by the National Science Foundation.

Tim Hodges is co-organizer of the 3rd International Symposium on Quantum Theory and Symmetries held at the University of Cincinnati in September, 2003.

Tony Leung spoke at the International Conference on Nonlinear Partial Differential Equations in Hong Kong last September. He chaired a session on Partial Differential Equations and Applications at the 4th International Conference on Dynamic Systems and Applications in Atlanta last May.

New faculty member **Xiaodong Lin** is spending 2003-2004 as a post-doctoral visitor at the Statistical and Applied Mathematical Sciences Institute in North Carolina, where he is participating in their year-long program in Data Mining and Machine Learning.

Chris McCord is serving as acting associate dean for graduate affairs for the College of Arts and Sciences during 2003-2004.

Joanna Mitro won the College of Arts and Sciences' 2003 McMicken Dean's Award for Distinguished Service.

Joy Moore was a member of the Ohio Board of Education's Task Force for Underrepresented Populations in 2002-2003.

Diego Murio co-chaired the 2003 Inverse Problems in Engineering Symposium (IPES 2003) in Alabama last June. He presented a 90-minute tutorial there on "Mollification and Regularization." He is chairman and organizer for IPES 2004, which will be held in Cincinnati next June. He was a member of the Scientific Committee for the Fourth International Conference on Inverse Problems: Identification, Design, and Control which was held in Moscow last July. He also presented a paper there and chaired a session.

Magda Pelikan spent a semester at the University of Paris VI, in the division of probability and random models, during her sabbatical last year. She was named Charles Phelps Taft Professor of Mathematics (see article in this issue).

Steve Pelikan spent his sabbatical working last year at the Division of Genomics at Proctor and Gamble.

Dan Ralescu was elected a fellow of the International Fuzzy Systems Association.

Nages Shanmugalingam organized a special session at the "Future Trends in Geometric Function Theory" workshop (see Dave Herron's entry above). This workshop followed the 19th Rolf Nevanlinna Colloquium, where she was an invited speaker. She also participated in a five-day workshop on Geometric Function Theory held at the Banff International Research Station this July.

Tara Smith participated in the International Conference on Quadratic Forms in Chile last December. She is a member of the American Mathematical Society's Centennial Fellowship Committee.

Srdjan Stojanovic's book and CD-ROM Computational Financial Mathematics using Mathematica : optimal trading in stocks and options was published Birkhäuser, Boston last Fall. Srdjan gave an invited talk on Optimal Portfolio Theories at the AMS-IS-IMS-SIAM Joint Summer Research Conference on Mathematics of Finance, in Snowbird, Utah this past summer.

Don Wright continues his research on moths. In June 2002 he participated in the Lepidoptera BioBlitz at Great Smoky Mountain Park, an event aimed at collecting and identifying as many species as possible in a 24-hour period.

Bingyu Zhang, together with his wife Ning Zhong (mathematics professor at UC's Clermont College branch), **Ken Meyer**, and Dieter Schmidt (formerly of this department, now in the College of Engineering) organized the International Conference on Computability and Complexity in Analysis held at UC this August. The conference was partially sponsored by the National Science Foundation, the Institute for Mathematics and Its Applications, and the Charles Phelps Taft Fund.

Shuang Zhang organized a special session on C*-Algebras at the annual meeting of the American Mathematical Society last January.

Student NEWS

Undergraduate

The department graduated 10 seniors this year, including six women. **Jay Heidinger** and **Julie Eyman** graduated with honors.

Afshan Adhami won the Richard E. Greenholz award from the College of Arts and Sciences.

Sabrina Blakeman participated in the Summer Research Experiences for Women Undergraduates Program, sponsored by the University of Cincinnati's Chapter of Women in Science and Engineering. She worked on a research project with faculty members Don French and Steve Pelikan.

Senior **Carl McTague** was an invited keynote speaker at the 5th International Mathematica Symposium. See the feature article in this issue.

Undergraduate award winners for 2002-2003 include: **Carl McTague** (Jeanne Gulden Scholarship), **Julie Eyman** and **Danielle Ross** (Harris Hancock Undergraduate Scholarship), **Jay Heidinger** (Feld Scholarship, Buck Scholarship), **Gregory Hull** (A&S Mathematics Scholarship), **Afshan Adhami**, **Sabrina Blakeman**, **Louis Blessing**, **Christine Carter**, **Jay Heidinger**, **Gregory Hull**, **Carl McTague**, **Michael Platt**, and **Hannah Seoh** (Harry S. Kieval Scholarship), **Christine Carter** and **Michael Platt** (Linder Book Award).

Incoming freshman **Emily Fox** is the first winner of the newly established Herbold Scholarship. This monetary award to the outstanding entering math major continues for all four years of undergraduate study. Fox comes from Jackson, Tenn., and also won a Cincinnatus Scholarship.

Graduate

The Department awarded three new prizes for graduate students for the first time this year. The Kieval Award for Outstanding Doctoral Student went to **Laura Bristol**. The Kieval Award for Outstanding Graduating Master's Student went to **Man Wang**, who specialized in statistics. Man was an intern at the Veteran's Administration Hospital last year. She has a full time job at the Veteran's Administration Hospital in Boston, where she moved to join her husband. The Kieval Award for Outstanding Graduate Assistant went to **Muhammad Usman** for his excellent work teaching Finite Math and Calculus. **Rong Zhou** won a Taft Advanced Graduate Fellowship for 2003-2004. He was an intern at Procter & Gamble this past summer. Also interning at Procter & Gamble is PhD student **Min Lin**. Rong and Min are both studying statistics. **Robb Sinn** completed an interdisciplinary PhD in mathematics and education last spring. He took a faculty position at North Georgia College and State University in Dahlonega, Ga.

Alumni NEWS

Robert Herbold (BS 1964)

Bob Herbold retired in 2001 from his position as executive vice president and chief operating officer of Microsoft Corporation, where he had worked since 1994. Prior to Microsoft, he was Senior Vice President for Advertising and Information Services at Proctor & Gamble. He continues to work part time for Microsoft. He also serves on the boards of directors of numerous corporations and institutions and has recently launched a consulting business. In his spare time, Herbold is an avid fisherman and enjoys hiking with his wife Pat, a commercial real estate attorney. They have three grown children. Last year, he endowed the Herbold Scholarship at UC for a mathematics undergraduate.
(See Student News)

Sharmanthie Fernando (MS 1997)

Fernando is Assistant Professor of Physics at Northern Kentucky University. Her research investigates general relativity and black holes with a mathematical approach. She invites interested readers to view her Web page at: http://www.nku.edu/~fernando.

Dan McWhorter (MS 1999)

McWhorter currently lives in Maryland and works at the National Security Agency as part of its Cryptologic Mathematics Program. He and his wife Nikki are proud parents of twins Evan and Elizabeth, born April 25, 2003.

Crista Coles (PhD 2000)

Coles is Assistant Professor of Mathematics at Elon University in North Carolina. She and **Sanjay Arangala** (MS 1996) have a new son, Emil, born on April 13, 2003.

Ken Meyer RETIRES

After 31 years of teaching at the University of Cincinnati, Ken Meyer ended his teaching career last spring. The following is an excerpt from the tribute Chris McCord prepared for an A&S Faculty meeting.

Tributes for retiring faculty can be occasions for hyperbole and sentimentality, but I can say without any exaggeration or adornment that Ken Meyer is one of the most important and influential mathematicians ever to be a member of the University of Cincinnati. In spite of the usual taboo against hiring your own students, Ken received his PhD in mathematics from the University of Cincinnati in 1964, and returned as a full professor a decade later, after having held positions at the Research Institute for Advanced Studies, Brown University, and the University of Minnesota. Ken had the good fortune to enter mathematics in post-Sputnik era of the early 1960s, just as the new field of dynamical systems was emerging from the classical area of differential equations. Ken was at the forefront of this revolution, and throughout his career has been one of the leaders in dynamical systems in the United States.

Ken has made fundamental contributions to several areas of dynamics: functional differential equations, bifurcation theory, Hamiltonian systems, and celestial mechanics. His work with Jack Hale in the 1960s on functional differential equations changed the direction of research in that area. With his student Dieter Schmidt, he pioneered the use of normal forms in bifurcation theory. In the 1970s, he applied the newly emerging concepts of dynamical systems to the traditional topic of Hamiltonian systems, and produced several substantial results. His work in celestial mechanics has permeated the field for the past 30 years. He has also been a pioneer in the use of computer algebra systems in mathematics: Almost 30 years ago he began combining computer techniques with mathematical analysis in ways that have now become standard tools embedded in computer packages such as Mathematica and Maple.

Ken's prominence in dynamical systems has been recognized by 30 years of funding from the National Science Foundation, 10 visiting positions, nine PhD students, six editorships, two joint appointments, and innumerable conference invitations. He has been a Charles Phelps Taft Professor since 1984. Ken is a charter member of the Midwest Dynamical Systems Seminar, one of the longest-running dynamics seminars in the United States. His stature and his involvement in the Midwest Seminar have given national prominence to dynamics at UC.

We wish him the very best in retirement.

backstage at PROOF

By Chuck Groetsch

Weird things have been happening lately. After decades of being portrayed in movies and plays by nerdy Wally Cox types, mathematicians are seeing themselves depicted by the likes of Jeff Goldblum, Gwenyth Paltrow, Russel Crowe and Matt Damon. Suddenly math is cool (well, outside the classroom anyway). I found myself – temporarily – in this strange new world of popular mathematical culture last fall when Michael Haney of the Cincinnati Playhouse in the Park asked me to serve as a technical advisor for the cast of their production of David Auburn's play *Proof*. Auburn's Tony Award and Pulitzer Prize winning play is really about madness, trust and human relationships, with mathematics forming only a backdrop, but Haney, as director, thought it was important for the actors to have some familiarity with the academic mathematics scene.

After a couple of meetings and discussions with Michael, I spent a total of six hours in rehearsal with the actors. I was struck by the detailed planning for the production. For example, during a long discussion on wardrobe, I couldn't help wondering out loud if we weren't spending more time on dressing two actor-mathematicians than had been cumulatively devoted to attire by all real mathematicians who had ever lived. The actors were an impressive group. Before a single line was read they spent hours asking questions to try to get a feel for what "working" at mathematics was like. These ranged from how it feels to be totally stumped by a mathematical problem without a clue of how to proceed (I gave expert testimony), to what if you are just dead wrong (again I shined), to really deep questions about the nature of mathematics and its relationship to reality. I came away with a new appreciation for the thoughtful work that actors do and a good feeling that the two cultures might not be as far apart as we usually think.

Once the play was in production, Dan Nelson of the College of Medicine's Department of Psychiatry and I were asked to do a dog and pony show on mathematics and madness in the Playhouse's Perspective series. The event was held during a January snowstorm at the exact time of the Super Bowl, yet it attracted a standing room crowd of about 80 to the rehearsal hall. I have to attribute the unexpectedly good attendance either to Dan's drawing power, or to the fact that the Bengals have completely soured the good citizens of Cincinnati on professional football. Dan gave a fascinating discourse on bipolar disease, while I had the temerity to present a proof of a theorem – and still I managed, Candide-like, to escape without permanent physical injury.

When the gig was over I was naturally curious as to why I was contacted for this job. Michael admitted that he had called the Mathematics Department to ask for someone who really knew what a crazy mathematician was like – and my name came up on the spot!

UC's MR. HYDE

By Chuck Groetsch

Today we take for granted that "space" can be extended to any number of dimensions by a process of appending linearly independent vectors. However, in the 19th century notions of space were limited to the Euclidean plane and familiar three-dimensional solid space. Hermann Grassmann, an obscure German gymnasium teacher, stretched minds and spatial conceptions with the publication in 1844 of his *Ausdehnungslehre* ("Extension Theory"), a remarkable work that has come to be fully appreciated only in relatively recent times. Grassmann was led to his theory of space analysis by an earlier study of tides in his *Theorie der Ebbe und Flut* (1840), a book in which spatial analysis was for the first time based on what we now recognize as vectorial concepts.

The first American to whole-heartedly adopt Grassmann's revolutionary ideas was a professor at the University of Cincinnati, Edward Wyllys Hyde (1843-1930). In fact, Michael Crowe, the leading authority on the history of vector analysis, has called Hyde one of Grassmann's most important followers. Hyde published two influential books, *The Directional Calculus* (1890) and *Grassmann's Space Analysis* (1906), which introduced Grassmann's ideas to the fledgling American mathematical community. His exposition of this extended notion of space has earned Hyde a place among the founders of what is now a thriving mathematical enterprise in the United States.

E.W. Hyde was born in Saginaw, Mich. and educated at Cornell University, where he received degrees in civil engineering in 1872 and 1874. After teaching at Cornell for several years, he was appointed an assistant professor (the only mathematics professor in the "Academic Department") at the University of Cincinnati in 1875. During the next 25 years he served UC as professor of mathematics, dean of the College of Liberal Arts, and president of the university. Hyde was also very active in the civic life of the university. As chairman of the faculty he pushed through a rule in 1897 prohibiting smoking in all university buildings. (Although this regulation was subsequently annulled, it was reinstated nearly a century later in 1992.) Hyde was forced from his faculty position and replaced by Harris Hancock when President Howard Ayres, in an academic bloodbath that came to be known as the "Upheaval of January 12," completely reorganized the faculty in 1900.

Hyde, though trained as an engineer, was at the forefront of American mathematics in his time, serving as an associate editor of the *Annals of Mathematics* and publishing widely read books on advanced topics. His first book, a work on civil engineering titled *Skew Arches* was reissued on the World Wide Web in 2000, 125 years after it was first published. Now that's staying power!

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THE **RIGHT ANGLE**
Department of Mathematical Sciences
McMicken College of Arts and Sciences
University of Cincinnati
PO BOX 210025
Cincinnati, OH 45221-0025

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from the EDITOR

Collecting the stories and news items for *The Right Angle* is a task I look forward to each summer. I hope you've enjoyed our latest issue. Please continue your stories and news items for the next issue by sending in the attached form or emailing us at RightAngle@math.uc.edu.

Joanna Mitro

Name _____

Address _____

_____

Year of graduation _____

Degree _____

Current occupation _____

Professional or personal news (comments/suggestions):

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Magda Peligrad NAMED CHARLES PHELPS TAFT PROFESSOR

This summer the university's Board of Trustees approved the appointment of Magda Peligrad as Charles Phelps Taft Professor of Mathematics. Peligrad joins four other outstanding UC faculty members currently holding this prestigious designation. (David Minda of our department is one of the four; Ken Meyer became Taft Professor Emeritus upon his recent retirement.) Taft Professors are chosen based on their national and international reputations for outstanding scholarship and on the vigor of their continuing research effort. This title is awarded to researchers still at the peak of their powers who can be expected to make distinguished contributions in the future.

Previously a researcher at the Center for Mathematical Statistics of the Romanian Academy, Peligrad joined this department in 1984, shortly after her immigration to this country. Her main interests have been in the limit theory of dependent random variables. Traditional statistical inference relies heavily on *independence* assumptions, but such assumptions are not always realistic. Two events are independent provided the occurrence of one does not affect the probability of the other. Mathematically, this idea is equivalent to $P(A \cap B) = P(A) \times P(B)$ for events A,B. When this equality fails to hold, we have dependence. Of special interest are situations where the dependence among observations decays as the time between the observations increases. Researchers characterize this situation using various measures of dependence called "mixing conditions" (for instance, using the rate at which $| P(A \cap B) - P(A) \times P(B) |$ goes to zero as the time between events A and B increases), and then try to find precise conditions under which various asymptotic results known to hold for independent sequences can be extended to dependent sequences. Peligrad is recognized for her sharp (best possible) central limit theorem results for various classes of dependent sequences. Rick Bradley of Indiana University concludes that she is "distinctly better than anybody else in the world" at getting such results, adding, "She has a unique, uncanny ability to extract, with original, ingenious, delicate mathematical arguments, the most 'mathematical leverage' out of the weakest possible assumptions." One of the most important unsolved problems in the field of dependent sequences is known as Ibragimov's Conjecture. This conjecture, first posed in the 1960s, has eluded complete confirmation in spite of many efforts. Peligrad is one of the few researchers who has been able to make progress toward proving this conjecture. Indeed, her work on this conjecture was a significant breakthrough, and provided key mathematical tools for other researchers. Her results on Ibragimov's Conjecture have never been improved.

Peligrad was named a Fellow of the Institute of Mathematical Statistics in 1995. She has had five PhD students at the University of Cincinnati and works with students and post-docs both here and in France. Peligrad receives many invitations to speak at meetings and has an impressive record of collaborative research with mathematicians around the world. She continues to work on many aspects of dependence, such as strong approximation (approximating dependent variables by independent ones), new mixing conditions, and statistical procedures for dependent sequences, and is currently writing a book. Congratulations to Magda Peligrad for a well-deserved honor!

THE RIGHT ANGLE
Department of Mathematical Sciences
McMicken College of Arts and Sciences
University of Cincinnati
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Cincinnati, OH 45221-0025

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UNIVERSITY OF Cincinnati
McMICKEN COLLEGE OF ARTS AND SCIENCES
Department of Mathematical Sciences
RightAngle@math.uc.edu

From the HEAD

Dear Alumni and Friends,

One of the great pleasures of being head of the Mathematics Department is to meet with Alumni and to hear of your varied careers and successes. It's heartening to hear how many of you appreciate the education you received at the University of Cincinnati.

We are particularly grateful this year to Bob Herbold for his generosity in endowing the new Herbold Scholarship that will be awarded to an outstanding freshman interested in pursuing a degree in mathematics. This year's recipient is Emily Fox of Jackson, Tenn.

It has been another busy and rewarding year for students and faculty.

Among this year's highlights, undergraduate student Carl MacTague was invited as a keynote speaker at the 5th International Mathematica Symposium. Junior Afshan Adhami was the winner of this year's Richard E. Greenholz award from the College of Arts and Sciences. Magda Peligrad was chosen as one of the college's two new Taft Professors. Assistant Professor Markus Banagl received a $100,000 research grant from the National Science Foundation to continue his research in algebraic topology. Dave Herron and Nages Shanmugalingam organized a graduate student workshop on geometric function theory in Jyväskylä, Finland.

This year saw the retirement of Ken Meyer, one of the department's most prominent scholars. Fortunately he plans to remain with us as Taft Professor Emeritus for many years to come.

The current Collegiate Structures Initiative will be bringing significant changes to the way mathematics is taught at UC. This year saw us taking over the teaching of mathematics in the evenings, yielding much greater flexibility in our course offerings for both full-time day students and part-time evening students. Next year will bring further constructive changes as a result of the restructuring of University College.

Thanks to all of you who wrote in with news last year. Keep those e-mails and letters coming. We're saving a spot for your news in next year's *Right Angle*!

Best Wishes,

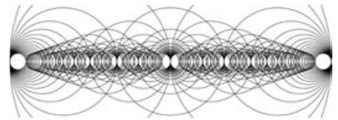
Tim Hodges

Undergrad's Work Mixes MUSIC AND MATH

Carl McTague, a 23-year-old senior with a double major in mathematics and music, is doing such innovative work in "algorithmic composition" (using abstract mathematical structures and computation to create music) that his work came to the attention of the organizers of the 5th International Mathematica Symposium, held last July at Imperial College London. McTague was invited to deliver one of the keynote addresses (other keynote speakers included Stephan Wolfram, creator of Mathematica, and Nobel Laureate John Nash). He spoke on "Music Through Computation."

McTague has been a stand-out at UC ever since he arrived in 1999. Admitted to UC in a program that guaranteed him a slot in medical school, he initially set his sights on an engineering degree, but quickly became so immersed in music and math that he dropped the engineering part of his major. He polished off sophomore-level math courses in linear algebra and calculus IV during the summer before his freshmen year, and jumped into the senior/graduate-level Introduction to Abstract Algebra sequence that fall. Since that first year, McTague has been carving out his own "fast-track" math major curriculum entirely of PhD-level graduate courses. He is the recipient of numerous prizes and scholarships, including the Department's Harris Hancock, Jeanne Gulden, and Harry Kieval awards and the Richard E. Greenholz Scholarship from the College of Arts and Sciences. He's an accomplished fiddler and "in his spare time" he does research in pattern formation in dynamical systems with Jim Crutchfield at the Santa Fe Institute.

The graphics used for this story were created by Carl McTague to accompany his program notes. You can read more about his ideas at his Website http://www.mctague.org/carl/. Adventurous readers can listen to his compositions and fiddle performances there, too.



His WORK

McTague uses abstract mathematical ideas to study and create music. He formalizes the notion of "sound space" as a vector subspace of functions from a linearly ordered set into some appropriate vector space. In this setting, sound superposition and attenuation correspond to point-wise addition and scalar multiplication. He represents sounds via mappings and operators. Such representations allow him to realize and manipulate rhythms, tempi, dynamics, and other parameters of music to create (program) compositions. He usually works in the functional programming language Haskell. An early piece composed using these ideas is *6 Integers*. In his program notes, McTague says the entire algorithmically composed piece (5292 notes) arises "from modulo division and the integers one through six." Another of his mathematically inspired ideas is the "helix of fifths." This is a model for musical pitch that gives the composer a countable infinity of pitch classes. McTague's helix extends music's conventional "circle of fifths," which is generated by transposing up or down the scale by intervals of one fifth. (This corresponds to adding sharps to the key signature as you move up by fifths, or adding flats as you move down.) His extension is unbounded because he distinguishes between "enharmonically equivalent" pitches, such as B-flat and A-sharp, which are identical on the piano. McTague uses this idea to create an algebraically inspired model for harmonies, which he implements in his composition *(ii-V-I)*^{7}. This work is based on the chord progression (ii-V-I), and unfolds via a recursive process. The recursion embeds the progression within itself seven times, producing a Koch snowflake-like "fractal" harmonic structure of increasingly elaborate progressions 2187 (= 3^7) chords long (which explains the seventh power in the title).