Kontsevich and Witten Receive 2008 Crafoord Prize in Mathematics

The Royal Swedish Academy of Sciences has announced the recipients of the Crafoord Prize in Mathematics and Astronomy 2008.

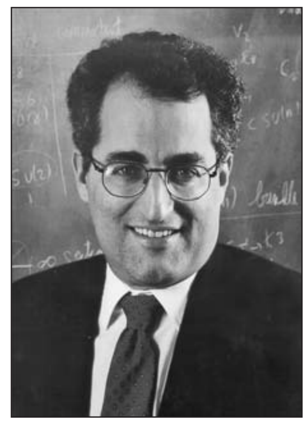
The mathematics portion of the prize is awarded jointly to MAXIM KONTSEVICH, Institut des Hautes Études Scientifiques, Bures-sur-Yvette, France, and EDWARD WITTEN, Institute for Advanced Study, Princeton, NJ. The two were cited "for their important contributions to mathematics inspired by modern theoretical physics".

The laureates in mathematics have used the methodology of physics to develop a revolutionary new mathematics intended for the study of various types of geometrical objects. Their work is not only of great interest in the discipline of mathematics but may also find applications in totally different areas. Its results are of considerable value for physics and research into the fundamental laws of nature. According to string theory, which is an ambitious attempt to formulate a theory for all the natural forces, the smallest particles of which the universe is composed are vibrating strings. This theory predicts the existence of additional dimensions and requires very advanced mathematics. The laureates have resolved several important mathematical problems related to string theory and have in this way paved the way for its further development.

Maxim Kontsevich was born in 1964 in Khimki, Russia. He received his Ph.D. in mathematics in 1992 at the University of Bonn. He is a professor at the Institut des Hautes Études Scientifiques. He received the Fields Medal in 1998.

Edward Witten was born in 1951 in Baltimore, MD. He received his Ph.D. in physics in 1976 from Princeton University. He is the Charles Simonyi Professor in the School of Natural Sciences at the Institute for Advanced Study in Princeton. He received the Fields Medal in 1990.

Maxim Kontsevich



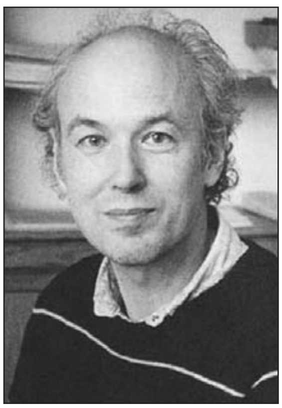
Edward Witten

The amount of this year's Crafoord Prize is US$500,000. Kontsevich and Witten are awarded one half, and the other half is awarded to Rashid Sunyaev, an astrophysicist who is receiving the astronomy prize. The prize-awarding ceremony will take place at the Academy in Stockholm on April 23, 2008, in the presence of His Majesty the King.

The Royal Swedish Academy of Sciences, founded in 1739, is an independent organization whose overall objective is to promote the sciences and strengthen their influence in society. Traditionally, the Academy takes special responsibility for the natural sciences and mathematics.

—From a news release of the Royal Swedish Academy of Sciences

Deligne, Griffiths, and Mumford Receive 2008 Wolf Prize



Pierre R. Deligne

Phillip A. Griffiths

David B. Mumford

The 2008 Wolf Prize in Mathematics has been awarded jointly to three individuals:

> PIERRE R. DELIGNE, Institute for Advanced Study, Princeton, "for his work on mixed Hodge theory; the Weil conjectures; the Riemann-Hilbert correspondence; and for his contributions to arithmetic";
>
> PHILLIP A. GRIFFITHS, Institute for Advanced Study, Princeton, "for his work on variations of Hodge structures, the theory of periods of abelian integrals, and for his contributions to complex differential geometry"; and
>
> DAVID B. MUMFORD, Brown University, "for his work on algebraic surfaces; on geometric invariant theory; and for laying the foundations of the modern algebraic theory of moduli of curves and theta functions."

The US$100,000 prize will be presented by the president of the State of Israel in a ceremony at the Knesset (parliament) in Jerusalem on May 25, 2008. The list of previous recipients of the Wolf Prize in Mathematics is available on the website of the Wolf Foundation, `http://www.wolffund.org.il`.

Description of Prizewinners' Work

The following description of the work of Deligne, Griffiths, and Mumford was prepared by the Wolf Foundation.

Central to modern algebraic geometry is the theory of moduli, i.e., variation of algebraic or analytic structure. This theory was traditionally mysterious and problematic. In critical special cases, i.e., curves, it made sense, i.e., the set of curves of genus greater than one had a natural algebraic structure. In dimensions greater than one, there was some sort of structure locally, but globally everything remained mysterious. The two main (and closely related) approaches to moduli were invariant theory on the one hand and periods of abelian integrals on the other. This key problem was tackled and greatly elucidated by Deligne, Griffiths, and Mumford.

David B. Mumford revolutionized the algebraic approach through invariant theory, which he renamed "geometric invariant theory". With this approach, he provided a complicated prescription for the construction of moduli in the algebraic case. As one application he proved that there is a set of equations defining the space of curves, with integer coefficients. Most important, Mumford showed that moduli spaces, though often very complicated, exist except for what, after his work, are well-understood exceptions. This framework is critical for the work by Griffiths and Deligne. Classically, the moduli space of curves was parameterized by using periods of the abelian integrals on them. Mathematicians, e.g., the Wolf Prize winner André

Weil, have unsuccessfully tried to generalize the periods to higher dimensions.

Phillip A. Griffiths had the fundamental insight that the Hodge filtration measured against the integer homology generalizes the classical periods of integrals. Moreover, he realized that the period mapping had a natural generalization as a map into a classifying space for variations of Hodge structure, with a new non-classical restriction imposed by the Kodaira-Spencer class action. This led to a great deal of work in complex differential geometry, e.g., his basic work with Deligne, John Morgan, and Dennis Sullivan on rational homotopy theory of compact Kähler manifolds.

Building on Mumford's and Griffiths' work, Pierre R. Deligne demonstrated how to extend the variation of Hodge theory to singular varieties. This advance, called mixed Hodge theory, allowed explicit calculation on the singular compactification of moduli spaces that came up in Mumford's geometric invariant theory, which is called the Deligne-Mumford compactification. These ideas assisted Deligne in proving several other major results, e.g., the Riemann-Hilbert correspondence and the Weil conjectures.

Biographical Sketches

Pierre R. Deligne was born in 1944 in Belgium. Starting in 1967, he was a visitor at the Institut des Hautes Études Scientifiques, where he worked with Alexander Grothendieck. Deligne received his *doctorat en mathématiques* in 1968 and his *doctorat d'état des sciences* in 1972, from the Université de Paris-Sud. He was a professor at the IHÉS from 1970 until 1984, when he took his current position as a professor at the Institute for Advanced Study in Princeton. Deligne received the Fields Medal in 1978, the Crafoord Prize in 1988, and the Balzan Prize in 2004.

Phillip A. Griffiths was born in the United States in 1938. He received his Ph.D. from Princeton University in 1962 under the direction of Donald Spencer. Griffiths has held positions at University of California, Berkeley (1962–1967), Princeton University (1967–1972), Harvard University (1972–1983), Duke University (1983–1991), and the Institute for Advanced Study (1991 to the present), where he was director until 2003. He received the AMS Steele Prize in 1971.

David Mumford was born in England in 1937 but grew up in the United States from 1940 on. He was an undergraduate and graduate student at Harvard University, where he received his Ph.D. in 1961, under the direction of Oscar Zariski. Mumford was on the faculty at Harvard until 1996, when he moved to Division of Applied Mathematics at Brown University. He received the Fields Medal in 1974 and the AMS Steele Prize in 2007.

—Allyn Jackson

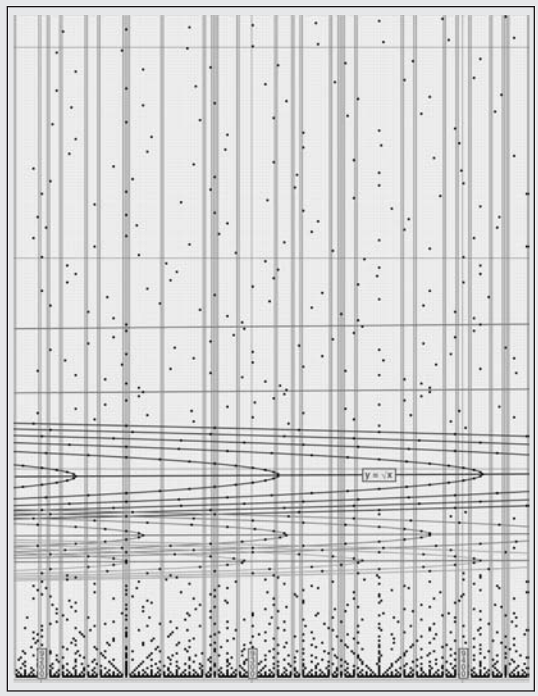
About the Cover

Patterns of factorization

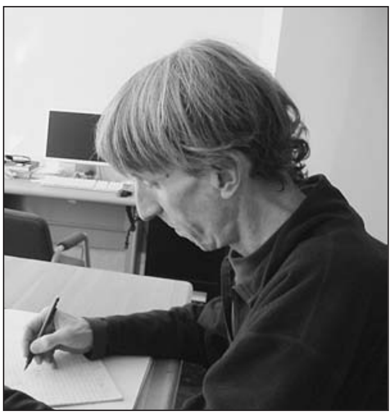
This month's cover is derived from David N. Cox's article on the arithmetic sieve. The pixels in the column above *n* are at heights equal to the divisors of *n*. The primes are characterized in this figure by yellow columns.

Clues in the cover image ought to help in figuring out the origin of the parabolas Cox observes. Various other views of Cox's factorization images will bring to light other interesting patterns, but none seem to involve deep number theory. What's astonishing is how good the human eye is at perceiving regular patterns in a noisy background.

—Bill Casselman, Graphics Editor
(notices-covers@ams.org)



Taubes Receives NAS Award in Mathematics



Clifford H. Taubes

Clifford H. Taubes has received the 2008 NAS Award in Mathematics from the National Academy of Sciences. He was honored "for groundbreaking work relating to Seiberg-Witten and Gromov-Witten invariants of symplectic 4-manifolds, and his proof of the Weinstein conjecture for all contact 3-manifolds."

The NAS Award in Mathematics was established by the AMS in commemoration of its centennial, which was celebrated in 1988. The award is presented every four years in recognition of excellence in research in the mathematical sciences published within the past ten years. The award carries a cash prize of US$5,000. Previous recipients are Robert P. Langlands (1988), Robert MacPherson (1992), Andrew J. Wiles (1996), Ingrid Daubechies (2000), and Dan Virgil Voiculescu (2004).

The Work of Clifford Taubes

The *Notices* asked D. Kotschick, Ludwig-Maximilians-Universität München, and T. S. Mrowka, Massachusetts Institute of Technology, to comment on the work of Taubes. They responded:

"By his own account, Cliff Taubes would like to be considered a topologist. Ignoring this wish, most of his colleagues see him as a great geometric analyst, whose work has had a profound impact on geometry, topology and mathematical physics.

"Starting out in mathematics with a physics background, Taubes did some of the early foundational work in mathematical gauge theory studying vortices and Bogomolny monopoles and building up a substantial existence theory for the self-dual Yang-Mills, or instanton, equations on four-manifolds. The latter was, of course, crucial in Donaldson's celebrated application of gauge theory to four-dimensional differential topology. Taubes himself proved the existence of uncountably many exotic differentiable structures on R^4; he reinterpreted Casson's invariant in terms of gauge theory and proved a homotopy approximation theorem for Yang-Mills moduli spaces. Taubes also proved a powerful existence theorem for anti-self-dual conformal structures on four-manifolds.

"When Witten proposed the study of the so-called Seiberg-Witten equations in 1994, Cliff Taubes was one of the handful of mathematicians who quickly worked out the basics of the theory and launched it on its meteoric path. From an analyst's point of view, the quasi-linear Seiberg-Witten equations may seem rather mundane, at least when compared to the challenges offered up by the Yang-Mills equations. True to this spirit, Taubes announced at the time that he would never again write a paper more than twenty pages long. Of course, this resolution lasted only for about six months! After that, Taubes wrote a whole series of deep, technical, and very long papers that became known by the slogan 'Seiberg-Witten = Gromov'. These papers establish the most profound results known to this day about the Seiberg-Witten equations, linking their solutions on symplectic four-manifolds to Gromov's pseudo-holomorphic curve theory in a very precise way.

"Taubes's work on the Seiberg-Witten equations remains one of the cornerstones underpinning the current very productive symbiosis between symplectic geometry and low-dimensional topology. Nevertheless, it was a shock to many when Taubes knocked off one of the holy grails of symplectic topology last year. The Weinstein conjecture predicts the existence of periodic orbits for the Reeb flows of arbitrary contact forms on closed three-manifolds. Many special cases had been proved by a variety of methods from symplectic geometry, and a proof of the full conjecture was one of the ultimate goals of symplectic field theory. However, Taubes's proof follows a rather different line, using gauge theory and deploying a strategy similar to his work on 'Seiberg-Witten = Gromov'. The proof also hinges on a novel estimate for the spectral flow of a family of Dirac-type operators.

"It is in the nature of Cliff Taubes's work that his papers are not usually short or easy to read. Rather they are difficult and original, and technically demanding by necessity. His faithful readers take comfort in the knowledge that Cliff is at least as hard on himself as he is on the readers, and they appreciate his very personal style peppered with what they affectionately refer to as 'Cliffisms'."

Biographical Sketch

Clifford Taubes grew up in Rochester, New York. After his undergraduate education at Cornell University, he received a Ph.D. in physics from Harvard University in 1980. After a Harvard Junior Fellowship, taken in the mathematics department at Harvard, he taught for two years at the University of California, Berkeley. Since 1985 he has been at Harvard, where he is the William Petschek Professor of Mathematics. He received the AMS Veblen Prize (1991) and the Élie Cartan Prize of the French Mathematical Society. He is a member of both the American Academy of Arts and Sciences and of the National Academy of Sciences.

—Allyn Jackson

2008 Award for an Exemplary Program or Achievement in a Mathematics Department

The Award for an Exemplary Program or Achievement in a Mathematics Department was established by the AMS Council in 2004 and was given for the first time in 2006. The purpose is to recognize a department that has distinguished itself by undertaking an unusual or particularly effective program of value to the mathematics community, internally or in relation to the rest of society. Departments of mathematical sciences in North America that offer at least a bachelor's degree in mathematical sciences are eligible. The award carries a cash prize of US$1,200 and is given annually.

The award is presented by the AMS Council acting on the recommendation of a selection committee. For the 2008 award, the members of the selection committee were: Steven A. Bleiler, Joel B. Brawley, Karl Knight (chair), Donal B. O'Shea, and Roger A. Wiegand.

The previous recipients of the award are Harvey Mudd College (2006) and the University of California, Los Angeles (2007).

The recipient of the 2008 Award for an Exemplary Program or Achievement in a Mathematics Department is the THE MATHEMATICS DEPARTMENT AT THE UNIVERSITY OF IOWA. What follows is the selection committee's citation.

Citation

The American Mathematical Society (AMS) presents its third annual Award for an Exemplary Program or Achievement in a Mathematics Department to the University of Iowa. The Mathematics Department at the University of Iowa is a national leader in recruiting and developing underrepresented U.S. minority doctoral students in mathematics. The department has accomplished this by devising a model for recruiting and developing U.S. minority doctoral students that could be used at other institutions.

The department's long-term commitment to graduate education in mathematics for students from underrepresented minority groups began in 1995 and has continued with support from several Department of Education grants. African American, Latina/o, and Native American U.S. citizens or permanent residents accounted for 20–25 percent of the department's graduate student population over the six-year period ending in 2005. This is an especially impressive percentage, given Iowa's demographics, and is currently among the highest at U.S. majority institutions.

The department's recruitment effort is supported by a carefully designed program that includes an intensive summer institute, weekly help sessions, and intensive faculty and peer mentoring. The program is open to majority students as well and, as often happens with well-designed programs developed for particular groups, has raised the level of educational achievement for all students. It has also made an impressive difference on a national level. The three minority students that received their Ph.D.'s in the department in 2002–2003 represented roughly 10 percent of the math doctorates awarded nationally to U.S. minority students during that year.

Members of the University of Iowa's Mathematics Department have willingly shared their methods with other departments at invited talks and conferences, including a session at a national AMS meeting and at a conference at NSF [National Science Foundation]. Furthermore, the department has established partnerships with other institutions in the United States and abroad that support the goal of increasing minority participation in mathematics. For example, the University of Iowa Mathematics Department has worked with the Department of Mathematics at Florida A&M University to build a partnership called the Alliance for the Production of African American Ph.D.'s in the Mathematical Sciences, supported by a US$1.8 million NSF grant, with the goal of providing a seamless transition for graduates of Alliance undergraduate institutions who wish to study at majority Ph.D. institutions.

The mathematics community is fortunate to have the University of Iowa present such an outstanding example of an exemplary program in a mathematics department.

University of Iowa Wins Exemplary Program Award

Allyn Jackson

> *We are happy to get the awards, but we are even happier to watch the students get Ph.D.'s.*
>
> —*Philip Kutzko*

In the mid-1990s, the mathematics department at the University of Iowa decided to apply for a large government grant to support fellowships for graduate students. The aim was to use the grant to recruit students from minority groups that are underrepresented in mathematics. Eight such students came. Some did well, others less well. One finished a doctorate in the department; others had new doors opened to them: One ended up getting an MBA, and another earned a Ph.D. in computer science. But the department did not stop there. Rather, faculty members got to know the students and tried to understand the factors behind their achievements and setbacks. The experience of bringing in those eight students put the department on a new path. "What happened as a result of that first year or two is, we began to change as a department," says Iowa faculty member Philip Kutzko. "It's a bit funny to say it this way, but we started to become a little less white."

Nowadays if you ask members of the Iowa department about their minority students, they can hardly stop rattling off the success stories. There is Juan Ariel Ortiz, who came from the University of Puerto Rico at Humacao, fell in love with topology, and is now a postdoc at the University of Rochester. There is Sara del Valle, who was a recent immigrant from Mexico with limited English skills but tremendous intelligence, and who now holds a Ph.D. and is on the permanent faculty at Los Alamos National Laboratory. Among the current students is Paulette Willis, an African-American from New Orleans whom Kutzko says is one of the strongest students in the department. Willis has passed all of her exams and is now working on her dissertation under the direction of Paul Muhly. Although clearly on track to a successful research career, she is still sometimes beset by anxieties that stem from having so few role models. "I have never seen any black people do this," she told Kutzko.

Over the years, the Iowa department has listened carefully to its students and has observed closely their successes and failures. The department has used this knowledge to rejuvenate its graduate program, making it a place where students of all colors can thrive. The department has received several awards for its success in recruiting minority students, including the 2004 Presidential Award for Science and Engineering Mentoring and designation as a "Program that Makes a Difference" by the AMS Committee on the Profession. This year, the Iowa department was chosen for the AMS Award for Exemplary Program or Achievement by a Mathematics Department.

Mentoring is Key to Success

> *It's an attitude of, "It's our job to make sure everybody succeeds," as opposed to, "It's our job to find out who the best students are."*
>
> —*David Manderscheid*

Over the past decade, the University of Iowa mathematics department produced about 1 percent of the total number of doctorates granted in the U.S., and about 4 percent of those granted to students who are members of underrepresented minorities. During that time, twelve minority students received Ph.D.'s at Iowa. Today about a quarter of the department's approximately 115 graduate students are minority, and about 40 percent are women. Because the department's retention rate has risen so much in recent years, more success stories are surely on the way. Before the minority recruitment initiative, the Iowa graduate student population was dominated by international students. Today, the majority are American.

The commitment that the department made to the minority students who started arriving in substantial numbers in the mid-1990s inspired a transformation of the department's basic philosophy. As department chair Yi Li explains it, "The old business-as-usual would be: Okay, you come to our program, that's it. If you study and you do well, that's okay; if you don't do well, you leave." At Iowa, this you're-on-your-own, sink-or-swim attitude has been replaced by one that puts student success as the top priority. With this student-centered attitude has also come a new spirit of inquiry that has allowed the department to analyze critically its graduate program to address trouble spots and make changes.

One of the most important changes has been the institution of a mentoring program. Every new student is assigned, or is allowed to choose, a mentor from among the department's faculty. The mentor is usually a person different from the thesis advisor—someone with whom the student can discuss a wide range of problems, from difficulties fitting in with other students, to lack of background in a particular mathematical area. "Having seen the impact and having seen what a broad change it brought to our program, I am a firm believer of mentoring early and in time," says Li. He noted that it is particularly important that students have a mentor from the very beginning of their graduate studies, so that problems are not left to fester. Many students come from smaller schools where the instruction in mathematics was not as rigorous as in a Ph.D. department like the one at Iowa, and the change can be a shock even for highly talented and motivated students. Proper guidance in the early stages can make a big difference.

After each midterm examination in the first-year graduate courses, the results are sent to the department's Graduate Committee, which identifies students who seem to be struggling. That information is then passed along to the mentors, who talk to the students about what might have caused poor performance on the exams. "We are trying to help the students as much as we can and to find out, if they are not performing, what the problem is," explains Li. "There may be a cultural problem, maybe homesickness, other personal problems, or language problems." The mentors also try to determine if some part of the student's mathematical background is lacking or needs shoring up. In addition, the mentoring system helps build support for the minority program across the whole department: Helping the students they mentor succeed has built faculty members' loyalty to the program. Says Li, "We all see that this is a great thing for the department, for the students, and for the educational purpose."

Building Community

> *Iowa is largely a white population…so for a minority student to be at Iowa, isolated, would be very difficult. We try to build a community so that they feel at ease, at home, so they have a sense of belonging.*
>
> —*Yi Li*

One of the hallmarks of the Iowa department is the strong sense of community that has developed, and this happened in large part as a result of the minority program. "Before we started bringing in minority students, the graduate students were not a very cohesive group," says faculty member Juan Gatica. "They didn't work together; they kept pretty much to themselves. When we started bringing in minority students, we asked them to get together and have study groups, and the non-minority students started participating in this too. It was a surprise that this became a big movement in the department and transformed it in many ways." There are now study groups for algebra, analysis, topology, and other topics, as well as exam-preparation study groups.

Another strategy to build community sounds mundane but made a big difference: Replacing the worn-out 1970s vinyl furniture in the department lounge. "I think one of the most brilliant things I did as department chair was getting new furniture for our lounge," says David Manderscheid, who was on the faculty at Iowa for twenty years before taking a position as the dean of the College of Arts & Sciences at the University of Nebraska in 2007. "It sounds sort of silly, and my dean thought it was sort of silly when I proposed it to her. But I really pushed it. It made the lounge a comfortable place for the students and faculty to hang out." The lounge is now the heart of the department, where faculty and students can meet informally and where coffee and cookies are served every afternoon. The department used to keep the lounge open only until 5 p.m. but now keeps it open until 11 p.m., as a way of encouraging students to gather and study together. On the way home in the evening, faculty often pass through the lounge and stop to talk to the students or to help with mathematical questions.

Also reinforcing a cohesive community among the students are recent changes to the graduate program. When the department decided to apply for a VIGRE (Vertically Integrated Research and Education) grant from the National Science Foundation, it gave a lot of thought to the VIGRE requirement that departments get students involved in research early on in their graduate studies. What emerged, along with a successful proposal, was a new structure for the graduate program. Previously, students took a couple of years' worth of graduate courses with the aim of passing the comprehensive examination as the gateway to starting research. Now, all students now must take a standard set of first-year graduate courses in analysis, topology, and differential equations, and in either algebra or numerical analysis. If students are not prepared to jump into these courses right away, they can take undergraduate-level courses to build the necessary background. Once finished with the first-year courses, students must take a qualifying examination on the material covered. After that they can start doing reading courses with an advisor, take advanced graduate courses, and prepare for the comprehensive examination. This new structure, with its clearer timetable, gets students into research more quickly.

Having students take all the first-year courses together has reinforced the community bonds. "They know each other much better because they are all taking these core courses, they study together, they help each other, they lecture to each other," says Li. "You will see them standing in front of blackboards, teaching each other. They develop a very active semi-research activity already" in their initial studies. In addition, students rose to the challenge of the new and tougher degree requirements. "People were concerned" about this change, says Manderscheid. "Would it have a negative impact on our minority students?" In fact the opposite happened: Students did better under the new system, in which expectations and milestones are clearly laid out. "Students were getting more feedback more quickly, and they loved it," notes Manderscheid.

In another innovative twist, the department started hiring third- and fourth-year graduate students to be teaching assistants in recitation sections in the first-year graduate courses. Not only does the extra instruction help the students, but the TAs serve as peer mentors to the younger students, further enhancing the sense of community in the department. The Iowa faculty are quick to point out that the changes inspired by the minority program have boosted the success of all students, minority, majority, and international. "These programs are always designed for the benefit of all of our students," says Manderscheid.

Developing a Path into Mathematics

> *I remember one of our faculty members was slow to become involved in our initiative. Then he mentored during our summer program, and I remember him getting up and saying at the closing ceremonies, to all of these mostly African-American kids, "I want to thank you for reminding me why I came into this profession."*
>
> *—Philip Kutzko*

The department has several ways of opening paths into graduate study in mathematics. One is its NSF-funded Alliance program, a collaborative effort of the mathematical sciences departments at the University of Iowa, Iowa State University, and the University of Northern Iowa, together with the mathematics departments at fifteen to twenty minority-serving institutions around the nation. Through the Alliance, students at the minority-serving schools are mentored by local faculty and by faculty in Iowa, and they also can attend the summer Research Experiences for Undergraduates program run by the three Iowa schools. The University of Iowa department also has the Heartland Partnership program, which has a structure similar to the Alliance and serves twelve small colleges in Iowa and surrounding states. Finally, the department's VIGRE grant supports undergraduates attending the summertime REU. In addition to giving undergraduate math majors a taste of research, these programs cultivate a diverse talent pool that is on track to graduate school in mathematics, whether at the University of Iowa or elsewhere.

When minority students apply to graduate school at Iowa, their applications are carefully studied by the department's Minority Recruitment and Development Committee, currently chaired by Gatica. This committee has over the years gained a lot of experience and skill in identifying students who have the potential to succeed in the graduate program. Picking students "is a hard job, and we are getting pretty good at that now," says Kutzko. "There are students who we know won't fit standard profiles but who we are pretty sure are going to succeed." Since the department has developed a reputation as a place with a supportive environment in which students flourish, it has started to receive applications from students with very strong backgrounds who would be able to get into the top schools in the country. While this is a clear boon for the department, the Minority Committee does not choose to take the easy path. Says Kutzko, "If we start resting on our laurels now and only accept black and Latino kids from elite institutions, because they want to come to graduate school at a comfortable place, we are not going to accomplish what our ultimate goal is, which is to change the population who do mathematics." The department wants to remain a place where high-potential students with non-standard backgrounds are welcome and can excel.

With the success of its minority program, the department has found its esteem rising within the university. It has also helped other departments on campus to launch recruitment programs of their own. The national recognition the department has garnered has opened the door for collaborations with other mathematics departments interested in enhancing the achievement of minority students.

It has also helped the department to attract high-quality faculty members. For example, the department recently hired Julianna Tymoczko, who earned a Ph.D. from Princeton in 2003. She was a Clay Mathematics Institute Liftoff Fellow as well as an NSF Postdoctoral Fellow. Says Manderscheid, "The fact that Iowa has this very active, vibrant graduate program that is doing things differently I think made the difference" to Tymoczko in deciding where to take a permanent job.

A Harmonious Department

> *The opportunity that this department has afforded me [to work in the minority program] has been invaluable. It has transformed my life and given me great satisfaction.*
>
> —*Juan Gatica*

One perhaps surprising fact about the faculty in the Iowa mathematics department is that it does not have a large minority presence: Less than 10 percent, three out of forty, are members of underrepresented minorities. Furthermore, the Iowa minority program has not been based on the model of a single charismatic figure who serves as a magnet for students. Rather, it has been a communal effort of the department—and the whole department has benefited. "This was a place that had its political troubles before we started doing this," says Kutzko. "I think now we are a department that has a harmony to it that is very, very rare."

For the faculty who have been directly involved in the minority program, the personal satisfaction has been enormous. "It's energizing," says Manderscheid. "It made me enthused. It made me want to come to work every day! Because I saw what great things we were doing, and I saw how we were giving opportunities to students who wouldn't go to graduate school otherwise."