MATH MATTERS

Department of Mathematics • Cornell University • Ithaca NY **Winter 1999**

Letter From the Chair, John Smillie

Bob Connelly stepped down as Chair of the Mathematics Department June 30th, after having served as Chair for three and one-half years. We owe him a debt of thanks for his service to the department. Bob ensured channels of communication were open within the department and he maintained and further developed our very good relations with the administration. During his tenure as Chair, he was integrally involved in the extension of small lectures to all the calculus courses taken by the engineering freshmen. He also oversaw the move of the Mathematics Department to larger quarters. Bob is currently on sabbatical at the University of Washington taking a well-deserved rest from administrative matters.

The Department has some new faces this year. We are very pleased to have a new statistician, Professor Michael Nussbaum from the Weierstrass Institute in Berlin. Michael has made major contributions to asymptotic decision theory. We hired Yuri Berest as a new tenure-track assistant professor; he comes to us from the University of California at Berkeley. Yuri has done some fascinating work on Huygens principle. Two new H. C. Wang assistant professors join us this year. Peter Topping, working in partial differential equations and differential geometry and Vlada Limic working in probability.

The Mathematics Department and Statistics Department jointly held a conference and dinner to honor Roger Farrell on the occasion of his retirement after 40 years of association with Cornell. The dinner was emceed by Gene Hwang and was marked by heartfelt tributes to Roger. There was also a demonstration of excellent Scottish and English country dancing and some very lively swing dancing.

Moss Sweedler has let us know that he will be continuing in his new position with the National Security Agency and will not be returning to Cornell. We are all sorry to see him leave after 32 years at Cornell.

A number of department members received honors and awards. Harry Kesten was elected as a fellow of the American Academy of Arts and Sciences. The University also awarded him a Goldwin Smith Chair. Cliff Earle received an honorary professorship from the University of Warwick. One of our graduating seniors, Daniel Gardner, was a banner bearer for the Class of 1999. This honor is bestowed upon the graduate with the highest grade point average in the college. Another senior, Vladimir Livshitz was chosen as a Merrill Presidential Scholar. Junior YiMin Wu was awarded the Energy Research Fellowship, and will spend next semester in Washington doing research at the Pacific Northwest National Lab.

I would like to mention some department members who provided service to the Department above and beyond the call of duty. Keith Dennis, John Guckenheimer, Rick Durrett, Lou Billera, Mike Stillman and Bob Connelly were awarded a grant from the National Science Foundation to buy new state-of-art computing equipment for the Department. Also, a large group of faculty members (18 at last count) took time out from their usual activities to help prepare the VIGRE grant application. This is described more fully on page 3 of this newsletter. The latest news is that we had a site visit from an NSF panel. They interviewed faculty, graduate and undergraduate students, and let us know that they are very impressed with the Mathematics Department.

Lastly the whole Department owes a debt of gratitude to the staff who knocked themselves out in helping us to move to our new quarters in Malott. The physical move of the department this past summer was a big effort and an enormous change for all the members of the department. I'm happy to report that we're settling in nicely, and look forward to having many of you visit in the future.

MALOTT HALL RELOCATION

This past year the Cornell Department of Mathematics moved from White Hall, which mathematics has called home since the 1880s, to Malott Hall. Many people were involved with the planning and preparation over the years. Professor's Keith Dennis, Moss Sweedler and Cliff Earle worked at the job of faculty liaison. This role was eventually taken over by Professor John Smillie, who shepherded us carefully and creatively through the past three years of planning and renovation of the Malott Hall facilities.

Malott Hall, from Tower Road

We are grateful to everyone involved with the project. Jane Pedersen, the Associate Dean for Administration in the College of Arts and Sciences, identified funding and coordinated the many institutional elements. Gary Wilhelm was the university architect in charge of the renovation project. John Barradas of Downing, Barradas and Magre Architects masterminded the renovations. Anne Adesso worked long hours creating a beautiful interior design plan. We are thankful also to Jim Holley and the construction crew of Welliver and McGuire, David Newman, construction supervisor for Cornell, and Henry Crans, Director of Facilities for the Arts College, for their contributions to the success of our move. Mathematics Librarian, Steve Rockey, helped create a plan for the enlarged and improved library.

White Hall on moving day, June 1, 1999. Moving vans on the Arts quad load up 130 years of Math Department.

In addition, we owe a special thanks to the departmental support staff, Doug Alfors, Nora Balfour, Gayle Davis, Arletta Havlik, Joy Jones, Michelle Klinger, Donna Smith, Cathy Stevens and Bob Terrell, led by Colette Walls, all of whom worked tirelessly to ensure that the move went as smoothly as possible. They had an integral part in moving 150 department

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ROGER FARRELL RETIRES

By Gene Hwang

On September 25, 1999, the Departments of Mathematics and Statistics held the first conference since the move into Malott Hall this summer. The one-day conference honored Roger Farrell's lifelong involvement in Mathematics. It featured five talks delivered by distinguished speakers including Jim Berger (Duke University), Don Burkholder (University of Illinois), Larry Brown (University of Pennsylvania), Iain Johnstone (Stanford University), and Jim Hobert (University of Florida). The majority of the speakers began by commenting on the impact Roger Farrell has had on them both personally and professionally.

The evening celebrated Roger Farrell's life outside academia. The festivities began with a parade led by a Scottish bagpiper and a troupe of English and Scottish dancers, including Roger dressed in full Scottish regalia with kilt and sporran. Roger is an avid dancer, and attendees were treated to several demonstrations of Scottish and English dances, with Roger and his wife LeMoyne participating. Those unfamiliar with Roger's dancing were astounded. The reputation Roger acquired during his 40 years of service at Cornell as a shy mathematician has been broadened by this event.

After a buffet dinner, the entertainment resumed with dance demonstrations by several local dance groups. The swing dancers were the hit of the evening. The national award-winning Lindy Hop dancers, made up of a group of Ithaca high school students, also gave an outstanding demonstration. Many of our usually shy mathematicians were inspired enough to join in the jitterbugging. The conference and evening's entertainment were made successful and thoroughly enjoyable by Donna Smith's and LeMoyne Farrell's devoted efforts.

GOLDWIN SMITH PROFESSORSHIP

We're happy to announce that at the end of the Spring 1999 semester, Harry Kesten was elected Goldwin Smith Professor of Mathematics. The first Goldwin Smith professorships were established in 1912 in the fields of Latin, English literature, American history, political science and English. Since that time they have been awarded in a number of other fields, including mathematics. In 1989 the professorships were expanded from 11 to 15. These endowed professorships are awarded to distinguished Cornell faculty in the College of Arts and Sciences.

Professor Kesten works in probability theory. One of his main interests is percolation, a probabilistic model that is of interest in statistical physics because it is the simplest model that exhibits a phase transition. His study, *Hitting probabilities of single points for a process with independent increments,* is considered a work of seminal influence. Professor Kesten was also elected a fellow of the American Academy of Arts and Sciences during the 1998/1999 academic year.

REINVIGORATING THE MATH DEPARTMENT

By Rick Durrett

The National Science Foundation's VIGRE Program provides grants to math departments to broaden the training of undergraduates, graduate students, and postdoctoral fellows and to Vertically InteGrate their Research and Education. At the end of the last academic year, John Smillie organized a departmental effort to prepare a proposal. John and his co-principal investigators Lou Billera, Jose Escobar, and John Guckenheimer led the group effort to formulate our plans and write the 30 pages of prose needed to describe them. However, they were aided considerably in this process by Bob Strichartz, Steve Chase, Dan Barbasch, Tom Rishel, Keith Dennis, David Henderson and others who provided data about undergraduate and graduate research and teaching activities, and helped to formulate our proposed activities in this area and outreach to K-12 education.

As proposed, our VIGRE grant (pronounced 'vigor') is a five year multi-million dollar basket of goodies. Specifically, if the grant is funded, we will have a significant number of new three-year research postdocs, several dozen years of research support for graduate students, as well as significant new support for undergraduate research on pure and applied topics during the summer and in the academic year.

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MATH CLUB NEWS

By YiMin "Z" Wu

Professor Joan Birman of Columbia University came to Cornell to give the Math Club guest lecture on November 19, 1999. Her talk was entitled "Parametrizing Knots". Professor Birman is the recipient of a Guggenheim Fellowship, as well as the Chauvenet Prize given by the Mathematical Association of America. She is also respon ible for establishing the Ruth Lyttle Satter Prize in memory o her sister. This $4000 prize is warded every two years to recognize an outstanding contribution to mathematics research by women.

Birman proved to be an animated and amusing lecturer, filling her hour-long talk with concrete results from her research and challenging open questions at the end. Her talk was the most popular guest lecture sponsored by the Math Club to date, drawing a large audience that included faculty members, graduate students and undergraduates from various majors. Professor Graeme Bailey, a long time friend of Birman's, suggested the Math Club invite her to Cornell. Math Club president Daniel Ramras ('02) and Math Club faculty advisor Professor Ravi Ramakrishna then put in a lot of effort arranging for and organizing Professor Birman's visit and talk.

After the lecture, seventy-two students and faculty joined Professor Birman at the weekly Math "Language House" table for dinner in Risley Dining Hall. The Department is most grateful for this weekly gathering sponsored by the Faculty Fellow Program of Campus Life at Cornell for the past several years.

Also in Math Club news, in September members A. McCabe (00'), J. Barry (02') and Y. Wu (01') attended the third annual Columbia Practitioners Conference on the Mathematics of Finance at Columbia University in New York City. The aim of this conference is to bring together academics, practitioners and students to discuss questions of current interest, and to suggest open problems. Speakers for the conference came from finance/investment firms such as Goldman Sachs, J.P. Morgan, Merrill Lynch and Bear Stearns.

CIRCUS AT CORNELL

By Lars Wahlbin

In October 1999, the Finite Element Circus met at Cornell to discuss the latest developments in numerical approximation of partial differential equations, such as those occurring in engineering practice for which the Finite Element Method is the industry standard. The Finite Element Circus is a semi-annual event that originated in 1970. It travels from town to town, hence its name. It is indeed an informal gathering of researchers, as no advance notice is required to attend. The presentation time slots are allotted by dividing the number of people who wish to speak by the amount of time available, and the order of the speakers

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MERRILL SCHOLAR INSPIRED BY MATH PROFESSOR

Physics major Mukund Thattai was named a Merrill Presidential Scholar in May 1999. Merrill Presidential Scholars are graduating seniors who are honored for leadership and scholarship. As a tribute to the importance of teaching in shaping academic success, Merrill Scholars recognize those secondary school teachers who provided inspiration during their high school years. They also cite the Cornell faculty member who they feel has made the most significant contribution to their education. Thattai named John Hubbard as the faculty member who has had the most positive influence on his education at Cornell.

Over the course of a year, Thattai helped Professor Hubbard complete the paper, *The dynamics of the forced damped pendulum*, which appeared in American Mathematical Monthly in October of 1999. Hubbard had observed a particularly vexing case, where a basin changes from being 4-legged to being 3-legged, apparently without passing through any intermediate states. Thattai, after working with Hubbard, discovered how a ghost of a 3-legged basin can grow inside a 4-legged one like an unobserved parasite, and suddenly kill its host and take over. This turns out to be a previously unknown example of a "parabolic implosion," a phenomenon in complex dynamics which has occupied the experts for fifteen years.

1999 SPINOZA LECTURE GIVEN BY CORNELL MATH FACULTY

By Anil Nerode

The European Association for Logic, Language and Information invited Sergei Artemov to give the Spinoza Lecture of 1999. The Spinoza Lecture is an annual special lecture given by an outstanding scientist. This lecture was delivered in 1997 by Solomon Feferman (Stanford University) and in 1998 by Moshe Vardi (Rice University). Artemov, a visiting professor at Cornell, devoted his lecture "Understanding Constructive Semantics" to his recent solution of two well-known problems in mathematical logic.

The first problem is the Godel provability calculus problem that had remained open since 1933. Provability is a fundamental notion in mathematics and logic. Formal proofs and their structure were studied in details during the past century. On the other hand, there was no satisfactory theory of the provability operator known. Such a theory is necessary for expressing provability of sentences that themselves involve the notion of provability. In 1933, Godel introduced a logical calculus axiomatizing the basic laws of provability operator and used it to build a constructive semantics for intuitionistic logic. This calculus is now widely used in logic and applications. Godel noticed that the straightforward interpretation of this calculus was incompatible with his Second Incompleteness theorem. Since then, finding the mathematical model for the Godel provability calculus became one of the foremost open problems in logic. Numerous attempts to tackle this problem met serious technical difficulties.

In 1994-1998, Sergei Artemov found a complete solution to the Godel provability calculus problem. Artemov's results disclosed a hidden constructive content of provability. His solution is formulated in the elegant form of a system of proof polynomials representing all invariant constructive operations on proofs. It turned out that proof polynomials admit a concise formal description and provide an exact realization of all invariant properties of provability.

The second problem solved by Artemov's system of polynomials concerns the foundational question of whether intuitionism provides an alternative to classical mathematics or it is a definable part of the latter. Brouwer developed intuitionistic mathematics in the beginning of this century. A major component of intuitionism has been Brouwer's thesis that a statement is true if we have a proof of it, and false if we can show the assumption that there is a proof for the statement which leads to a contradiction. For example, the logical principle of excluded middle "P or not P" is not valid intuitionistically, since it is not the case that for any proposition P there is either a proof of P or a proof of "not P". This intended meaning of intuitionistic logic was elaborated in the early 1930's by the Brouwer-Heyting-Kolmogorov semantics that informally specifies intuitionistic logic via operations on proofs. Despite continuous efforts of leading researchers and many artificial interpretations proposed prior to Artemov's works, there were no sound semantics for propositional intuitionistic logic suggested which met the original Brouwer-Heyting-Kolmogorov requirements.

In his paper of 1933, Godel defined the propositional intuitionistic logic in his provability calculus. However, the ultimate goal of specifying intuitionistic logic via classical proofs had not been achieved because Godel's provability calculus was left without exact semantics. Artemov's solution of the Godel provability calculus problem provides a solution to the Brouwer-Heyting-Kolmogorov problem as well. From those results, it follows that intuitionistic propositional logic is indeed a definable fragment of classical mathematics that studies the provable properties of mathematical objects.

Artemov's work opens up new areas of research in proof theory, constructive and modal logics, lambda-calculus, automated deduction and formal verification, knowledge representation etc.

VISIT THE MATH DEPARTMENT WEB SITE:

http://math.cornell.edu/

Our home page offers links to the Annual Report, faculty and graduate student home pages, information on the grad and undergrad programs, seminars and courses. New links are added all the time.

RESEARCH EXPERIENCE FOR UNDERGRADUATES

The summer of 1999 marked the 6th year of the math department's Research Experience for Undergraduates Program. REU is an intensive 8-week program in which 10 of the brightest undergraduate math majors from around the country come to Cornell to work on research projects under the direction of Cornell faculty and visitors. The program is funded by the National Science Foundation, and the current grant continues through 2001. If the VIGRE proposal is funded, it will enable us to upgrade the REU Program. A new component of the program this summer was the inclusion of three high school teachers (funded by the Research Experience for Teachers program, a new NSF initiative.)

This is the first year the program was held in Malott Hall, and the students were enthusiastic about our new headquarters. Instead of complaints about the lack of air conditioning in White Hall, we were treated to complaints about too much air conditioning – you can't win them all! This year, all the students in the program were housed together in the Cayuga Lodge Cooperative. The students found this arrangement conducive to forming lasting friendships.

The areas of research for 1999 were:
1) Analysis on Fractals, directed by Robert Strichartz, with the assistance of Alexander Teplyaev, a recent Cornell Ph.D.
2) Complex dynamics, directed by Adam Epstein and John Hubbard, with the assistance of graduate student Suzanne Lynch.
3) Discrete Geometry, directed by Karoly Bezdek, a visitor from Eötrös University in Budapest.

The students working on analysis on fractals were continuing work that has engaged many REU students since 1996. The goal is to create a kind of calculus for functions whose domain is a fractal rather than a smooth space, to create a framework in which important scientific problems may be addresses. To begin the process we have been concentrating on certain very symmetric examples, such as the Sierpinski gasket. Two complementary goals are to extend our understanding as deeply as possible for these special examples, and to broaden the class of fractals as much as possible. Both goals were advanced during this summer's work. A notable achievement was the completion of a working finite element method to approximate solutions of fractal

SMORGASBORD SEMINAR

1999 Cornell REU Program

The Smorgasbord Seminar is part of the REU program which is open to the public. It is billed as 'a little taste of a lot of mathematics' and gives the REU participants a high level of exposure to math topics they may not yet have encountered in their education. The talks were given twice a week, and the speakers and topics follow:

Irena Peeva (Algebra) *Counting in Algebra*

Richard Shore (Logic) *Computable structures and their presentations*

Ravi Ramakrishna (Number Theory) *Fermat's last theorem*

Robert Strichartz (Analysis) *Hölder-Zygmund smoothness classes*

Lars Wahlbin (Numerical Analysis) *Some questions and answers in numerical analysis for differential equations*

Peter Kahn (Topology) *What is symplectic topology?*

Lou Billera (Combinatorics) *Combinatorics, Topology, and Evolutionary Biology*

John Hubbard (Dynamical Systems) *The KAM Theorem*

Rick Durrett (Probability) *Scaling limits of particle systems*

Karoly Bezdek (Geometry) *Sphere Packings*

Jose Escobar (Partial Differential Equations) *The Maximum Principle*

differential equations on the Sierpinski gasket, which may be found on the Web at: http://mathlab.cit.cornell.edu/~gibbons. An article describing the whole field was published in the November 1999 issue of the Notices of the AMS.

The students working on complex dynamics met together for the first few weeks to familiarize and offer a general understanding of the subject to the participants. Having established a foundation upon which to start their research, the participants broke off into groups to explore different problems. Scott Wilson made an extensive investigation of the family $M3$ where one critical point is periodic of period 3. Ben Wittner and Mary Rees have studied this family, but much of the structure is still mysterious. Scott located in particular a whole new family of "exotic hyperbolic components." Vicki Kowalski and Scott Corry started writing a program called *Medusa*, which computes parameter values for a class of rational functions called *captures*. This should become a major exploration tool for the entire field. Alex Raichev investigated "long ray connections." The question of whether there are arbitrary long ray connections has implications for the limiting behavior of matings, and locating such things is a delicate problem in combinatorics. Melkana Brakalova and Keith Hilles-Pilant investigated the family M4. This is largely unexplored territory, and even the algebraic problems are interesting. They discovered many new phenomena, including an unexpected approximate periodicity. Since all of the projects were related, participants working on different problems often helped one another out. This created a collaborative atmosphere that played a large part in the results of each participant.

The students working on discrete geometry were able to solve several problems involving bodies of constant width and sphere packings. For example, did you know that every convex body of constant width in 3-space may be illuminated by 6 directional sources? (Hint: illumination means that the light ray must hit the surface and enter the body, not just glance a corner point.) Do you know what the minimum diameter is for a convex polytope in d-space with vertices with edge lengths of at least 1? No one knows exactly, but it is now known to be at most 3 provided $n \geq d + \geq 4$. While such results are easy to state, they required considerable ingenuity to discover! One of the students also discovered an error in a much quoted paper of Bieberbach. It seems that Bieberbach merely stated that a proof he had given in the case of plane geometry also works in spherical geometry. Not so, it turns out, but Greg Blekherman, NYU, came up with a correct proof. Two of the students in this group have been invited to a conference in Budapest to discuss their work.

DURRETT RECEIVES FUNDING FOR DNA RESEARCH

For most of this decade, Rick Durrett's research has been focussed on the application of stochastic spatial models to problems that arise from problems in Ecology. Much of this work has been done with Simon Levin, who left Cornell for Princeton in 1992, and Rick Harrison, head of the Ecology and Evolutionary Biology Department. Three years ago, during the supervision of a Ph.D. thesis written by Semyon Kruglyak, Durrett met Chip Aquadro and became interested in his work on "microsatellites." These DNA repeat sequences have higher mutation rates than the rest of our DNA and are thus useful as genetic markers. Examples that have been in the headlines are "Thomas Jefferson fathered slave's last child," and the verification that Dolly the sheep was indeed a clone. Less famous, but perhaps more important, are their use as markers for locating genes, and for dating events associated with the movement of humans out of Africa and subsequent colonization of Europe and the Americas.

For the purposes just mentioned, one needs a model of how DNA repeat sequences evolve in time. In 1998 Kruglyak, Durrett, Aquadro, and postdoc Malcolm Schug introduced a new model that avoided some of the problems with the then standard "stepwise mutation model." It provided a good fit

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CORNELL STORMS POPULAR PRESS

Cornell Math Department members are constantly publishing technical articles in the leading mathematics research journals, intended for specialists. In recent months, they have also been publishing articles meant for a wider audience in the American Mathematical Monthly and the Notices of the AMS, two of the most widely distributed mathematics periodicals.

Robert S. Strichartz, *Analysis on Fractals*, Notices AMS, November 1999, 1199-1208. This article describes the construction and analysis of the analog of differential equations for functions defined on fractals. This is a new area of mathematics that is intended to create a framework for serious scientific applications, but it also fits in with the purely mathematical goal of extending the theory of analysis on manifolds to objects that are very rough. Much of the work described in this article was carried out in collaboration with undergraduates participating in our REU program. (See related article on page 6.)

Lou Billera, Ken Brown and Persi Diaconis have a recent paper, "*Random walks and plane arrangements in three dimensions*", in the American Mathematical Monthly, June-July 1999 issue. They describe recent work by Brown, Diaconis and others on random walks in hyperplane arrangements and show, in the case of dimension 3, that these walks have a surprisingly simple form for their limiting distribution. Such walks are of interest since they generalize well-known card-shuffling schemes. This and other applications are discussed in some detail. The article can be found in American Mathematical Monthly, Volume 106, no. 6, June-July 1999.

During the 1997-98 academic year, **John Guckenheimer** served as President of the Society for Industrial and Applied Mathematics, the primary professional organization for applied mathematics. One of his obligations as SIAM President was to give an address at the annual meeting following his term of office. A written version of this address was published in the October, 1999 SIAM News, "*Computer simulation and beyond—for the 21st century*", Notices AMS Oct 1998 (Vol 45 # 9) 1120 - 1123. In the address, he tried to weave together comments about scientific policy with reflections on problems that were particularly intriguing throughout his own career. SIAM volunteered to help the National Science Foundation investigate the topic of "uncertainty" related to simulations with a view towards future research programs or initiatives. As part of this effort, John Guckenheimer wrote a paper about the challenges that he sees in enhancing the use of simulation as a tool in science and engineering. The paper was published in the Notices of the American Mathematical Society as a "Forum" column. The outcome of SIAM's efforts to help the NSF plan future programs remains uncertain.

John Hubbard, *The dynamics of the forced damped pendulum*, American Math. Monthly, October, 1999. The forced pendulum has tremendously complicated dynamics, as this paper illustrates. It explores the motions of a forced pendulum, illustrating the amazing complication. It shows that you can choose an initial condition so that the pendulum will go through any prescribed sequence of gyrations. It also that the basins of attraction for attracting periodic motions can have the *Wada property*: any point in the boundary of one basin is in the boundary of all the others. So letting the pendulum loose near such a point is a gigantic roulette game, with all of infinitely many outcomes possible with arbitrarily small perturbations of the initial state. Hubbard has also collaborated with his wife, Barbara Burke Hubbard, on a calculus text. Vector Calculus, Linear Algebra, and Differential Forms: A Unified Approach (Prentice Hall) has earned praise for its original presentation of material usually taught in separate courses. The couple are in the process of completing a sequel.

Tom Rishel has published his second book, *A Handbook for Mathematics Teaching Assistants*, (MAA). The book is a natural extension of the extensive notes that Tom gave to participants in his national teaching assistant workshop at last summer's MAA Mathfest in Providence, RI. Rishel, who has been training TA's in the Cornell Mathematics department for twenty years, will also conduct a workshop for TA trainers at the joint AMS – MAA meetings in Washington, DC, this January.

(...Durrett Receives Funding, continued from p. 7)

to data from genetic databases on the abundance of microsatellites and to experimental work on their mutation rates. The math involved in the model is very simple. In principle, an undergraduate with knowledge of stochastic processes could have developed it. However, the model is useful because it provides more accurate predictions of properties of microsatellites.

In order to follow up on this work, Durrett and Aquadro submitted a proposal for a supplement to Aquadro's NIH grant under a program to foster the development of cross-disciplinary collaborations for the "study of complex biological systems." The grant was funded in the spring of 1999 and will provide teaching relief for Durrett during the next three years so that he can develop the background necessary to do research in this area.

(...Malott Hall Relocation, continued from p. 2)

members and their belongings from White Hall into Malott Hall. They provided much needed help and direction, coordinating the move for faculty members. Donna Smith, the graduate field coordinator, helped the graduate students. Duties for the staff included providing packing materials, disseminating information, coordinating details of the move, and directing the placement of furniture and boxes into the new offices. Graduate student representatives Leah Gold and Matthew Horak, with the assistance of Walker White, admirably managed the concerns and needs of their fellow grad students. Administrative manager Colette Walls coordinated the move, overseeing the staff effort and serving as liaison between the college, movers, interior designer, contractor and construction crews.

The moving of the department's computer room machines and network and their reinstallation Malott were coordinated and implemented by our computer support staff, Doug Alfors and Robert Terrell. Their considerable efforts and dedication to excellence resulted in a nearly flawless network conversion with minimal "down" time.

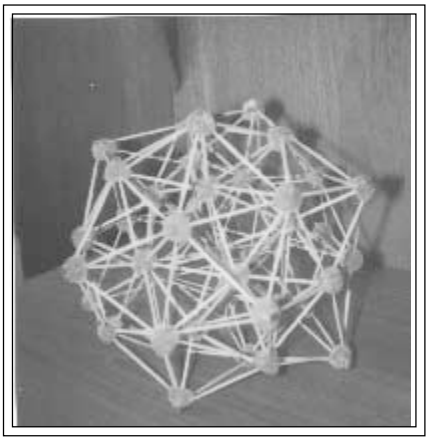
(Reinvigorating the Math Dept, continued from p. 3)

At this point the proposal has passed the first hurdle: a three-person team came to Cornell on November 2 for a one-day site visit. In the morning of that day, the eight writers of the grant mentioned above and newly appointed VIGRE coordinator, Rick Durrett, described the proposal and answered a number of questions sent to us by NSF. In the afternoon, the panel held closed-door meetings with current postdocs, graduates, and undergraduates to find out what they really thought about life at Cornell.

Based on the exit interview with the site panel we are cautiously optimistic that in late December we will get some good news from the National Science Foundation. If not, then we will be looking at our reviews and regrouping for the next round of competition in July 2000. We do not want the math department to miss out on this golden opportunity.

FRESHMEN WRITE PROGRAM TO DISPLAY SURFACE DEFINED BY EQUATION

Adam Barth, a freshman enrolled in Math 223, with help from classmate Joseph Palin, has been writing a program to display surfaces given by an equation f(x,y,z)=0. This requires a discretization of the surface, which might be done using a cubical decomposition of space. They built a model to illustrate this out of pumpkin-shaped gumdrops and toothpicks, shown below.



The model shows the failure of a "tetrahedral" decomposition of space.

If you try to add more gumdrops, you discover that the toothpicks are too long or too short. This illustrates the fact that you cannot pave space with regular tetrahedra.

COMINGS AND GOINGS...

Alexander Bendikov is a Visiting Professor from Mathematisches Institut, Universitaet Erlangen-Nuernberg. He will be with us at Cornell for the academic year 1999-00. His areas of interest are Potential Theory and Probability measures on algebraic structures. Prof. Bendikov graduated from Gorky University (Kharkov, Ukrain Republic), and has held the position of professor at both Rostov University and Erlangen-Nuernberg University.

Visiting Professor **Bill Dunbar** is on sabbatical this year from Simon's Rock College of Bard. He wrote his Ph.D. thesis on Euclidean 3-dimensional orbifolds in 1981, under Bill Thurston, and his interests remain centered in low-dimensional geometry and topology (broadly defined to include differential geometry, crystallography, geometric group theory, knot theory, and the geometry of deformation spaces). He is a devoted fan of Brazilian music, and still pines for the fresh-squeezed passion-fruit drinks that he drank at the street stands in Rio 15 years ago, during 8 months spent in Brazil as a visiting researcher. He still speaks Portuguese tolerably well, though it would be difficult to get him to admit as much.

Maria Fung is a Visiting Professor for 1999-00. She completed her Ph.D. at Cornell in August, under Dr. Birgit Speh. She is happy to remain at Cornell for one more year.

John Rosenthal is a Visiting Professor. He is on sabbatical leave from Ithaca College. His areas of interest include Logic, Computational Complexity, Asymptotic Methods in Combinatorics, among others. John's area of current research involves finding finite dimensional Steinitz Exchange Systems whose lattices of closed subsets code various noncomputable sets of integers. Also, asymptotic results on complexity of algorithms for Exact Satisfiability. He is also working with Diane Schwartz (Ithaca College) on an Applied Calculus text. John lives in Ithaca with his wife, and has two grown sons and one grandchild.

Ed Swartz is a Visiting Professor for the academic year. He received his Ph.D. from the University of Maryland, College Park in spring of 1998. As a long time resident of Connecticut and Rochester, spending the last 5 years in College Park, alias "the land that snow forgot," has left him eagerly anticipating winter in Ithaca. Ed's main fields of interest are geometry, topology and combinatorics. His current research centers on a connection between matoids and quotients of spheres. When not at work, Ed can occasionally be found at the bridge table or walking his pet ferret throughout campus.

Stephen Wirkus is a Visiting Professor in Spring, 2000. He was born and raised in Kansas City, MO, and received bachelor degrees in Math and Physics from the University of Missouri-Kansas City. He received his Ph.D. in Applied Math from Cornell University in August 1999; his thesis advisor was Richard Rand. Stephen's research interests are dynamical systems and mathematical biology. He co-directed the summer 1999 MTBI, Mathematical and Theoretical Biology Institute at Cornell University, for talented undergraduate minority students. Stephen is married to the former Erika Camacho, a graduate student in Cornell's Applied Math program.

Sumio Yamada is a Visiting Professor for 1999-2000. Originally from Japan, Sumio has been in the U.S. for 13 impressionable years, although this is the first year at Cornell. Sumio received a Ph.D. from Stanford in 1996, and has interests in geometric analysis, in particular harmonic maps and Teichmueller space.

Andrzej Zuk is a Visiting Professor for fall semester, 1999. His permanent residence is in Lyon, France, where he works at the Ecôle Normale Superieure, and holds a research CNRS position. He did his graduate studies in France in both Paris (Orsay) and in Toulouse. Andrzej's mathematical interests are geometric group theory, Kazhdan's property (T), harmonic analysis and random walks on groups. During his semester at Cornell, he is teaching a graduate course and presenting several talks at seminars related to his research. He is finding Cornell University an excellent place to do research and has begun some new research projects while here.

(...Circus at Cornell, continued from p. 4)

is determined by a lottery (formerly by drawing from a hat, now by computer). The Circus does have an interesting rule which is enforced: participants come to listen as well as to talk. You are not allowed to talk unless you stay for the whole conference. While the Circus has visited Cornell many times, this was the first time it was held in the Math department's new quarters. The organizers proudly showed off Malott Hall to their colleagues, and many envious comments were overheard, in particular about our Math Library.

About forty people attended the Circus at Cornell, and sixteen people spoke. These days, travelling to a two-day conference is a bit of an expensive hassle and to combat this the Circus has spawned an offspring, the Texas Finite Element Rodeo. Periodically, this meets in spite of distance; the Spring 2000 meeting will be a joint Circus-Rodeo down in Austin.

For more about the Circus, see http://www.math.psu.edu/dna/fecircus

NEW MATH FACULTY FELLOWS

Professors Buzzard and Ramakrishna were appointed this year to the Faculty Fellow Program at Cornell, and join current Fellows Professors Speh and Bailey. This program is sponsored by Campus Life, and is designed to bridge the gap between faculty and students by supporting interactions outside the classroom, often through shared meals and events. Each Fellow is 'attached' to a dormitory and have enthusiastic followings of students from all fields. More information at www.campuslife.cornell.edu

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