MATH MATTERS

Department of Mathematics ♦ Cornell University ♦ Ithaca NY November 2003

Letter From The Chair, Kenneth S. Brown

This issue of Math Matters finds me optimistic and, at the same time, breathing a sigh of relief. I am relieved because, after months of hard work, we just finished a self study in preparation for our first external review in about 30 years. I am optimistic because it shows us as a strong department with opportunities to become even stronger over the next five years.

The writing of the self study was a collective effort by our 39 tenured and tenure-track faculty members, with substantial support by the staff. It was difficult at times (the phrase "herding cats" comes to mind), but I am pleased with the final product. I would like to share some of our conclusions with you.

I will begin with the research mission. According to the most recent rankings of American mathematics departments by the National Research Council (published in 1995), we are number 15. The 2002 U.S. News ranking of graduate mathematics programs has us tied for 10th. According to the National Science Foundation, we are 7th on the list of most highly funded mathematics departments. These rankings are good, but we believe we can move higher.

Our faculty includes a Fields Medalist, four fellows of the American Association for the Advancement of Science (AAAS), two members of the National Academy of Sciences (NAS), one winner of the American Mathematical Society's Steele prize, and several winners of other prestigious awards. Two of our recently-retired professors, Harry Kesten and Michael Morley, were awarded Steele prizes shortly before they retired, and Kesten is a fellow of the AAAS and a member of the NAS.

Many of our faculty have been invited speakers at the quadrennial International Congress of Mathematicians, including three in August 2002 in Beijing. Two of our faculty members, Greg Lawler and Bill Thurston, are major players in mathematical subjects featured recently in the scientific and popular press.

A second part of our mission is undergraduate education. Our self study shows the number of math majors has increased dramatically in recent years, following a low point during the dotcom boom of the late 1990s. In fact, the number of graduating math majors has more than doubled over the last five years, reaching 64 last May. We encourage our majors to combine the study of mathematics with serious study in a variety of other disciplines by means of a double major and/or a concentration. Last spring we added biology to our existing approved concentrations in computer science, economics, physics, and operations research. A concentration in statistics is under discussion.

Our math major program is very important to us, but the bulk of our teaching is service teaching for people in other disciplines. We teach undergraduate courses to over 5700 students a year. A large part of this is calculus, but there is increasing demand for non-calculus courses at the freshman/sophomore level. We developed new courses at that level and will continue to do so under the leadership of Director of Undergraduate Studies Birgit Speh.

Our service mission has extended in recent years to our upper-level courses, which double as courses for math majors and service courses for undergraduates and graduate students from all over campus. A surprising trend uncovered during our self study is that graduate student enrollment in our undergraduate courses has increased 53% over the past five years. This reflects the fact that mathematics is increasingly serving as a gateway to computer science, biology, and other disciplines.

In addition to developing new courses in response to student demand, we are experimenting with new teaching techniques. (See page 2.) Although we don't know where this will go, we are very excited about the possibilities.

The third part of our mission is community service. We are engaged in several outreach activities in local schools, some of which are described in Rick Durrett's article on page 6. Our activities will increase if the National Science Foundation funds the $1.7 million grant proposal described in that article. Regardless, we will remain active in outreach programs.

In order to stay strong and get stronger, we need to make outstanding hires. With 29 of 39 faculty over the age of 50, including five over the age of 70, we have entered a period where we can expect to make yearly appointments of new faculty to replace colleagues who retire.

As I write, we are preparing for a faculty meeting to take a first look at the candidates for tenure-track positions. We are currently searching to fill one of three vacant lines. (Because of budgetary pressures on the college, we will not be able to fill the other two this year.) The field of candidates is strong, and I look forward to meeting the ones we invite for interviews. Interacting with promising young mathematicians, and trying to persuade them that Cornell is a good place for them, is my favorite part of being department chair.

Speaking of promising young mathematicians, I offer my congratulations to Irena Peeva, our newest tenured associate professor as of November 1. Irena is an algebraist with an international reputation.

I offer thanks and best wishes to our recent retirees—Marshall Cohen, Michael Morley, and Beverly West.

Lastly, I offer my condolences to the family of Oscar Rothaus. (See page 2.)

Please visit us!
www.math.cornell.edu

Department Mourns Loss of Oscar Rothaus

Professor Oscar S. Rothaus, 75, passed away on May 24, 2003. Oscar came to Cornell as a professor in 1966 and served the department and university with distinction for 37 years, including a term as department chair from 1973 to 1976 and as acting chair in fall 1995.

Prior to coming to Cornell, he was Deputy Director of the Institute for Defense Analyses in Princeton, NJ from 1960 to 1965, and a mathematician for the National Security Agency in Washington, DC between 1953 and 1960. Oscar was a distinguished mathematician and outstanding contributor to the areas of several complex variables and Sobolev inequalities, authoring about forty research papers.

Oscar was admired and respected by all who had the pleasure of knowing him. He will be deeply missed by his many friends.

Alumni Notables

Jeffrey S. Lehman, B.A. Mathematics 1977, was inaugurated as Cornell's 11th president on October 16, 2003. He earned a J.D. and a master's degree in public policy at the University of Michigan and was dean of the University of Michigan Law School before accepting the presidency of Cornell.

John Bell, Ph.D. Mathematics 1979 (Lawrence Payne, Advisor), was a co-recipient of the 2003 SIAM/ACM Prize in Computational Science and Engineering. He is the director of the Center for Computational Sciences and Engineering at the Lawrence Berkeley National Lab.

Faculty Honors & Awards

Marshall Cohen

Professor **Marshall M. Cohen** was the recipient of the 2003 Kendall S. Carpenter Memorial Advising Award.

The Department Teaching Awards for 2002 were presented to Professor **Michael E. Stillman** and VIGRE Postdoc **Matthew Fickus** at the department's annual holiday party held on December 6.

Michael Stillman

Matthew Fickus

At the Joint Mathematics Meetings in Baltimore, Maryland, in January 2003, Professor Emeritus **Michael D. Morley** was presented with the 2003 AMS Steele Prize, one of the highest distinctions in mathematics.

Michael Morley

The Council of the University of Warwick bestowed the Honorary Degree of Doctor of Science to Professor **Eugene B. Dynkin** in July.

Eugene Dynkin (center)

Faculty Innovation in Teaching Award

Using Web Technology to Support Just-In-Time Teaching and Peer Instruction in Teaching Calculus

This project, under the direction of Maria Terrell, was awarded for 2003 and initiated this fall. The project aims to help students in MATH 111, Calculus I, develop a stronger conceptual understanding of calculus. Pre-class questions administered over the web test students' understanding of homework assignments and gets them thinking about concepts before they are covered in class, a technique known as Just-In-Time Teaching. In class, instructors pose concept-driven questions that apply concepts to familiar situations. A computerized polling system collects students' opinions of the right answer; before responding to the poll again, the students discuss their answer with a classmate. This Peer Instruction approach significantly increases their ability to understand and articulate concepts.

VIGRE Program

by Rick Durrett

Last year's article ended with a cliffhanger—we had just completed our third-year site visit from NSF and were cautiously optimistic that our program would be renewed for two more years. That optimism turned out to be justified. Indeed the major complaint from our NSF visitors was that "the report given to the site-visit team understated the accomplishments of the project."

With the official approval in hand in late January, we were able to hire our last group of Postdocs: Hsiao-Bing Cheng (Harvard), Paul Jung (UCLA), and Sarah Day (Georgia Tech), and admit our last group of VIGRE graduate fellows: Joshua Bowman (St. Olaf), Matt Noonan (Hampshire College), Chris Lipa (North Carolina State), Jonathan Needleman (Hampshire College), and Anael Verdugo (Caltech).

Postdocs receive three years of support and graduate students receive two, so it is not possible to have anyone in these categories start in the fifth year of the VIGRE grant, which begins in fall 2004. We hope that this interruption will just be for one year. NSF officials tell us there is no such thing as a renewal of a VIGRE grant, but they will consider applications by universities with existing grants, so we will be submitting a proposal for the September 16, 2004 deadline.

As this newsletter is being prepared, the future of the VIGRE program is uncertain. The mounting federal deficit cannot be good news for the NSF budget. Early in 2004 we will learn the fate of the nine schools currently in their fifth years, and who are competing with other fresh applicants for what the NSF web page says will be 6-7 awards. However, as we wait and watch for signals, the business of the grant goes on as usual.

In spring 2003, three graduate students escaped from their TA duties thanks to VIGRE support. Spencer Hamblen, working with Ravi Ramakrishna, used his free semester to make extended trips to Berkeley where Ravi was enjoying his AMS Centennial Fellowship. Dmitriy Leykekhman, working with Lars Wahlbin, finished up his MA in Computer Science and took several 700-level courses. Brigitta Vermesi, working with Greg Lawler, passed her A-exam and worked on an article on the multifractal spectrum of Brownian motion.

As in the past, the VIGRE grant provided support for graduate students in the summer. This year 20 students were supported (VIGRE fellows in their first three years plus five other advanced students). Summer fellowship support is important to allow students to broaden their knowledge of mathematics or to concentrate on their thesis research.

Two undergraduates received small grants over the summer to do research. Tom Maloney worked with Veit Elser of Physics to apply a technique called the difference map to the assignment problem and the traveling salesman problem. Joe Otchin, working with Anil Nerode, read papers on the historical development of game theory in preparation for a senior thesis on that topic. The VIGRE grant also provided support for two Cornell undergraduates to participate in the Cornell REU and for graduate students to work with two of the projects. (See REU, pp. 4-5.)

The VIGRE Interdisciplinary Colloquium in spring 2003 featured a variety of talks. Carlos Bustamante from the newly-formed Department of Biological Statistics and Computational Biology described the evolutionary consequences of amino acid variation with results from weeds, humans, and flies. Kevin Brown in the Vet School asked 'How many parameters does it take to fit an elephant?' The answer involved ideas from statistical mechanics and so-called sloppy models, which he applied to a biological problem in joint work with Jim Sethna from Physics. Elizabeth Housworth, a visitor from the University of Indiana, discussed the modeling of recombination between chromosomes. Michael Macy from Sociology described 'Culture Wars and Dynamic Networks: A Hopfield Model of Emergent Structure.' The final talk was an example of the success of the Interdisciplinary Colloquium. VIGRE Postdoc Lawren Smithline, a number theorist, described a method that he invented to visualize the alignment of DNA sequences.

In the fall of 2003, the VIGRE Colloquium will turn its focus inward—Reyer Sjamaar, Yulij Ilyashenko, and Ed Swartz will give us a look at their research, while John Guckenheimer and Robert Strichartz will explain Experimental Mathematics. This series of talks, which aims to expose first- and second-year students to possible research directions and to broaden the education of mathematicians of all ages, will continue in the spring semester with lectures by Karen Vogtmann, John Smillie, Louis Billera, and other members of department.

Research Experiences for Undergraduates

by Bob Strichartz, Rodrigo Perez & Rick Durrett

Every summer since 1994, the Cornell Mathematics Department has offered a Research Experiences for Undergraduates (REU) Program, sponsored by the National Science Foundation. This program brings talented undergraduates from Cornell and colleges across the country to work on research projects directed by Cornell faculty. By pooling resources with other programs, we were able to support a total of 16 students during summer 2003. For the first time in the history of our program, women students outnumbered the men.

Summer 2003 projects were Analysis on Fractals, directed by Robert Strichartz, Complex Dynamics and Number Theory, directed by Rodrigo Perez, and Probability Problems from Genetics, directed by Richard Durrett. Cornell graduate students Pavel Gyrya, James Worthington, and Deena Schmidt assisted with the projects. In addition to their research work, the students attend a Smorgasbord Seminar where Cornell faculty give talks about different areas of mathematics. The students gave presentations on their work to each other in a weekly Jam Session and also to the whole Cornell Mathematics community at the final Undergraduate Research Forum. Several papers based on the research are in preparation.

Students working on **Analysis on Fractals** followed a tradition started in 1996: A substantial portion of research in this area has come out of our REU Program. The students, Nitsan Ben-Gal (Michigan), Brian Bockelman (State University of West Georgia), Abby Shaw-Kraus (UCLA), and Clint Young (Binghamton), were building on the work of previous "generations" of REU students and also striking out in new directions. One of the accomplishments of this summer was understanding the possible point singularities of functions of polynomial and exponential types on the Sierpinski gasket (SG). This may seem strange, because in the Euclidean setting these types of functions do not have singularities. But the fractal world is different. This work involved both theoretical and experimental mathematics, using computer programs to explore possibilities and suggest conjectures. Another area that was explored for the first time was the analog of partial differential equations on SG^2, the product of SG with itself. Here we developed software to numerically approximate the solutions of these equations using the finite element method, building on earlier software for solutions of differential equations on a single copy of SG. We also discovered a new type of p.d.e. on SG^2 that has no analog in the non-fractal world, exploiting the fractal-like structure of gaps in the spectrum of the Laplacian on SG.

Students on the **Complex Dynamics and Number Theory** project studied fractal Julia sets with a number theory twist: There is a string of integers associated to the Julia set of any complex polynomial with one critical point. This numerical invariant known as an "itinerary" describes the structure of the Julia set, and the question arises of classifying Julia sets according to their itineraries. This leads to counting identities that can be proved with algebraic methods, but which are likely to remain undiscovered if the dynamical motivation is not present.

Yelena Yassinik (MIT) and Matthew Holden (Pomona College) worked on the description of polynomials with a critical orbit that is finite but not periodic. They obtained a general formula to count polynomials whose critical orbit has preperiod *m* and period *n*, and went on to provide a thorough classification.

Gwyneth Whieldon (St. Mary's College, MD) and Andrew Bridy (Cornell) looked at the role played by renormalization in the classification of polynomials with periodic critical orbit. The phenomenon of renormalization is invisible to the algebraic proof of the identity for this case. Andy found some formulas that are helping him study the asymptotic growth of the number of renormalizable polynomials of period *n*. This additional work is almost finished.

Two other Cornell students, Vorrapan Chandee and Grace Qiu, studied the case of periodic polynomials with real coefficients. This restriction is hard to encode in terms of the itineraries, so Vorrapan and Grace had to incorporate techniques of real dynamics. They rediscovered a formula for the number of real polynomials with critical orbit of period *n* and gave a new proof. They also found a characterization of itineraries that correspond to real polynomials and are working on determining the number of real polynomials with a given itinerary.

Many students in the **Probability Problems from Genetics** project

investigated gene duplication. Elizabeth Rach (Cornell) studied probability models of the growth of gene families in order to find explanations of why the sizes of gene families follow a power law.

Rachel Ward (University of Texas, Austin) examined predictions of the subfunctionalization model, which postulates that gene copies are preserved because they evolve to perform complementary functions. One of her surprising findings was that a model that should move around in six-dimensional space spent most of its time near a particular curve.

Amanda Stephens (Rose Hulman) and Mandy Pfeister (University of Colorado, Boulder) studied duplication patterns in the *q* arm of human chromosome 19 and the homologous part of mouse chromosome 7. They discovered many examples of adjacent gene duplicates but found that these duplicates preferentially occurred in a few families, suggesting that these mutations were not random changes but beneficial, e.g., to increase the number of toxins that can be identified and eliminated.

Jon Winkler (Arizona State U.) studied DNA sequences from a statistician's perspective—assuming they are a sequence of letters from a four-letter alphabet output by a black box. Statistical irregularities of the chromosomes he examined led him to rediscover some known features (e.g., the high mutability of CG pairs) but revealed some other striking patterns that have no known explanation.

Oxford graphs, which indicate the evolutionary relationship between chromosomes in two species, are bipartite graphs and each vertex has degree at least 1. Jonah Blasiak (Princeton) investigated properties of a random pick from the set of Oxford graphs with m left vertices, n right vertices, and k edges. In particular, he found conditions on m, n, and k for the existence of a giant com-ponent or for the graph to be fully connected with high probability. These results, which we expect to have published in a probability journal, are one of the four or five papers that will result from the summer's work.

The REU Program will continue next summer with projects in Analysis on Fractals, directed by Robert Strichartz, Dynamical Systems, directed by John Guckenheimer, and one more to be announced.

Cornell Probabilists Receive NSF Grant

Six Cornell probabilists—Richard Durrett, Gregory Lawler, and Laurent Saloff-Coste from Mathematics and Philip Protter, Sidney Resnick, and Gennady Samorodnitsky from OR&IE—have received a substantial five-year grant from the Infrastructure Program in the Division of Mathematical Sciences at the National Science Foundation. Much of the funding, which is in addition to their individual research grants, will be used to provide support for the almost two dozen graduate students doing research in probability. The grant provides enough money each year for six full year research assistantships, which will be shared equally by Mathematics and OR&IE.

Other aspects of the grant will benefit researchers young and old throughout the country. A visiting position is available for the 2004-2005 academic year and one or more will be available in subsequent years. This visiting position can provide full support for an assistant professor, or partial support for someone at a higher rank who might do some teaching or be on sabbatical.

There will be two hot topics workshops each year. A typical workshop will last from Sunday morning to mid-day Tuesday and involve eight speakers and eight young researchers. Phil Protter (Mathematical Finance, April 2004) and Laurent Saloff-Coste (Markov Chains, May 2004) will organize the first two meetings.

Each summer, beginning July 10-24, 2005, a two-week Summer School in Probability and its Applications will be held at Cornell University. There will be three main speakers who will give mini-courses of 4-6 lectures as well as some shorter lecture series. While there will be some talks by participants, it is intended to keep much of the day free for informal interactions. There will be 20-30 grants covering local expenses for graduate students and young researchers.

Greg Lawler is leading the organization of the summer school. The choice of speakers and topics for our workshops will be done in consultation with an advisory board that consists of representatives of most of the major probability groups throughout the country—David Aldous, David Heath, Thomas Kurtz, Claudia Neuhauser, Charles Newman, Yuval Peres, Simon Tavare, and Ruth Williams.

VIGRE Programs at Ithaca High School

by Rick Durrett

The Senior Seminar is an advanced mathematics option at Ithaca High School, started during the 2002-2003 academic year by three Cornell graduate students—Kristin Camenga, Todd Kemp, and Jeff Mermin. The class, designed for students who have completed all of the math courses IHS has to offer, meets for one period (45 minutes) during school hours each Monday, Wednesday, and Friday at the high school.

Ten IHS students attended the seminar in the first year. Some of the projects covered were on cellular automata, working on breaking the random number generator on a TI calculator, perfect graphs, and list-coloring graphs, and this year there are 15 students. The first six months are taught as three two-month modules, each led by a graduate student. During the last three months of the school year, the students work on individual projects with direction from the organizers. This year, fifteen students are participating in a program led by graduate students Sharad Goel (game theory), Jim Belk (topology), and Jay Henniger (topics in combinatorics, graph theory, and geometry).

Our second outreach activity, the Math Explorer's Club, has existed since the beginning of our VIGRE grant in fall 2000. In *Field of Dreams*, Kevin Costner is told "If you build it, they will come", but Kevin did not have to compete with the busy schedules of today's high school students. To make it easy for students to attend, we changed the Math Explorer's Club from a 2.5-hour Saturday activity at Cornell to another one of the many after-school clubs at IHS, which meet for 45 minutes at the end of the school day.

The first set of activities involve learning probability by playing games and are led by Rick Durrett with the assistance of CAM graduate student Sharad Goel. The first meeting, which advertised black jack and free pizza, brought an overflow crowd of 39 students to learn Thorpe's basic strategy, which reduces the house advantage to zero. Other topics in applied probability that have been or will be covered include craps, yahtzee, backgammon (especially the use of the doubling cube), and poker (lowball and Texas Hold'em). The semester will end with a short course on game theory by Sharad Goel.

Those who are curious about what we are doing can visit www.math.cornell.edu/~durrett/MEC/mec.html and learn some of the math behind these games. The idea behind this web page is to create an archive of tested materials that can be used by students and teachers throughout the country and facilitate the development of similar programs in other communities. If the last sentence sounds like it is from a grant proposal, you are correct. During the spring and summer, Rick Durrett and Maria Terrell hatched a plan for expanding our outreach activities on a national scale and developing materials on applications of mathematics for the high school curriculum.

Since the ultimate aim of our plan is to interest more high school and middle school students in mathematics as a career, Ken Brown, Rick Durrett, Karen Vogtmann, and Maria Terrell submitted a proposal to the Mentoring Critical Transition Points (MCTP) sub-program of NSF's recently revised suite of infrastructure programs. In addition to Ken and Karen, the proposal and the formulation of the new Math Explorer's Club received valuable input from David Henderson, Avery Solomon, Daina Taimina, Charlie Troutman of the ScienCenter, and Dave Bock and Tom Mariano at Ithaca High school. Karen Seifert, another high school teacher, helps out with club activities and local logistics.

We are optimistic that our MTCP proposal, which was submitted with a supporting letter from the American Mathematical Society signed by Jim Maxwell, will be funded for four years beginning in the summer of 2004. In 2003-2004, the activities are supported by a university grant from the office of Vice-Provost Francille Firebaugh in response to a proposal we sent to Provost Biddy Martin. Cornell is providing TA support for four graduate students to work on the project for one semester each. Sharad Goel is being supported in fall 2003, and Kristin Camenga, who will lead activities on graph theory, will be supported in spring 2004. Two other graduate students will be recruited to lead activities in number theory, cryptography, and exploring geometries.

Graduate Student News

Awards

Director of Graduate Studies Michael Stillman presented the following awards at the annual holiday party last December:

The 2002 Department Teaching Award for Graduate Students: **Christopher Francisco**.

The Battig Prize: **Todd Kemp**.

The York Award: **Christopher Hardin**.

Hutchinson Awards: **Radu Haiduc** and **Fernando Schwartz**.

Conferences Attended

Many graduate students were busy attending conferences over the past year, including:

Henri Johnston and **Jason Martin** attended the "Web of modularity" conference at Urbana-Champaign in June.

Jose Trujillo Ferreras, **John Thacker**, **Christian Benes**, and **Brigitta Vermesi** attended the NATO Advanced Study Institute on Conformal Invariance in Edinburgh in July.

Michael Kozdron attended the workshop on Random Walk and Random Environment at the Isaac Newton Institute in August.

Christian Benes, **Nathanael Berestycki**, **Michael Kozdron**, and **Lee Gibson** attended the 2003 Seminar on Stochastic Processes.

Cornell Mathematical Contest in Modeling

The CMCM is open to all undergraduates. Teams build models for a "real-world" problem and have a weekend to brainstorm. The results of the 2003 contest are just in:

1st: Lars Backstrom, Jonathan Goldstein, Stephen Lesko, *The Benefits of Greed: A Solution to the Museum Security Problem.*

Tie 2nd/3rd: Jacob Godwin-Jones, Punit Gandhi, Matthew Herndon, *A Mathematical Model for the Election Process*, and Michelle Fullwood, Daniel Montiel, Jules Paulynice, *Surveillance Cameras in Art Museums*.

Honorable mention: Christopher Yeung, Ramin Farhangi, Timothy Wong, *Museum Security*.

The Class of 2003

Commencement was held on May 25, 2003. Bachelor of Arts degrees were conferred upon sixty-four math majors. Eighteen received honors in mathematics.

Summa Cum Laude
Charles O. Abbott
Yousi Daniel Hue
Gideon Simpson
Justin Conrad Sinz

Magna Cum Laude
Adam Chandler Barth
Sami Umut Can
Benjamin Cooper
Chien Meng Simon Ho
Robert Marangell
Michael Patrick O'Neil
Oded Yacobi
Paul Young

Cum Laude
Salman Arif
Michael P. Ferguson

Cum Laude
(continued)
Jason Gertz*
Jonathan Helm
Anselm Levskaya
Alan Pogrebinschi

*January degree

Many of our graduates accepted positions, in the U.S. and abroad, as actuaries, consultants, analysts, teachers, etc. Several will be attending medical school. One-third of the class are pursuing advanced degrees at Cornell and other institutions in a variety of areas, including mathematics education, applied mathematics, computer science, physiology, physics, and economics. Benjamin Cooper (UC San Diego), Robert Marangell (UNC, Chapel Hill), and Justin Sinz (Chicago) are attending graduate school in mathematics.

The Harry S. Kieval Prize

The Kieval Prize was awarded to **Justin Sinz** for his outstanding achievement in a broad array of difficult undergraduate and graduate courses and also for his original research on symplectic quotients under the supervision of Yuri Berest.

Ph.D.'s August 2003

Matthew E. Horak, *Mapping Class Subgroups of Outer Automorphism Groups of Free Groups.*

Samuel K. Hsiao, *Peak Quasisymmetric Functions and Flag Enumeration in Eulerian Posets.*

Fernando Marques, *Existence and Compactness Theorems on Conformal Deformation of Metrics.*

Reba Schuller, *A Theory of Multitask Learning for Learning from Disparate Data Sources.*

Mathematics Department Endowments

The department is grateful to alumni, friends, and family who support the department endowments. Without their generosity, we would be unable to provide many of the offerings that make our department unique.

The **Michael D. Morley Senior Prize in Mathematics** is presented annually to an Ithaca High School student who has excelled in mathematics and who has demonstrated originality and innovative power in mathematics.

We instituted new departmental teaching awards for graduate students and faculty in 2001. We would like to endow the **Teaching Award for Graduate Students** so that a generous prize can accompany it.

The **Colloquium Endowment Fund** was instituted to invite distinguished scientists to speak at the Oliver Club seminars. The Oliver Club was founded (as the Mathematical Club of Cornell University) in January 1891 by James E. Oliver. (See www.math.cornell.edu/~oliver/.)

The **Eleanor Norton York Endowment** was established in honor of Eleanor Norton York, with the intent of recognizing outstanding graduate students in both Astronomy and Mathematics. The income from this endowment is used to provide annual prizes to a continuing graduate student.

The **Faculty Book Endowment** is dedicated to the goal of providing the Cornell community with immediate access to one of the world's finest collections of mathematics books and publications.

The **Israel Berstein Memorial Fund** was established in honor of Israel Berstein, who was a professor in this department 1962-1991. The memorial fund has as its central purpose helping young mathematicians in the field of topology.

The **Logic Endowment** was established as the direct result of a very generous gift from a former Cornell undergraduate. This endowment seeks to actively support promising logic students.

The **Robert John Battig Endowment** was established by his parents after his untimely death. Robert was awarded a January 1998 Ph.D. in mathematics. The fund provides an annual prize to an outstanding continuing graduate student in mathematics at Cornell.

If you would like to contribute to any of these endowments, please make your check payable to Cornell University, indicate the specific endowment on the check, and send it to:

The Mathematics Department Endowments
310 Malott Hall, Cornell University
Ithaca, NY 14853-4201

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