



Mathematics department newsletter

San Francisco
State University
Fall 2007

College of Science & Engineering

The Chair Act

It has been a pleasure serving as the acting chair of the department during the past academic year. Besides affording an



opportunity to work more closely with many of my colleagues, I have gotten to interact with many students outside the classroom. (Though teaching one class each semester helped me maintain perspective and sanity.) As all students know, time flies when you are learning on the job. So looking back, the past year from the first day of classes to our potluck department graduation party has been a pleasant blur, but one feature stands out clearly: the gender gap among this year's graduates. Thirteen of the nineteen bachelor's degrees and seven of thirteen master's degrees in mathematics went to women. Moreover, women dominated the top tier of their classes. Four graduated with honors and two received Graduate Student Distinguished Achievement Awards. Among the women earning MA degrees, two have accepted plum tenure track positions at local community colleges and three are bound for Ph.D. programs in mathematics. So who says that men have the edge over women in mathematics?

Eric Hayashi

From Then Till Now

Hello! This is the first Department newsletter since our Spring 2003 issue. Instead of a traditional "Report from the Chair" you're reading this column, from the newsletter editor. Our chairmanship has been a major preoccupation of the Department this year, as you'll see.

That previous Report came from David Meredith, who had become our Chair in 2002, when his predecessor, Sheldon Axler, became Dean of the College of Science and Engineering. Meredith guided many of the developments reported in this issue. During that time he served in our Academic Senate, and in Spring 2006 accepted nomination for election to its chairmanship, a full-time position. Meredith has for decades been deeply concerned with shared governance of the University, and with relations between our College and the other faculties. Of course, he was elected. Meredith indicated that he would return to teach in the Department after his term in the Senate.

Prof. Eric Hayashi accepted the acting chairmanship of our Department. His preoccupation would be the selection of a permanent chair: he would not be a candidate. Axler agreed that an external search should be conducted. (He had come here in 1997 as the result of a chair search.) He persuaded the higher administration, ads were placed, applications arrived during Fall 2006, and our Search Committee selected five finalists for February interviews. These occupied virtually 100% of faculty time outside classes that month. Afterward, the University extended an offer, and a month later it was accepted. Along with all these distractions, Hayashi has kept our Department running efficiently and gracefully.

Our next chair, Dr. David Bao, will assume the office at the beginning of Fall 2007. He earned the BS in mathematics from Notre Dame in 1976, and the PhD in differential geometry from UC Berkeley in 1983. Since 1985 he has been a member of the mathematics faculty at the University of Houston. Bao is a specialist in Finsler geometry and author of many research

papers and coauthor of a recent monograph on this subject. He has vast experience serving his current university and department and the mathematics profession. We salute him and eagerly await his arrival!

This editor queried Meredith and Hayashi about significant news to incorporate in lieu of a chair's report. You'll see that as you read along. A paragraph from Meredith is especially appropriate:

"Finally, many of the recipients of [the previous] newsletter also received a request for donations I want to thank all who responded. The money raised has enabled the Department to start a Student Project Fund to pay for equipment and travel in support of student research. One student was sent to the AMS meeting in Phoenix, and some received honoraria for participating in the Student Project Showcase held every spring in the College of Science and Engineering."

You'll find in this issue an insert with a message from Dr. Tendai Chitewere, College of Science and Engineering Relations Officer, concerning the needs of our Department. I urge you to consider it seriously after reading here about current achievements of our students and faculty.

The editor acknowledges the assistance of Prof. Anne Krause in constructing this newsletter.

James T. Smith,
MA 1964
Professor and Editor





Biomathematics at SFSU

Biomathematics

has exploded at SFSU. In past decades, Profs. David Ellis and David Meredith collaborated in biomathematics projects that involved a few of our applied mathematics majors, but there was little close connection with biology faculty. The recent vast growths of quantitative methods in biology have brought mathematical and biological scientists closer together.

The research of some of our younger mathematics faculty involves techniques whose application to biological problems has only recently come to light. These areas—for example, algebraic geometry, combinatorics, Fourier analysis, graph theory, and topology—can be applied in studying DNA structure and genome evolution and to the ultra-large-scale data analysis problems that now arise in statistical applications in biology.

A major step was an NSF Undergraduate Biology Mathematics Collaboration (UBM) grant awarded to Prof. Edward Connor, an ecologist in our Biology Department who worked with Ellis and Meredith. This established a Mentoring Program that has supported several students pursuing our BS degree, fostering their hands-on participation in both biological and mathematical research.

In 2005 the Department hired a team of biomathematicians: Javier Arsuaga and Mariel Vazquez. They had earned PhDs from Florida State on topological knot theory applied

to DNA biology, and had held research positions at UC Berkeley and UCSF. Their earlier educations were in Spain and Mexico, respectively.

All these preparations—collaboration, fundraising, hiring—are now bearing fruit.

Arsuaga, Trevor Blackstone, and three others have co-authored a paper to appear in the *Journal of Physics*. Blackstone is an SFSU undergraduate. They derive an estimate for the probability that a given closed 3D polygon P should be linked with a random one in a specified box, and present numerical evidence to support an estimate to hold when both polygons are random. These results apply to both the study of polymer structure and DNA biology.

During Spring 2007, Arsuaga and Vazquez jointly taught three undergraduate and graduate biomathematics courses featuring application of mathematical and computational methods to the study of DNA structure and chromosome organization—for example, use of White's knot-theory formula to study DNA super-coiling. They actively mentor both undergraduates and graduate students in related research.

One of the UBM students, Jameson Cahill, completed a research project with Prof. Shidong Li, investigating possible applications of wavelets (closely related to Fourier series) to decide whether species occur together in an



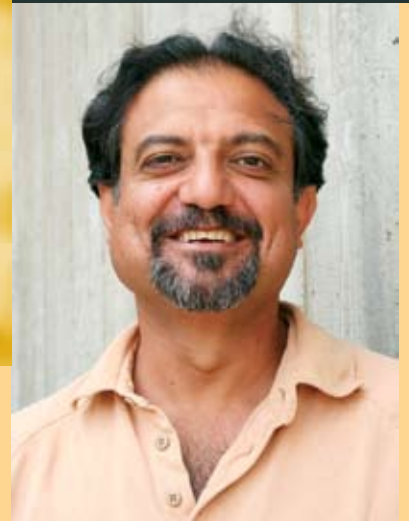
Mariel Vazquez, Assistant Professor



Javier Arsuaga, Assistant Professor



Vital Statistics



Mohammad Kafai, Professor

The SFSU Bachelor of Science degree program in Statistics has undergone major revision. It has moved to the Mathematics Department and its Director is Professor Mohammad Kafai. The program prepares students for careers in business and industry as well as for graduate study. Prospects are bright: our graduates are already starting careers with companies such as TMC Software and Wells Fargo, or proceeding with advanced study at several universities. Professor Kafai reports that companies are offering jobs to students still completing the program.

In 2006 Dr. Alexandra Piryatinska joined our statistics faculty as Assistant Professor. Previously a research associate at the Jet Propulsion Laboratory in Pasadena, she holds PhD degrees in mathematics and in statistics from the Kiev State University and Case Western Reserve. Her research emphasizes time-series analysis and statistical applications in medicine and oceanography.

The Economics Department as well as the College of Business collaborated in revising the statistics degree. The new 54-unit program is highly flexible. After completing 27 units of core mathematics and computer science courses, students choose an emphasis on applications in economics, business, or science. Overlapping course requirements facilitate transferring to statistics from various other majors or completing it as a second major. Although there is no graduate program in statistics yet, several students are emphasizing statistics in their Mathematics MA programs.



Alexandra Piryatinska, Assistant Professor

Biomathematics continued...

ecological community independently or as a result of a web of interdependence. Cahill is now a graduate student here.

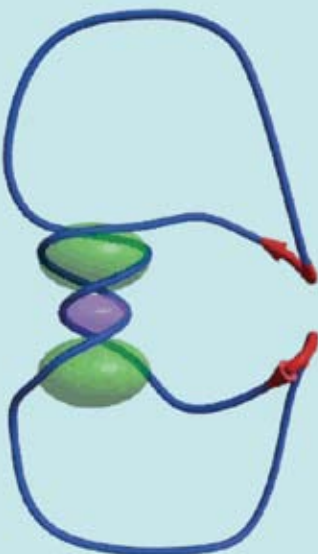
Similar questions arise in studies of evolution, concerning DNA mutations. Scientists seek a taxonomic tree relating various species of interest. Such a tree is determined by a huge number of variables related to mutation frequencies of particular DNA components. Do observed data reflect chance variation or mutations significant for evolution?

The tree can be represented by a point in a geometry of millions of dimensions—one for each variable—and its coordinates must satisfy certain polynomial equations. Algebraic geometry provides methods to study such equations, even though it was not developed with such high dimensions in mind. The desired tree is one that best fits experimental DNA data.

Undergraduate Mark Contois (in the UMB program) and graduate student Alexander Milowski worked with Prof. Serkan Hosten on algorithms used in determining this optimal solution. Each student has coauthored a published research paper on his results.

"The Mathematics of Phylogenetics," by UC Berkeley professors Lior Pachter and Bernd Sturmfels is the first article in *SIAM Review* 49 (2007), a leading journal surveying current applied mathematics research. It describes a major program for applying algebraic geometry to the study of DNA. The 63 publications cited in this survey include Contois' and Milowski's papers, as well as related reports coauthored by Hosten and his former SFSU student Seth Sullivant (see the Alumni news column).

Our biomathematics students are rapidly entering the mainstream of this exciting research area!





Alumni news

1960–1979

Samuel Macy, MA 1968, retired from US government service, is living in San Francisco.

Patricia Shank Elam, BA 1971, is a contract software developer in the Bakersfield area and is studying organ.

Ben Choate, BA 1974, is CEO of SoftCare Systems in Santa Rosa. His company develops software for child-care-center management.

Judith Ekstrand, BA 1968, MA 1976: see the “Faculty News” column.

Marietta Sloan Bartoletti, MA 1976, has worked as a small-business adviser in Eastern Europe for various US government and international organizations.

1980–1989

Ken Logan, BA 1987, recently earned an MA in mathematics at CSU Fullerton. He teaches mathematics at Allied National High School in Laguna Hills, CA.

David Stricker, BA 1987, earned a second BA and an MA in Physics at SFSU. He is a research engineer at the Hansen Experimental Physics Laboratory at Stanford, working on projects associated with the Space Shuttle and International Space Station.

Wendy Brunzie Alexander, MA 1989, earned the PhD in dynamical systems from UC Davis in 1994, and now teaches at Cy-Fair Community College in Houston. Her husband David is a physics professor at Rice University; they have three young children.

1990–1999

Noelle Eckley, BA 1979, MA 1991, teaches mathematics at Lassen Community College in Susanville, California.

Andrew Ellett, MA 1995, earned the PhD in financial mathematics at the Indiana University in 2005. He is now Assistant Professor of Mathematics at DePauw University in Greencastle, Indiana.

Robert Hauss, MA 1995, teaches mathematics at Mt. Hood Community College in Gresham, OR.

Jeffrey Lidicker, MA 1995, earned an MS in statistics from Temple University in 2006, and is now Director of Statistical Consulting at its Center for Statistical and Information Science. He wrote, “Boy, do I miss the coffee and food [at SFSU]!”

Jennifer Murphy Sinclair, BA 1992, MA 1995, is a full-time mother of two, and a part-time instructor at Foothill College.

Jim Voss, MA 1996, teaches mathematics at Front Range Community College in Westminster, CO.

Seth Braver, BA 1999, earned an MA at UC Santa Cruz, taught at a community college in Oregon, and is now finishing a PhD in history of mathematics at the University of Montana.

Alan von Herrmann, BA 1999, is completing the PhD in group theory at Colorado State University. He described his research recently at an SFSU colloquium.

2000–2006

Bernard Walp, BA 2000 after a career as financial consultant. He is now a member of the Planet Search team at Lick Observatory, directed by Dr. Geoff Marcy, SFSU Adjunct Professor of Physics.

Kaytee Bock, BS 2002, has been working for Genentech, first in its laboratories, and now in marketing analysis. In Fall 2007 she will enter the MBA program at the Wharton School in Philadelphia. She hopes to start her own pharmaceutical company someday!

Seth Sullivant, MA 2002, completed the PhD in algebraic geometry at UC Berkeley in 2005, and is now a Harvard Junior Fellow—one of the Nation’s most highly regarded research positions.

Tim Coxon, MA 2003, is now studying law at Santa Clara University.

Yukie Goto, MA 2003, is a graduate student in mathematics at the Indiana University.

Amy Morrow, MA 2003, is a full-time instructor at College of the Canyons in Santa Clarita, north of Los Angeles.

Megan Moore, MA 2004, is Chair of the Mathematics Department at Convent of the Sacred Heart High School in San Francisco.

Pamela Sheehan, BA 2004, has earned an MAT degree in Mathematics from UC Davis.

David Ai, MA 2005, and Thomas Long, MA 2005, are graduate students in mathematics at the Indiana University.

Karen Miller, BS 2002, MA 2005, has worked for a statistical consulting firm on marketing strategies, then for an educational-software company. She’s now seeking a community college position in mathematics. She says the word is out that SFSU graduates good teachers!

Amy Starks, MA 2002, teaches mathematics at the Loyola School in New York City.

Marco Rainaldi, MA 2004, teaches mathematics at San Mateo High School.

Mary Lawrence Bravewoman, BA 2000, MA 2006, is a full-time instructor in Mathematics at City College of San Francisco.

Mark Contois, BA 2006, is a graduate student in mathematics at the University of Washington.

PLEASE

KEEP IN
TOUCH!

Send your news and especially
any changes of address to
alum@math.sfsu.edu

OR visit

http://math.sfsu.edu/alum_response.php
to fill in our quick online questionnaire

Join

the growing number of alumni and friends who are helping our undergraduate and graduate students become leaders in the mathematics community.

Here are the funding priorities for the Math Department this year:

- Scholarships and fellowships for graduate and undergraduate students
- Computer lab renovations
- Support the mathematics Chair fund

Here's how to make your gift:

Online: <https://www.applyweb.com/public/contribute?s=sfusceng>

Make sure you select the "Mathematics Department"

Call: The Office of University Development at (415) 338-1042 and mention the mathematics department

By mail: send your check (made out to the "San Francisco State University Foundation, Inc.) to the:

Office of University Development
1600 Holloway Avenue
San Francisco, CA 94132

In the memo section be sure to write: for the mathematics department

Consider joining *InCircle*, SF State's exclusive online alumni community. Go to <https://incircle.sfsu.edu>. Join the mathematics alumni group and start networking!

You'll meet fellow alums from the College of Science and Engineering as well as friends from across campus. *InCircle* is free and a great way to stay in touch with your professors and friends.



To learn more about the different ways you can give, go to this link:
<http://www.sfsu.edu/~develop/GivingInfo.htm>

Remember to always designate your gift to the mathematics department, and THANK YOU!

More Faculty News

This column reports news items involving Department faculty, beyond those in separate articles. Here we are introducing four new faculty members, eight full or partial retirements, and some recent books published by our faculty.

Matthias Beck, originally from Germany, earned the doctorate in discrete geometry from Temple University in 2000 and came to SFSU in 2004. He is an expert in enumerating points with integer coordinates in convex polytopes. His early work includes their use in the record-breaking computation, with Dennis Pixton, of the volume of the ninth and tenth Birkhoff polytopes. Much of this theory is based on polynomials related to polytopes by the French mathematician Eugène Ehrhart about forty years ago. Their investigation uses techniques from analytic number theory and contemporary combinatorics and commutative algebra. Prof. Beck's current research interests include various graph-theoretical applications of Ehrhart polynomials, and have already led to MA theses by several of our students, some involving computational experimentation. Beck is also involved with teacher education and the San Francisco Math Circle program for middle- and high-school students and teachers.

Federico Ardila received the doctorate in algebraic



and geometric combinatorics from M.I.T. in 2003 and joined SFSU in 2005. He maintains close connections with his native Colombia, where he is adjunct professor at the Universidad de Los Andes. His work already touches several areas of combinatorics. With Profs. Beck, Gubeladze, and Hosten, he is establishing SFSU as a major research center in that field. In Spring 2007 Ardila is teaching our graduate course in his specialty, described in the article Shoestrings in this issue. Ardila has also been heavily involved in fostering mathematical activity at pre-university levels, here and in Latin America.

Yitwah Cheung, originally from Denmark, received the doctorate in dynamical systems from the University of Illinois in 2000, and came to SFSU in 2005. His work is closely related to that of Prof. Arek Goetz; they are now collaborating, and invite the interest of graduate students interested in writing theses in their areas.

Three new faculty members—**Alexandra Piryatinska**, **Javier Arsuaga**, and **Mariel Vazquez**—are introduced in the articles in this issue on statistics and biomathematics.



continued on back page

Shoestrings



Federico Ardila, Assistant Professor



Arek Goetz, Associate Professor

Peek into Prof. Federico Ardila's office just after his Math 890 class, Discrete Geometry. On his computer he's reviewing—start and stop—the lecture he just gave in room TH211. But he's also discussing it in Spanish with some invisible students—invisible until they pause the lecture video. Then they too appear on his computer, evidently televised by the mini-camera on theirs. They question a formula on their whiteboard, and Ardila corrects it on his. The matter is settled, and they resume the lecture.

A student in the High Sierras logs onto the Internet after work. She's taking Math 226, Calculus I. Onscreen is Prof. Arek Goetz, speaking to an audience in TH211. But she is one of forty participating via Internet. Later, she downloads an assignment, views an older lecture on a related subject, and discusses a problem online with another student and with Goetz's assistant. Then she works out her solutions, snaps them with her digital camera and uploads the graphics files to the course website.

What makes this possible? High tech on a shoestring!

Around 1999, Sheldon Axler, then

chairman, suggested equipping TH211 with technology, but with no special budget. Goetz and Prof. J. T. Smith collaborated on design and installed the initial equipment themselves, with some minor construction by University staff.

Some of it is conventional: Internet, cable TV, and telephone hookups, VCR, computer and projector, two projection screens, and whiteboard. A better than usual sound system helps the audience understand untrained speakers.

Later, about 25 computers were purchased with a Federal grant and installed on the audience tables. They're connected to the Internet and run Mathematica software.

Jointly with the Mathematical Sciences Research Institute, the Department experimented with Internet streaming-video dissemination of advanced courses. Two obstacles arose: hiring and training assistants to operate TV cameras was too difficult and expensive, and processing videotape for Internet broadcasting was tedious and time-consuming.

Goetz overcame both obstacles. A standard computer with inexpensive but specialized software now converts

the TV signal to an Internet stream with only a ten second delay. He mounted an inexpensive miniature TV camera in the back, with a robot that automatically points it at the lecturer. That is accomplished by motion sensors that broadcast signals when the speaker moves in and out of three zones at the front of the room. The robot receives them and aims the camera. Designed and constructed by Goetz, his brother, and Olga Afanasieva, it is an adaptation of technology commonly used by amateur figure-skaters.

Several microphones are installed: radio-enabled for the lecturer, and cabled for class discussions. Their quality must be high to compensate for non-studio conditions.

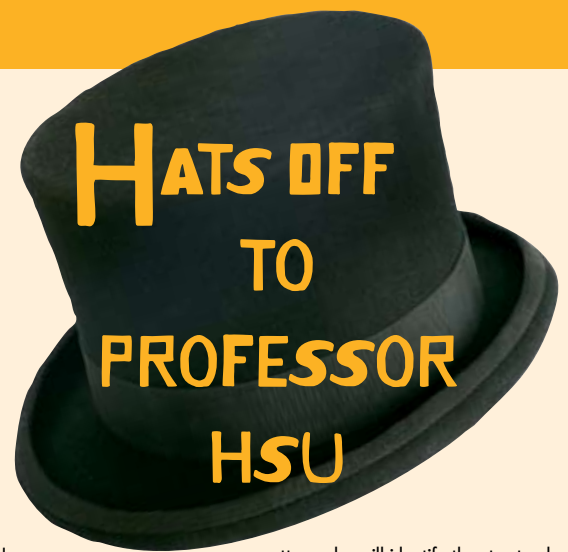
Initially the room was used for colloquia and MA thesis presentations, and for broadcasting discussion sections of an Internet-based elementary calculus course that Goetz was developing. In 2005, TH211 supported a Computer Science course for which the instructor was in Armenia. Our class watched his lectures on streaming video, and their questions were relayed by our equipment and inexpensive Internet telephony.

Goetz's Internet-based calculus course now uses the room exactly as planned. His technological work currently stresses investigations into effective educational software usage. Ardila uses the facility and standard Internet conferencing to enable students in his native Colombia to participate equally in his high-level course. Ours are tasting the international flavor of mathematics through interaction with their Colombian peers.

Plans for future use of TH211 include dissemination of its techniques to other types of mathematics courses and other departments. It's not yet ideal. For example, the audience's computers are usually in their way and cannot be controlled easily by a teacher. Broadcasting class participation is inadequate without a trained camera operator, and difficult then. Detailed whiteboard writing and rapid hand motion, vital to a mathematics lecture, requires high-definition TV, which places high demands on Internet transmission. Technology is adapting rapidly to these problems, but its evolution will create others.

Solving technical problems often requires mathematical reasoning. For example, Goetz was recently investigating noise in Ardila's broadcasts that he couldn't reproduce on his own. He deduced that the cause must lie in their differences. Slowly it dawned: the thin clip-on microphone cable picked up interference from the motion sensor transmitters. It was worse for Ardila: a foot taller than Goetz, he uses a longer cable!

That's the long and short of shoestring tech!



In Spring 2007, Prof. Eric Hsu started the fourth year of work supported by his National Science Foundation CAREER grant. This prestigious award recognizes and supports "the early career development of scholars who are most likely to become the academic leaders of the 21st century."

He is applying his \$489,000 award to study "how teachers learn to teach and to improve their teaching." He seeks efficient ways for teachers to communicate online regularly with colleagues so they can learn from one another about the effectiveness of their methods. Hsu's study will also consider the socialization that occurs between teachers and students.

Hsu has been studying online communities since his postdoctoral work at the University of Texas, Austin. He believes the Internet has not yet reached its potential as a tool for mathematics teachers. "Teachers have their own professional culture," he says, "and it doesn't disappear when they go online. We need to find ways online networks can fit the best parts of teacher culture."

For several years, Hsu has been supervising the graduate students who teach mathematics at SFSU. He developed the course Math 700, a workshop required of them.

Another project that has been underway here for several years is the REAL (Revitalizing Algebra) Partnership, designed to find ways to help high school students "over the algebra hump." Directed by Profs. Hsu and Judith Kysh and Prof. Emerita Diane Resek, REAL brought together three communities: undergraduates interested in teaching, graduate students teaching algebra at SFSU, and algebra teachers in several Bay Area school districts.

Hsu's CAREER study is a natural extension of his work with our graduate students and the REAL Partnership. It has also involved a group of teaching assistants in a program developed at UC Berkeley by Prof. Uri Treisman. The latter form a "control group" free of a potential conflict; Hsu is not their supervisor.

Hsu has been studying conversations among teams of these students and teachers. By analyzing observed

patterns, he will identify the structural features of both online and in-person communities, and use those to foster better alignment of the cultures of mathematics instruction in these settings. He has studied the results of several online communication methods, and is now concluding that these work best side-by-side with intensive face-to-face interaction. A significant problem is coming to light; it is difficult to convince teachers not previously disposed to online communication to start it, in spite of its promised effectiveness. In fact, a major general focus of his study is now, "how teachers change their practice."

The students involved with Hsu's study teach classes with high minority enrollments. He hopes their participation will not only improve their effectiveness as teachers but, in turn, help their pupils succeed in courses that have a reputation as obstacles for minorities. Moreover, Hsu says, "Life doesn't end with graduation. Teachers working in schools and those studying to become teachers need to find ways to connect as a community." The community Hsu imagines cannot only instill professional support among our students; it can facilitate communication and establish mentorship between practicing teachers and those who follow in their footsteps.

Dean Sheldon Axler notes that "Eric Hsu already plays a key role in the effort to make SFSU a national leader in mathematics and science education, and the CAREER award reflects his potential to make further major contributions to mathematics education in general as well as to our students who will become teachers." Prof. Hsu concludes,

"In my years here, I have seen some graduate students support each other in fascinating, inspiring and touching ways. I want to understand how that happens, and have our university as an institution support and enhance the best parts of our teaching culture. I want to make sure all our students benefit from it and to share what we do with other institutions."

More Faculty News continued...

Since the previous newsletter, two professors have fully retired: **Daniel Fendel** and **Diane Resek**. After completing doctorates in algebra and logic at Yale and UC Berkeley respectively, they joined SFSU in 1973 and 1975. National leaders in mathematics education, Fendel and Resek collaborated on teacher training, methods for combating mathematics avoidance, high-school curricula and texts, and a text to help mathematics majors progress from calculus-like courses to the abstractions of higher-level mathematics. They will surely continue some of that leadership as professors emeriti.

Two professors have completed five years of partial retirement: **Ali M. Tabatabaian** and **Radhakrishnan J. Aiyar**. After earning doctorates in statistics and analysis at UC Berkeley, they joined our faculty in 1966 and 1967, respectively. Many of our graduates remember learning the principles of our discipline from them.

Three more will have partially retired by the end of Spring 2007: **David B. Meredith**, **Susann Novalis**, and **Judith Ekstrand**.

David Meredith earned the doctorate in algebra from Brandeis and joined us in 1972. He has served the University in many capacities, currently as Chair of the Academic Senate, and before that as Chair of our Department. Meredith contributed many innovative instructional efforts, including major collaborations with english and physics faculty, and has been instrumental in developing biomathematical studies here. He'll be teaching part-time for us in Fall 2007.

Susann Novalis's doctorate is in aeronautical engineering from Stanford. She joined us in 1973. She taught courses in

analysis and biomathematics and then left teaching around 1980 to serve as associate dean of the College for fifteen years. Novalis became a certified accountant, applied that skill to University organizational problems, and published books on using software. More recently she has worked for various programs, developing database software now in general use on campus.

Judith Ekstrand received the doctoral degree in statistics from Stanford and then joined SFSU as a faculty member in 1983. She had earned BA and MA degrees here some years previously. Ekstrand has helped guide our statistics program, consulted for many nursing projects, and served in several administrative capacities. She'll be teaching part-time in Fall 2007.

The mathematics faculty have published countless research papers since the previous newsletter, and four books:

Matthias Beck (with Sinai Robbins). 2007. *Computing the Continuous Discretely: Integer-Point Enumeration in Polyhedra*. New York: Springer.

Matthias Beck, ed. (with Alexander Barvinok, Christian Haase, Bruce Reznick, and Volkmar Welker). 2005. *Integer Points in Polyhedra—Geometry, Number Theory, Algebra, Optimization*. Proceedings of the AMS-IMS-SIAM Joint Summer Research Conference in Snowbird, Utah (July 12-18, 2003). Providence: American Mathematical Society.

Alexander Schuster (with Peter Duren). 2004. *Bergman Spaces*. Providence: American Mathematical Society.

James T. Smith (with Elena Anne Marchisotto). 2007. *The Legacy of Mario Pieri in Geometry and Arithmetic*. Boston: Birkhäuser.



Mathematics Department

San Francisco State University
1600 Holloway Avenue
San Francisco, CA 94132
415.338.2251

<http://math.sfsu.edu>

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