
Math Matters

The Cornell Mathematics Department Newsletter

VOLUME 4, NUMBER 1 June 1996

New Chair of Department is Announced

The Mathematics Department is pleased to announce the selection of Professor **Robert Connelly** as department chair. Professor Connelly replaces **Peter Kahn**, who was selected by the Arts College to serve as associate dean. Connelly, whose term began January 1, 1996, will lead the department through many changes during the next three and a half years, including the possible relocation to Malott Hall, the college review of resources, and the university's re-engineering projects.

Connelly received his Ph.D. from the University of Michigan in geometric topology; however discrete geometry, especially the geometry of rigid structures, is his main area of interest. Recently, he has taught Math 103: Mathematical Explorations and Math 452: Classical Geometries in the fall of 1994; Math 401: Honors Seminar in the spring of 1995; and Math 455: Applicable Geometry in the fall of 1995. Connelly has also been the coordinator of the Putnam exam, a national contest involving colleges and universities in Canada and the United States.

A message from Bob Connelly:

"My goals as chair are to promote excellence in teaching and research in our department as well as to create an atmosphere of openness and mutual understanding that will make all of our experiences here at Cornell rewarding and stimulating. I have been very happy and privileged to have the opportunity to be at Cornell for the last 25 years, and I am honored to be able to serve the department as chair."

The department wishes Professor Connelly well in his tenure.

The Department on the Web

Please visit the Mathematics Department's new and improved homepage!

It can be found at the URL
<<http://math.cornell.edu>>.

Cornell Team Earns 2nd Place in Int'l Competition

The mathematics team, which consisted of three undergraduate students, recently placed second in the annual William Lowell Putnam Mathematics Competition, an international contest among colleges and universities. The competition, held December 2nd last year, included 2,468 participants from 405 colleges and universities in the United States and Canada.

Cornell's team, under the guidance of **Bob Connelly**, professor and chair of mathematics, consisted of **Jeremy Bem**, a sophomore English major from Ithaca; **Bobby Kleinberg**, a junior math major from Buffalo; and **Mark Krosky**, a senior math/computer science double major from Brooklyn. They were all returning team members from last year. Individually, all the team members scored among the top fourteen participants, and Krosky scored in the top ten.

Last year, the Putnam team, consisting of the same members, also scored second, and the year before that the team scored sixth. "Our

Putnam Exam, cont'd.

teams have scored incredibly well in these last few years, certainly better than any other time at Cornell,” remarked Connelly.

The Putnam Competition, established in 1938, promotes a healthful rivalry in mathematics between institutions across Canada and the United States. Regulated by the Mathematical Association of America, it consists of 12 mathematical questions, and six hours to do them in two three-hour sessions. The questions are designed to be understandable, yet challenging, to any undergraduate student. For example, the following was part of one question in 1988: “If every point of the plane is painted one of three colors, do there necessarily exist two points of the same color exactly one inch apart?” (You had to justify your answer).

The competition is open to all undergraduate students, and others are welcome to practice sessions. This year, six other Cornell students entered the competition, almost all ranking within or near the top 500.

Bob Connelly is a professor and chair of mathematics.

Experiments in Math 111 by David Henderson

This spring, Math 111 offered several slightly different sections of its traditional calculus curriculum. Three sections of the course required students to use graphing calculators. Since graphing calculators are being used extensively

Math 111, cont'd.

in high schools and are now required for the SAT exams, many students entering Cornell already own graphing calculators and are familiar with their use. Therefore, the students tend to use their graphing calculators in calculus, regardless of whether or not it is an official part of the course.

The department, taking this factor into consideration, decided to experiment with integrating the calculators into the calculus curriculum. Visiting Associate Professor **Carolyn DeSilva** used graphing calculators in the teaching of calculus for several years at Gettysburg College in Pennsylvania; she agreed to share her expertise with the department by teaching, together with Professor **David Henderson**, three sections that used the graphing calculator. Professor Henderson had never before even held a graphing calculator in his hand, but he found it easy to use and to incorporate into the teaching of Math 111.

It is important in using the graphing calculator to know when it is misleading (or actually incorrect). For example, when a graphing calculator (or Analyzer* and other computer graphing programs) graph the function

$$y = x^{50} + 1 - x^{50} + 1$$

it does **not** display the correct line

$$y = 2.$$

For some values of x , the calcula-

Math 111, cont'd.

tor computes $y = 1$ and, if you look close enough (it is easier on Analyzer*), for some values of x it actually computes $y = 3$.

On the other hand, there are problems that can be easily solved using the graphing calculator that would be impossible otherwise. For example, it is stated in calculus that the tangent line is the “best linear approximation” to the function near the point of tangency, but just how good is the best? Given

$$f(x) = 3x^5 - 2x^4 + 13,$$

the tangent line at $x = 1$ is given by $y = 14 + 7(x - 1)$. For what values of x does this equation of the tangent line give a value that is within .0001 of $f(x)$? Using the graphing calculator, students can easily solve this problem and along the way actually see graphically the relationship between the tangent line and the graph.

The department currently plans to offer graphing calculator sections of Math 111 in the fall.

David Henderson is a professor with the department. He taught Math 111 as well as a new seminar dealing with Educational Issues this spring.

“Preparing Future Faculty” Program Continues

Under the direction of **Tom Rishel**, senior lecturer and director of undergraduate teaching, the Mathematics Department has continued to sponsor the “Preparing Future Faculty” program.

Preparing Future Faculty, cont'd.

The program has been an unqualified success in the department, focusing student attention on the professorate and their relationship to it. It has also brought significant interaction between faculty at the participating college, Cornell students, and faculty, and increased professional activity at the related colleges.

The "Preparing Future Faculty" (PFF) program comprised five sections: the speaker series; travel to regional meetings; the Wells College Initiative; the job fairs; and the Calculus Reform project. The Speaker Series consisted of fourteen talks by a cumulative total of eighteen Cornell graduate students. The talks, given at Ithaca, Wells, and Hobart and William Smith Colleges, ranged over such topics as DNA and topology; cryptography; DNA as a computer; and probability theory applied to hiring practices. A total of about 450 students and faculty attended the talks. In addition, a total of twenty-four graduate students went to the regional meetings of the Mathematical Association of America's Seaway Section. These meetings were held in New York at Binghamton, Rochester, Albany, Geneva, and Elmira. Two Cornell graduate students, **Ed Bueler** and **Reed Solomon**, spoke. In addition, graduate student **Debra Boutin** went to the MAA summer national meeting held in Burlington, Vermont.

During the first year of the program, a "home-and-home" pair of

get-togethers with Wells College was held. The Cornell-to-Wells component was very popular. The Wells-to-Cornell session was much less popular, however; later discussion indicated the need to replace this component with more speaker series talks in future years. Cornell also hosted two job fairs, in which visiting faculty and chairs at small colleges discussed the job market, CV's and cover letters, and the teaching portfolio. Eighty-five students attended the two sessions, and additional sessions on letters of recommendation and tenure were added for this year. During the first year, Ithaca College faculty gave presentations at Cornell on "project-oriented calculus", dubbed The Calculus Reform Project. In subsequent years, three PFF graduate student participants, **Harel Barzilai**, **Lisa Orlandi** and **Maria Gargova**, have used reform methods in their classes.

Next year, the department hopes to test three new initiatives. As part of a calculus reform program, calculators will be introduced into the department's first semester calculus course; Professor **David Henderson** will oversee the project. A proposed college teaching course will focus on the basics of classroom teaching, including following the syllabus, overseeing a TA, problems and their solutions, and the structure of universities; grading; jobs; writing a CV and cover letters; and alternatives to lecturing. The peer review and mentoring will allow graduate stu-

dents in PFF to attend each other's classes on an informal basis.

Locally, Rishel has spoken to Cornell deans and departmental faculty about extending aspects of PFF to their departments. Regionally, participants described the program at the Seaway Section meetings and at the Hudson River Undergraduate Mathematics seminar. **Nikhil Shah**, **Cathy Stenson**, **Kathryn Nyman** and Rishel have encouraged other schools in the region, including Binghamton, Syracuse and Stony Brook, to establish the "speaker series" idea. Nationally, Rishel, **Rachel Hastings** and **Teresa Moore** have spoke of their efforts at the PFF meeting in Colorado Springs last summer. **Bob Connelly**, chair, and Rishel spoke at the national conferences of TA trainers at the University of New Hampshire in February, 1996. Rishel also spoke at the American Association of Higher Education gathering last March, and with **Christine Ranney** at the Council of Graduate Schools meeting in Seattle. Further, Tom will be attending the National Academy of Sciences Convocation on Doctoral Education in June, and the Conference of Composition and Communication in March, 1997 to describe the program. He has also been selected to join the MAA Task Force on Graduate Study, a national committee formed to investigate questions of preparation of graduate students in mathematics.

Tom Rishel is a senior lecturer and the director of undergraduate teaching.

Research Experience for Undergraduates Program Summer 1996

This summer, the Cornell Mathematics Department will once again sponsor the Research Experience for Undergraduates program. The program will be held June 10 through August 2nd and will culminate in a series of talks given by the participating students. This year, the participants will be: Evelyn Abeles of Wellesley College; Laura Biven of the University of Maryland at College Park; Eva Brezin of Columbia University; Shelly Harvey of California Polytechnic University, San Luis Obispo; David Helder of the University of Michigan; Yevgeniy Kovchegov of New York University; Joshua Levy of Hope College; John-Peter Lund of the University of California at Berkeley; Joshua Maher of the University of Maryland; and Jade Vinson of Washington University.

Once again, three projects are offered. Professor **Robert Strichartz**, the coordinator of the program for the last three years, will be researching *Fractals and Harmonic Analysis*. Students will study properties of self-similar measures, which can be thought of as mass distribution or probabilities on fractal sets. Interest will be focused on algorithms for generating these measures and estimating their dimensions, and the mapping properties of convolutions with such measures. The work will mainly involve writing computer programs and running numerical experiments to generate conjectures and test hypotheses.

Assistant Professor **Kevin Pilgrim** will offer a project on *Complex Dynamics*. Under his supervision, students will study a natural class of fractals called Julia sets which arise from iterating complex functions. Concentration will be on finding examples of functions whose Julia sets have special properties and then studying how the Julia sets change as the function is changed. The work will involve writing computer programs to find functions and families of functions, and then drawing pictures of the corresponding Julia sets to generate conjectures. The students will also systematically develop a catalog of examples.

Finally, **Karoly Bezdek**, visiting professor and who participated last year, is offering research on *Computational Geometric Convexity*. He plans to work on the following problems: A) Proving or disproving that the shortest closed billiard path of an arbitrary d -dimensional convex body of constant width 1 has length 2; B) Whether a central symmetric d -dimensional convex polyhedron can be cut into an odd number of simplices of equal volumes; C) How small the volume of a d -dimensional convex polyhedron that contains a unit sphere and possesses n facets can be; and D) Proving that any 3-dimensional convex body can be illuminated by 8 point sources.

Funding for this program comes from the National Science Foundation. Further information, as

well as last year's program and highlights, can be found on the REU webpage at <http://math.cornell.edu/~karen/reu.html>.

Cornell Topology Festival

Once again, the Mathematics Department held its annual "Topology Festival," this year scheduled for May 2-4, 1996. The festival, which was initiated in 1962 by Professor **Paul Olum** (see article this issue), became one of the most prestigious topology conferences in the country, and has set the standard for the many annual topical conferences in mathematics now held across the country.

The conference began on Thursday, May 2, with registration and refreshments. The first speaker was David Gabai of the California Institute of Technology, who spoke on "Geometric and Topological Rigidity of Hyperbolic 3-Manifolds." Dinner at the Taughannock Farms Inn followed. The next day, Friday, Yair Minsky of the State University of New York at Stony Brook lectured on "The Complex of Curves on a Surface: Hyperbolicity Lost and Found in Teichmüller Space," followed by Michael Weiss of the University of Notre Dame on "Index Theory Without Operators."

After lunch, Matt Brin of SUNY Binghamton discussed "Automorphisms of Some Small Homeomorphism Groups," while the

Topology Festival, cont'd.

University of Utah's Noel Brady spoke on "Branched Coverings of Cubical Complexes and Subgroups of Hyperbolic Groups." Friday's events were capped off by a picnic at Stewart Park, which overlooks Cayuga Lake.

On Saturday, Ronnie Lee of Yale University lectured on "The Spherical Space Form Problem" and Mike Davis of Ohio State University on "Boundaries of Coxeter Groups." Once again, a successful and informative Topology Festival was enjoyed by all. Next year's event will be May 1-3, 1997. Please contact Professor Marshall Cohen at <marshall@math.cornell.edu> for further information.

Mathlab Developments by Allen Back

The spring semester was a busy one in the Mathlab, located in 206 Stimson Hall. Individual visits were more than fifty percent higher than any previous semester, and there is a steady stream of classes using the lab, particularly the second year math courses 213, 221, and 222. This was partially driven by the fact that three dimensional visualization, application of linear algebra, and differential equations-related work are topics whose everyday consideration often involves and is enhanced by computation.

Strategies of use in these courses varied. One class interspersed group computer assignments with prelims. Another encouraged the use of computer systems (within

Mathlab, cont'd.

limits) whenever they aided the regular homework. A third used weekly computer assisted lectures, computer exploration assignments, and a student project.

Major users of the lab were also the Math 103 "Mathematical Explorations" courses, especially the fractals and graphics course taught by Beverly West. Math 171, a popular beginning statistics course, was another "alternative to calculus," where computers are a very natural fit. In addition, Math 408 "Perspectives in Mathematics," and Math 356 "Groups and Geometry," were upper division courses making use of or exploring lab resources.

The lab's World Wide Web server is being increasingly used to support software and classes in the lab. Support pages supplement written manuals and course handouts, helping lab consultants and students learn of software problems and techniques needed either in general or for specific assignments. Hypertext indices like that to the on-line collection "Multi-variable Calculus in the Lab" allow people to find and view examples within seconds. The lab server also maintains an extensive list of external resource pointers as well as locally generated materials for sharing with other mathematical users across the Internet. The lab's WWW page is <<http://mathlab.cit.cornell.edu/home.html>>.

Allen Back is director of the Mathlab, which is located in 206 Stimson Hall.

Awards and Honors

Graduate student **Jeff Mitchell** was recently awarded the Clark Award for teaching. Also honored at the awards ceremony on April 12th in Kennedy Hall was **Michael Morley**, professor and former director of undergraduate studies/associate chair. Mike received the Robert A. and Donna B. Paul Award for Excellence in Advising.

Mark Krosky '96, a double major in mathematics/computer science, was awarded this year's Kieval Prize at the 1996 Mathematics Department Commencement Ceremony. **Robert Battig '96**, a graduate student in the department, received the York Prize for math, while Brett Gladman won for astronomy.

William F. Hinkley '93, recently wrote that he has won a graduate teaching award for this year at the University of Illinois, Urbana-Champaign. He is currently interviewing at various schools.

Congratulations to all!

Math Comp Names New Editor

Originally known as "Mathematical Tables and Other Aids to Computation" in 1943, "Mathematics of Computation" (*Math Comp*) has named Mathematics Professor **Lars Wahblin** to the position of managing editor. The journal, whose managing office is a small operation run out the Center for Applied Mathematics headquarters in 657 Frank H.T. Rhodes Hall, is one of four main research journals published by the American Math-

Math Comp, cont'd.

ematical Society. The majority of papers focus on numerical analysis, computational algebra and number theory. The January 1996 issue had articles on new error estimates for Ritz-Galerkin methods with minimal regularity assumptions; orbits and lattices for linear random number generators with composite moduli; calculation of Manin's invariant for Del Pezzo surfaces; integral bases in relative quadratic fields; and the largest known twin primes.

Lars, with editorial assistance from Anita Wahlbin, states that being a managing editor is "a balance between keeping the standards high and cutting down on the back-log, while not throwing the baby out with the bath water." The main work in judging papers for presentation, correctness, originality, interest, and importance is done by twenty-seven editors. These editors often rely on additional "referees." Wahlbin, in turn, insures that the board of editors is suitable and well-functioning, while at the same time mercilessly bugging late editors.

Math Comp currently has about 1,500 subscribers, mainly libraries. Contributions arrive at the rate of one new paper a day and, with a limit of 1,800 printed pages a year, space is at a premium. *Math Comp* is decidedly not a rapid publication journal; in particular, progress reports are generally discouraged. Since January of this year, the journal is available in electronic form, but not yet heavily used in that format due to slow servers and imperfect quality. This is likely to change, however. For further information, please contact Wahlbin at the address above, or via <awahlbin@cam.cornell.edu>.

Lars Wahlbin has been a professor of mathematics at Cornell since 1974.

Spotlight

Paul Olum was recently named professor emeritus, effective July 1, 1995. Olum began his career as a physicist at Princeton, working on the atomic bomb project. He eventually switched fields to mathematics, receiving his Ph.D. from Harvard in 1947. After a two-year stay at the Institute for Advanced Study, he came to Cornell as assistant professor in 1949. At the time, Paul was the only representative in the department in the burgeoning field of topology. He subsequently went on to recruit a large number of the current senior topology/geometry faculty, including Professors **Cohen, Connelly, Henderson, Kahn, Livesay** and **West**.

Olum initiated the "Topology Festival" in 1962, an annual regional professional gathering in topology, which is still being offered (see article this issue). He also served as department chair from 1963-66. In 1971, he was elected to the University's Board of Trustees, and in 1974, was offered the position of dean of the Arts College. Due to personal circumstances, however, he and his wife accepted positions at the University of Texas at Austin.

Once there, however, he says: "It started rather badly ... [so] I decided to look around for something else and ended up two years later as vice-president and provost at the University of Oregon in Eugene for four years, followed by nine years as president. I loved it. Oregon and Cornell are different in many ways, but they are the same in the basic academic spirit which represents the two schools and I was extraordinarily happy at both of them." Paul comments that further information on his career is available through *Who's Who*.

Ph.D. First Positions

1996

Baggett, Jeffrey: 2 year Postdoc, Center for Turbulence Research, Stanford
Cai, Tianwen: ass't prof., statistics,, Purdue
Goldfarb, Boris:Szego ass't prof., Stanford
Huber, Birkett: 2 yr. Postdoc, Texas A&M U.

1995

Coykendall, James: C.C. Tsuing ass't prof., Lehigh U., Bethlehem, PA
Dalbec, John: Gibbs instructor, Yale
Farzaneh, Ramin: teaching assoc., CU
Liu, Niandong: Global Finance Division, Citibank, New York, NY
Luo, Jiaqi: system analyst, Beacon Software, Edison, NJ
Ma, Gang: actuarial, Des Moines, IA
Wang, Weizhen: Postdoc, Purdue

1994

Dengler, Heike: quantitative researcher, Deutsche Bank, Frankfurt
Kalies, Bill: 2 year Postdoc, Georgia Tech.
Lee, Susan: 1st year: Postdoc, U. of San Diego; currently: tenure track, NM St. U.
Lee, Sungchul: 1st year: teaching assoc., CU; currently: ass't. prof., Singapore U.
Ma, Lawrence: lecturer, National University of Singapore
Parker, John: 1st year: teach. assoc.; currently: visiting ass't prof., Northwestern
Schleicher, Dierk: 1st year: Postdoc, MSRI, Berkeley; currently: ass't prof., Tech. U. Berlin
Zhou, Geng-qiang: Postdoc MSRI, Berkeley

1993

Hall, Brian: Whyburn Research instructorship, University of Virginia
Lee, Vee Ming: ass't prof., Wilkes University, Wilkes-Barre, PA
Li, Xiao'e: Postdoc, Penn State U.
Machiavelo, Antonio: ass't prof., U. de Porto, Portugal
Sheu, Yuan-chung: assoc. prof., National Chiao Tung U., Taiwan
Zhao, Linda: ass't prof., UCLA
Zulli, Louis: G.C. Evans instructor, Rice

Compiled by Richard Durrett, professor and the director of graduate studies.

Yes, I would like to help support the Mathematics Department endowments with my donation of \$ _____ for:

△ *The Mathematics Faculty Book Fund:* provides the Cornell Community with immediate access to one of the world's finest assortments of mathematics books and publications by enriching the collection of the Mathematics Library.

△ *The Mathematics Colloquium Endowment Fund:* instituted to invite distinguished scientists to speak at Cornell. Major contributions come from faculty who teach extra courses and donate their earnings to the fund.

△ *The Eleanor Norton York Award in Astronomy and Mathematics:* established in honor of Eleanor Norton York, a valued Astronomy Department employee who worked closely with graduate students. Recognizes outstanding graduate students in Astronomy and Mathematics with an annual prize.

△ *The Israel Berstein Memorial Fund:* honors the memory of a former Mathematics Department professor with an initial donation from his sister, Gita Fonarov. Funds annual awards for deserving graduate students in the fields of topology and/or geometry.

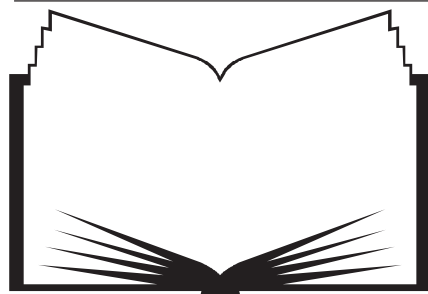
△ *The Logic Endowment:* recently established by a donation from a former Cornell undergraduate. Seeks to actively support promising logic students in the areas of institutional memberships and travel expenses, for Association for Symbolic Logic meetings and events, and other activities in the field of logic.

Make checks payable to Cornell University; a receipt may be sent to you for tax purposes if you wish. Please send to The Mathematics Department Endowments, 135 White Hall, Cornell University, Ithaca, NY 14853-7901.

Comments: _____

Name: _____

Address: _____



Recent Faculty Publications

Henderson, David, *Experiencing Geometry on Plane and Sphere.* Prentice Hall, 1996.

West, Beverly, Steven Strogatz, Jean Marie McDill and John Cantwell, *Interactive Differential Equations,* Addison Wesley, 1996.

Interactive Differential Equations is a CD-ROM with workbook containing over 90 interactive illustrations. Applications are drawn from engineering, physics, chemistry, and biology. Topics span first order differential equations, second order differential equations, linear and non-linear applications, Laplace Transforms, series solutions, and boundary value problems. This easy-to-use collection brings dynamic interactivity, realistic applications, and multiple representation to any differential equations course. It is designed as a new component for the course and can be used with any textbook and a variety of teaching approaches. *IDE* will run on both Macintosh and Windows platforms; publication dates are July 1996 for Macintosh and December 1996 for Windows.

Fun and Games

Professor **Bob Terrell** has developed a Macintosh program, *Mac 3D Art*, to create stereograms like the popular *Magic Eye 3-D* art found in stores, but with some mathematical content. Stereograms are explained in the paper by Professors Robert and Maria Terrell, "Behind the Scenes of a Random Dot Stereogram," in the *American Mathematical Monthly* for October 1994.

A copy of the program can be obtained via anonymous ftp to archives.math.utk.edu in the directory:

/software/mac/miscellaneous/Mac3D_Art

"If you can see this picture stereoscopically, try to guess parametric equations for the knot it contains:

<picture>

Bob Terrell is an adjunct associate professor with the department and taught two lectures of Math 294 this spring. Maria Terrell is also an adjunct associate professor as well as the assistant dean for academic services in the Arts College. She taught a section of Math 106 this spring.

DEPARTMENT OF MATHEMATICS
129 White Hall
Cornell University
Ithaca, NY 14853-7901

Editor:

Karen L. Finch

Cotnributors:

Allen Back
Bob Connelly
Diane Downing
Rick Durrett
David Henderson
Paul Olum
Tom Rishel
Bob Strichartz
Bob Terrell
Lars Wahlbin