Berkeley
Mathematics
Newsletter

A newsletter of the Department of Mathematics and Center for Pure and Applied Mathematics at the University of California at Berkeley

Fall 1996, Vol. IV, No. 1

MESSAGE FROM THE CHAIR

CALVIN MOORE

As I begin my term as Chair on July 1, I want to extend greetings and best wishes to the faculty, students, staff, graduates, and friends of the Department of Mathematics and the Center for Pure and Applied Mathematics. I especially want to congratulate our graduates, and to welcome our new students who will be joining us. Last year was a very good one for the Department, and I would like to bring you up to date.

Developments in Calculus

Alan Weinstein, Paul Vojta, and I have been working with a group of graduate students including Julie Mitchell, Alex Gottlieb, Christine Heitsch, Aaron Abrams, and Eric Hsu to develop new models of calculus instruction. We will leave in place the three hours of large lectures per week, but will replace the traditional two hours per week of recitation sections run by Graduate Student Instructors (GSIs) with three hours in a laboratory or workshop setting of 20-25 students that will be run by GSIs. The idea is to exploit the model of intensive discussion section developed and pioneered by Uri Treisman here at Berkeley. In these workshops the GSI will function more as a facilitator, and students will work individually and in groups of two or four, using specially designed worksheets that we are currently developing. This structure will create an active rather than a passive learning environment for the students. The GSI will answer questions about homework or the lectures for part of the time, but the majority of the time will be spent in the workshop facilitator role.

We plan to implement this general approach in two different ways. First, we will have students from one lecture section meet for three hours in a newly completed computer studio classroom laboratory located in the basement of Evans Hall. We are developing computer based modules and

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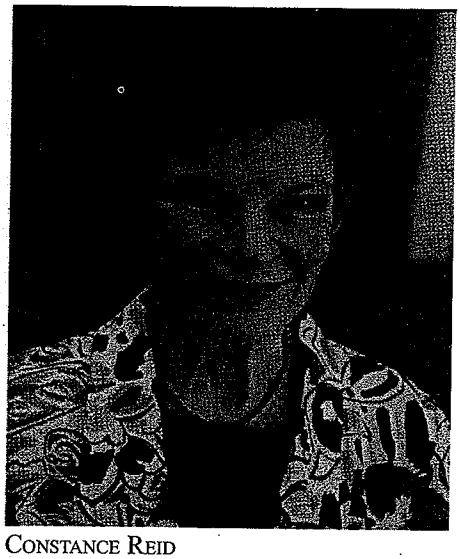
PROFESSOR CALVIN MOORE

COMMENCEMENT SPEAKER LOOKS BACK

U.C. BERKELEY MATHEMATICS, FROM 1936 TO MAY 10, 1996

CONSTANCE REID, MATHEMATICAL BIOGRAPHER



CONSTANCE REID

When Professor Wagoner called and invited me to speak at Commencement today, my reaction was no no no, I can't do it, I've talked too many times already this year. But then a few hours later I called back and said, if he didn't already have somebody else, yes I would talk — there was something I would like to tell the graduates.

Commencement is traditionally a time for looking forward, but this afternoon I am going to look back because it seems to me that, as you leave the Berkeley Mathematics Department, you may like to take with you some sense of its past.

The Mathematics Department's home — and your home away from home for the last few years — was not always Evans Hall, and "Mr. Evans" was not always that white-haired, black-gowned old fellow with a pipe whose portrait hangs in the Mathematics Library. In fact, I recently obtained a photograph of him as a very young man, good-looking with dark

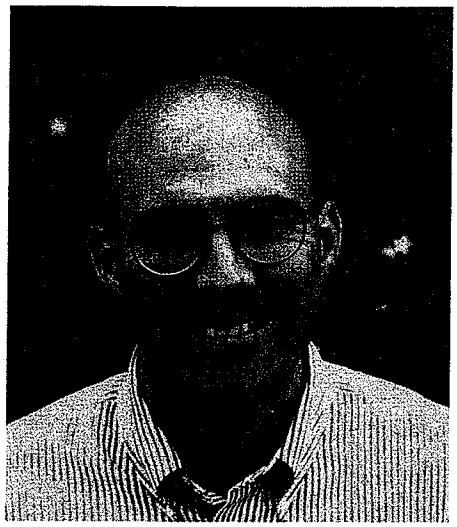
(continued on page 4)

Highlights

What's inside:

NEW FACULTY

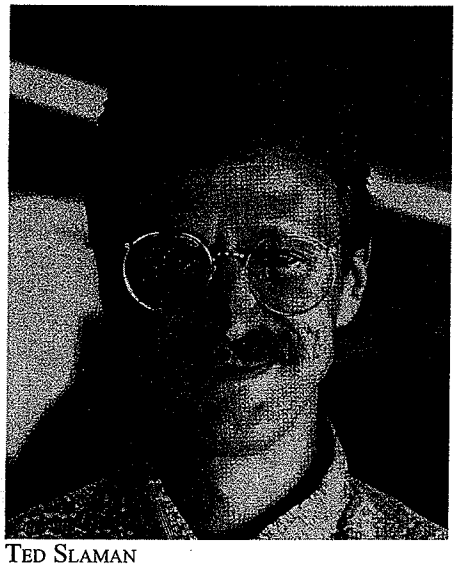
Michael Christ came to us from UCLA where he was professor since 1988 and Graduate Vice-Chair (1992-94). Graduate of the University of Chicago, Christ earned his Ph.D.



MICHAEL CHIRST

in 1982. His interests include harmonic analysis, partial differential equations, and complex analysis in several variables. Christ was an invited speaker at the International Congress of Mathematicians, Kyoto in 1990, award recipient of a Presidential Young Investigator 1986-91, an Alfred P. Sloan fellow in 1986, and awarded an NSF postdoctoral research fellowship in 1982. He has also been visiting guest professor at Institut des Hautes Etudes Scientifiques, Paris, France 1989-90 and Fall 1991 and at Universite de Paris VI, France in December 1993, and he was an MSRI Research Professor in 1995-96. Valued for his established record of excellence in research and teaching, we welcome Michael Christ!

Theodore Slaman earned his Ph.D. at Harvard University in 1981. He was an NSF Postdoctoral Fellow from 1981-83 at Harvard, UCLA, and University of Chicago. He comes to us from the University of Chicago where he's been professor since 1983. Slaman's awards include five years tenure of the Presidential Young Investigator Award, 1985, the Japan Society for the Promotion of Science, Senior Fellowship, 1987, and the SERC Visiting Fellowship Research Grant, United Kingdom, 1993. Slaman was an invited speaker at the 1990 International Congress of Mathematicians in Kyoto, Japan. Additionally, since 1990, Slaman has been Managing Editor for the Lecture Notes in Logic and Editor for the Archive for Mathematical Logic, as well as referee for various mathematics journals and grant proposals. We warmly welcome Theodore Slaman!



TED SLAMAN

John Steel, UC Berkeley graduate, 1977 joins us again from UCLA where he's taught since 1977. Mathematician of international renown, Steel is noted as one of the world's leading authorities in set theory. In 1985 he shared the Carol Karp Prize with Woodin and Martin (of UCLA). This prize is awarded by the Association for Symbolic Logic once every five years for the best work in mathematical logic. Additionally, he was awarded an Alfred P. Sloan Fellowship in 1986 and was an invited speaker at the 1990 International Congress of Mathematicians in Kyoto, Japan. His area of expertise includes set theory, descriptive set theory, and fine structure. Welcome John Steel!

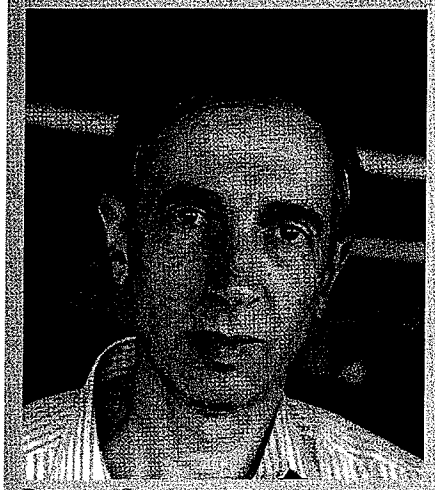
JOHN STEEL

CHERN SYMPOSIUM 1997

THURSDAY, FEBRUARY 13, 1997 AT 2 P.M.
IN SIBLEY AUDITORIUM, BECHTEL HALL
FEATURING PROFESSOR RICHARD STANLEY
AND PROFESSOR ROBERT MACPHERSON
FROM MIT

CHERN VISITING PROFESSOR

Richard Stanley has been invited to serve as the 1996 Shiing-Shen Chern Visiting Professor in the Department of Mathematics. Born in New York City on June 23, 1944, Stanley completed the BS at California's Institute of Technology in 1966. He worked summers as a research scientist at the Jet Propulsion Laboratories in Pasadena, California. From 1970-71 Stanley was a C.L.E. Moore Instructor of Mathematics at the Massachusetts Institute of Technology (MIT). In 1971 he completed the Ph.D. from Harvard University. A Miller Research Fellow at UC Berkeley from 1971-73, Stanley returned to MIT in 1973 as Assistant Professor of Mathematics, gaining tenure in 1979. From 1993-96 he has served as Chairman of the Applied Mathematics Committee at MIT.



RICHARD STANLEY

Professor Stanley has held many visiting positions and been an invited guest speaker at eminent conferences since 1978: UC San Diego, Universite de Strasbourg, France, Stockholm, Sweden, Cal Tech, Augsburg, Germany, Japan, China, and this year he is both a Chern Visiting Professor at UC Berkeley and general member at the Mathematical Sciences Research Institute (MSRI) in Berkeley.

Active on many editorial boards, award committees, and advisory panels, Professor Stanley is an elected member of the American Academy of Arts and Sciences, the National Academy of Sciences, the American Mathematical Society and the Mathematical Association of America.

On February 13, 1997 the Department of Mathematics at UC Berkeley will honor Professor Stanley at the second annual Chern Symposium.

VISITING FACULTY & RESEARCHERS

Charles B. Morrey, Jr. Visiting Assistant Professors


ANA CANAS DA SILVA

Ana Canas da Silva received her Ph.D. from M.I.T. During the first year of her appointment she will be on leave at the Mathematical Sciences Research Institute participating in their Geometry program. She will join us July 1, 1997. Dr. da Silva's specialty is differential geometry. The area of her specialization is Symplectic Geometry with emphasis on Hamiltonian group actions, presymplectic quantization and orbifolds.

Adrian Vasiu received his Ph.D. from Princeton in 1994. Prior to coming to Berkeley, he held visiting research positions in Germany and Switzerland. Dr. Vasiu's specialty is number theory. He is described as one of the leading researchers of his generation.


ADRIAN VASIU

Adjunct Assistant Professors

Yi Hu will join us this year as one of our Adjunct Assistant Professors. He received his Ph.D. from M.I.T. in 1991. He has held a position as Visiting Assistant Professor at the University of Utah, and a position as Assistant Professor at the University of Michigan. Dr. Hu is a recipient of an AMS Centennial Fellowship. His success in being awarded the fellowship places him in the top ranks of junior mathematicians nationwide. His field of principal interest is Algebraic Geometry.


YI HU

Annegret Paul received her Ph.D. from the University of Maryland in May 1996. Her research interests are Representation Theory, Lie Groups, Lie Algebras, Algebraic Groups, Theta Correspondence, and L-groups.


ANNEGRET PAUL

NSF Postdoctoral Fellowship Recipients

NSF Postdoctoral Fellowships are extremely competitive, the recipients are among the best junior mathematicians in the country. We are honored to have four postdoctoral fellows visit our Department for the next year.

David Borthwick held a position of Assistant Professor at the University of Michigan from 1993 to 1996. This follows the receipt of his Ph.D. in 1993 from Harvard University. His research interests include Scattering theory on hyperbolic 3-manifolds; Microlocal analysis, asymptotic analysis of Toeplitz operators; and Deformation quantization.


DAVID BORTHWICK

John McCuan received his Ph.D. from Stanford University in 1995. While at Stanford, he was an instructor and mathematical consultant. His research interests are geometry and (variational) stability of prescribed mean curvature surfaces.


JOHN MCCUAN

Shuzhou Wang graduated from UCB in 1993 after receiving his Ph.D. He has held a position as Lecturer at UCB, a Visiting Assistant Professor position at IUPUI, and was a Postdoctoral Research Fellow at the University of Leuven, Belgium. Before coming to Berkeley, he was a Visiting Member at the Institut des Hautes Etudes Scientifiques in France. His primary mathematical interests are Quantum Groups, Representations of Lie Groups, Operator Algebras, and Functional Analysis.


SHUZHOU WANG

Daniel Wise earned his Ph.D. from Princeton 1996. His mathematical interests are Geometric Group Theory, Residual Finiteness of Groups, CAT(0) Spaces, and Low Dimensional Topology. Ω


DANIEL WISE

COMMENCEMENT SPEECH

(cont. from page 1)

curly hair, wearing a sharp Italian pinstriped suit — he studied in Italy, you know, with Volterra and Levi-Civita. So this afternoon I am going to take you back some sixty years — to the time when Mr. Evans came to the University of California.

Photo courtesy of The Bancroft Library, UC B

GRIFFITH C. EVANS

But first I want to give you a sense of the time and the place that I am talking about. It is not the same. Sixty years ago, in 1936, when Mr. Evans actually came to Berkeley (although he had been selected earlier), the year 1996 was as far away to him as the year 2056 is to you sitting here in this auditorium on the Berkeley campus of the University of California this afternoon. And in 1936 — although this land was owned by the University — this auditorium was not here and the land on which it stands was not part of the campus. The entrance to the campus was at Sather Gate.

Sather Gate can be a "gateway" into the past — those of you who have read the book *Time and Again* by Jack Finney will know what I mean. Such a gateway is something that existed in the past and exists still today, a place through which you can go back in time if you have the knowledge and the psychic energy. Wheeler Hall can also be a gateway. To go back to the Mathematics Department of 1936, however, you would have to climb the stairs to the fourth floor because in those days only the faculty had keys to elevators, but when you got there you would find the offices of the department: two rooms, one for Mr. Evans and one for Sarah Hallam, a graduate student who was also the half-time secretary. But even if you don't have the kind of psychic power needed to actually go back in time, you can still stand at Sather Gate this afternoon and look up past Wheeler Hall toward the Campanile and *see* the Berkeley campus almost exactly as it looked in the 1930s.

Now at that time nobody spoke of a university called "Berkeley" — there was "the University of California" and there was "the Southern Campus," which was just beginning to be called "UCLA," and then there was Davis, which was the agricultural branch, "the cow college". *This* was the University of California, and the President of the University actually lived on this campus and *had his office* on this campus.

Things were really quite different.

The President of the University, whose name was Robert Gordon Sproul — not "Sproul Hall"— was offered the presidency of the Bank of America in 1939. The students demonstrated, as Berkeley students do — that hasn't changed. They begged him to stay — and he did.

Photo courtesy of The Bancroft Library

ROBERT GORDON SPROUL

You can imagine the kind of man Robert Gordon Sproul was if the Bank of America thought he would be an appropriate successor to A.P. Giannini. But Sproul had something bigger in mind than the biggest bank in the country. His ambition was to build a state university the equal, maybe even the superior of any private university in the world. Not first in size — although obviously that too, it was pretty big even then — but first in scholarship. The interesting thing is that Sproul, although he had this ambition, was not a scholar himself. His provost, however — a man named Monroe Deutsch, a lovely man — was the scholar whom he was wise enough to call upon for advice.

Now, in the early 1930s the Department of Mathematics here suffered from a malady that I have been told (by a European mathematician) was endemic among many — although certainly not all — American mathematicians of the time. They might have studied abroad, and they might have done high quality work in their dissertations, but when they came home they settled down to what this European mathematician described to me as the curious American ideal of being "a scholar and a gentleman," with the emphasis on teaching and a civilized social life rather than on research. Well, as departments in the other sciences began to improve under Sproul and Deutsch, especially physics — just to give you an idea of the quality of that department, it had a young associate professor not yet thirty named J. Robert Oppenheimer — those departments became increasingly dissatisfied with the quality of the Mathematics Department. So they went to Sproul. Couldn't something be done? Sproul consulted Deutsch and they appointed a search committee to find a new chairman for the Mathematics Department — an outstanding research mathematician who was also capable of building what Sproul and Deutsch envisioned as a *great* department. It was a search committee that included not a single mathematician!

To go back to 1936...you would have to climb the stairs to the fourth floor (of Wheeler Hall)

The man whom the committee found — in Texas, at the Rice Institute — was Griffith C. Evans.

You can imagine what most men would do, coming into such a position and with a mandate to build a great department as fast as possible. They would rid themselves of the people already there, let them know they were no longer wanted, offer them early retirement, fire them, whatever was necessary, and start fresh.

But not Evans. Under him, although he began hiring even before he could leave Texas, there was no sudden change, no turmoil. As vacancies occurred, because of retirements or increased numbers of mathematics students, he hired new people: very young people, who had long and promising careers ahead of them — and who were of course cheap. (Remember that this was still the time of the Great Depression.) Alfred Foster was 30 when Evans hired him, Charles Morrey, 27 — these were the first two appointments.

Photo courtesy of The Bancroft Library

ALFRED FOSTER

They were so young looking, especially Morrey, that people used to ask in the elevator if that was his dissertation in his briefcase. I was once told by an outstanding mathematician in Morrey's field how this "boy," as he called him, came up at some mathematical meeting and said that he had been working on a certain problem and he had solved it. "Very nice," the older man nodded politely, and went on. Then — WHAT? He turned back. "What was the problem you just told me that you had solved?" It was a problem that those in the field had been working on for years! Well, you get the idea. Evans had an eye for mathematical talent.

Photo courtesy of The Bancroft Library

CHARLES MORREY

Two years later he hired Hans Lewy, a young German Jew who had left Germany as soon as Hitler came to power, not even waiting — as many did — to be dismissed. For two years Lewy had taught at Brown, but the funding for the position had been only temporary. In 1936 he was out of a job. He had a firm offer in the east, but he was enthralled by the American West. When he heard that there was a *possibility*, nothing certain, of a job at the

HANS LEWY

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COMMENCEMENT SPEECH

(cont. from page 4)

University of California, he decided to take a chance, figuring — he told me — that if he didn't get the job he could always camp out and sleep in his car. Of course he did get the job, and much of my knowledge of this period came from him — he was the "European mathematician" I mentined a few moments ago.

It was also Lewy who told me that the "gentlemen and scholars" of the pre-Evans Mathematics Department were excellent teachers; and this is borne out by the fact that Evans very soon hired two young men who had received their Ph. D.'s here — one of them was D.H. Lehmer, the son of Professor D.N. Lehmer, and the other was Raphael M. Robinson, who was to marry my sister Julia.


D.H. LEHMER

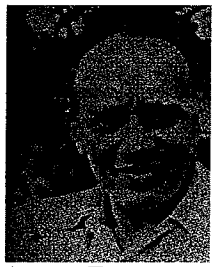
But I don't want to give you the impression that Evans just went around picking up gifted, very young mathematicians. Two of his early appointments were made in quite different circumstances.


RAPHAEL ROBINSON

Evans was very interested in what was happening in mathematical statistics — it was an exciting time, especially in England — and he wanted Berkeley to develop a strength in that field, which he rightly saw would become increasingly important. I could give a whole talk on the negotiations that took place between the University of California and Jerzy Neyman (a Pole at the University of London whose work had already made history in statistics), but I will limit myself to the negotiations about salary. Neyman had set as his goal $5000. Sproul went up to $4500. Michigan entered with a counteroffer. Sproul and Evans stood firm, and I want to quote from the relevant correspondence between them on the subject because it seems to me so typical of the spirit at the University of California in those days.


JERZY NEYMAN

"We do not regard ourselves as engaging in a financial race with the University of Michigan," Evans wrote to Sproul. "The competition is in the nature of the opportunities of the respective institutions. If we are willing to take a risk on Neyman, then Neyman ought to be willing to take a risk on us! It would be one test...of his fitness."


ALFRED TARSKI

Well, Neyman took the risk. Incidentally, he later told me that he chose California over Michigan because there was *absolutely nothing* in mathematical statistics at Berkeley.

Evans's other unusual appointment was, coincidentally, another Pole. Alfred Tarski had been a visiting lecturer at Harvard when the Germans invaded Poland in September 1939. The invitation there had expired, and Tarski — a man with an international reputation in philosophy, algebra, and logic — had found himself marooned in the United States for the duration of the war, and unemployed.

Evans heard of this opportunity to obtain a mathematician of Tarski's stature, and he immediately went to Sproul. Well, when Neyman heard that Evans wanted to hire Tarski, he pressed Evans to hire instead Neyman's own very good friend Antoni Zygmund, also a refugee, also a Pole, employed but in a job that was not worthy of him in Neyman's opinion. Now Neyman was a man who could press, but Evans remained unmoved. Tarski came to Berkeley. Zygmund, also a very great mathematician, went ultimately to the University of Chicago.

Tarski's coming was a fateful event in the career of my sister, Julia Robinson, because his interest in logic was in a number of ways so exactly suited to her that it is difficult to imagine what she might have done mathematically if Neyman had pressed successfully and Zygmund, not Tarski, had come to Berkeley.

Although Tarski was not permitted to teach any courses in logic during his first years here, he eventually created the powerful Section on Logic and Methodology. Neyman built from the "absolutely nothing" that had existed when he arrived a statistics group that became eventually a separate, great department.

Evans of course made other, brilliant appointments — but this afternoon I very much wanted to give you a glimpse of what I think of as "the seeding" of the Berkeley Mathematics Department — because you, after all, are the crop that was being sowed so many years ago.

I am sure that Mr. Evans and the other mathematicians that I have mentioned, all of whom remained at Berkeley until their retirement, would be very proud of you today — and of the Mathematics Department which is today awarding you degrees. Ω

The Editor is grateful to Constance Reid for the photos in this article that appear in her latest book, Julia, a life in mathematics.

GRATEFUL THANKS TO OUR FRIENDS

The Department of Mathematics extends heartfelt thanks to all our donors over the past years for their generous support. Our donors have contributed to the strength and vitality of our students and the Department. The following is a list of our donors since 1995-96. We apologize if we have omitted anyone. Please do let us know if that is the case. A special thanks to all our donors who wish to remain anonymous.

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MATHEMATICIANS INSPIRE DONORS

JULIA ROBINSON (1919-1985)

(Based on Constance Reid's biography of Julia Robinson, "A Century of Mathematics in America-Part III", American Mathematical Society, Providence, Rhode Island.)

The first woman mathematician to be elected to the National Academy of Sciences and first woman to be president of the American Mathematical Society (AMS), Julia Bowman Robinson continues to be a source of inspiration to student mathematicians.

Julia was born on December 8, 1919, in St. Louis, Missouri, to Ralph and Helen Bowman. She graduated from high school in 1936 with honors in mathematics and science and was awarded the Bausch & Lomb Medal for Excellence in Science.

At sixteen she entered San Diego State College, a teacher's college. Despite financial losses from the Great Depression and her father's suicide in her sophomore year, Julia persevered in school and eventually transferred to the University of California at Berkeley (UCB) for her senior year.

At UCB, Julia met Raphael Robinson, professor of one of her first classes in number theory. After Julia completed her Masters of Arts degree in mathematics, they were married December 22, 1941. Julia had been teaching statistics for Jerzy Neyman and so was able to continue to work in the Mathematics Department despite a ruling at the time that members of the same family could not teach in the same department. Then, while the United States was at war, Julia worked for Neyman in the Berkeley Statistical Laboratory on secret projects for the military.

In 1948 Julia took her Ph.D. under Alfred Tarski, renowned logician from Poland who joined Berkeley's faculty during the war. Her thesis, "Definability and decision problems in arithmetic," attracted worldwide attention among logicians. That same year she also solved a famous problem in game theory.

From 1948 and for most of the rest of her professional life, Julia devoted herself to the Tenth Problem of David Hilbert's list: to find an effective method for determining if a given Diophantine equation is solvable in integers. In 1950, in a ten-minute talk at the International Congress of Mathematicians in Cambridge, Massachusetts, Julia presented her first results.

In 1959, using Julia's work, Martin Davis and Hilary Putnam proved a theorem crucial to the ultimate solution of the Tenth Problem. The final published version, now co-authored with Julia, appeared in 1961 revealing an elementary and elegant proof.

Julia's renown came after many years of research, work, and irregular teaching (because of her health) as a Lecturer at UC Berkeley.

Julia Robinson

When Yuri Matijasevic unexpectedly solved Hilbert's Tenth Problem, Julia's work was of decisive importance to the solution. Many honors were subsequently awarded her: in 1975 she was elected to the National Academy of Sciences, the first woman mathematician to receive this honor. UC Berkeley made her a full professor with the duty of teaching just one-quarter time. In 1978 she became the first woman officer of the American Mathematical Society. Other honors followed. In 1979 she was awarded an honorary degree by Smith College. The following year she was asked to deliver the AMS Colloquium Lectures — the second time a woman was so honored. (Anna Pell Wheeler was the first in 1927.) In 1983, Julia became president of the AMS, its first woman president. Additionally, she was awarded a MacArthur Fellowship in recognition of her contribution to mathematics. In 1985 she was elected to the American Academy of Arts and Sciences. She was also elected Chair of the Council of Scientific Society Presidents, but had to decline because of her health.

During the last decade of her life Julia's time and energy were occupied by both the AMS and human rights problems. She died on July 30, 1985, in Oakland, California, after a year's struggle with leukemia.

THE JULIA BOWMAN ROBINSON FELLOWSHIP

After his wife's death, Professor Raphael Robinson established a memorial fund in Julia's name. The income is used to support students in mathematics and is awarded to graduate students of promise to encourage their pursuit of doctoral research. A fellowship of $7,000 each was awarded at the 1996 Spring Commencement to Concetta Gomez and Johanna Neaderhouser.

Concetta Gomez was born August 6, 1959 in Chicago, and graduated from high school in Eau Claire, Wisconsin. She attended the University of Wisconsin and the City College of San Francisco before completing her BA in mathematics at UC Berkeley in 1989. Her area of research is model theoretic algebra (similar to Julia Robinson's). Ms. Gomez has served as President of the Mathematics Graduate Student Association (MGSA) in 1994-95 and as President of the women student mathematician's group, the Noetherian Ring, in 1995-96.

Johanna Neaderhouser was born in Rome, New York, and grew up in Cincinnati, Ohio. Receiving her BS in mathematics from Cal Tech in 1994, she started the Ph.D. program in 1995 in the Department of Mathematics at UC Ber-

(continued on page 7)

1996 Julia Robinson Fellows Johanna Neaderhouser and Concetta Gomez

Photographer: Paul Brown

From left to right: Carolyn Katz, Manager of Math Dept., Chancellor Tien, Johanna Neaderhouser, Concetta Gomez, Chair Jack Wagoner, Constance Reid, Acting-Dean of Physical Sciences Geoffrey Chew.

MATHEMATICIANS INSPIRE DONORS

DAVID ROSS RICHMAN (1956-1991)

JIM PROPP

For those who knew him personally, David leaves behind fond recollections, and for those who knew him professionally, he leaves behind a tragic sense of promise incompletely fulfilled.

David was a problem-solver by temperament, with strong interests in number theory, algebra, invariant theory, and combinatorics. He did his undergraduate work at Harvard and received his Ph.D. in mathematics from the University of California at Berkeley, under the supervision of Elwyn Berlekamp. I met him at one of the annual convocations of the West Coast Number Theory Conference held at the Asilomar Conference Center in Monterey, California. His quick mind and unassuming manner made him a pleasant person to discuss mathematics with, and he was one of the people I most looked forward to seeing at subsequent conferences.

By the beginning of 1991, he had received tenure at the University of South Carolina, and was commencing his first sabbatical. He planned to spend the first half of 1991 in Taiwan and the second half at MSRI. He died on February 1, 1991, in a widely-reported accident at Los Angeles Airport in which many other people were killed. He left behind a wife, mathematician Shu-Mei Richman, a daughter, Miriam, and his parents, Alex and Shifra. His wife was expecting their second child at the time of his death; the baby was born on Shu-Mei's birthday and named David Harry.

The David Ross Richman Fellowship was established by Shu-Mei in December 1994 in the Department of Mathematics at UC Berkeley for the purpose of encouraging students who have demonstrated excellence in mathematics and are in need of financial assistance for continuing their education. Ω

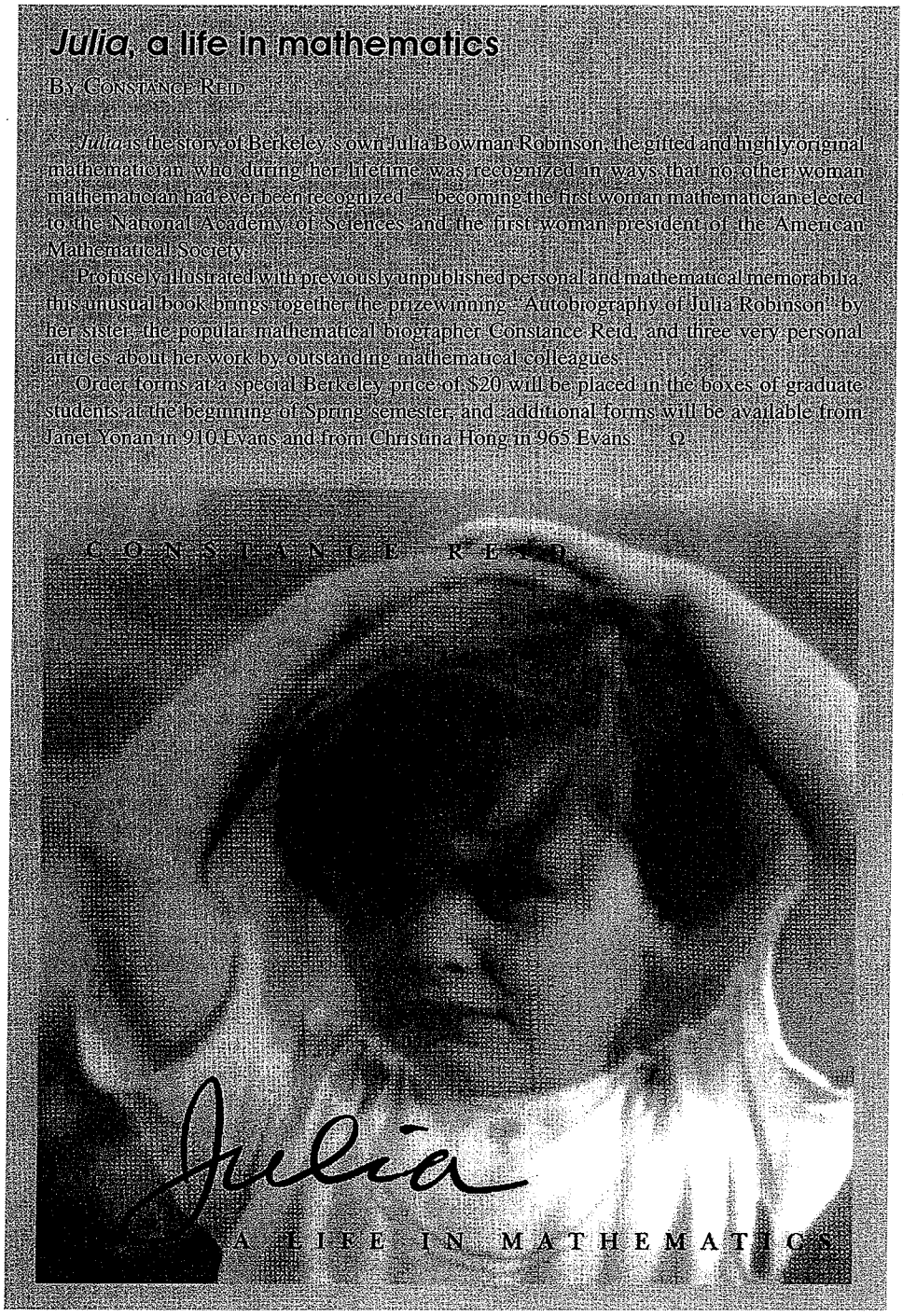
JULIA ROBINSON *(cont. from page 6)*

keley. Her area of interest is geometry and dynamical systems.

In January, 1996, a quiet luncheon honoring the generous bequest of Professor Raphael M. Robinson ($1 million for fellowships in Mathematics) and the 1995-96 Julia Robinson Fellows was hosted by Professor Jack Wagoner, Chair of the Department of Mathematics. Chancellor Tien presented a certificate of appreciation to Mrs. Constance Reid, executor of Professor Robinson's estate.

In addition to cataloging and distributing Professor Robinson's immense collection of books and personal papers, Mrs. Reid completed a book about her sister, Julia Robinson. *Julia, a life in mathematics* has just been published by the Mathematical Association of America. Order forms with a special discount for Berkeley students will be distributed at the beginning of Spring semester 1997. Mrs. Reid has agreed to be present to sign copies one afternoon at Tea.

For additional reading about Julia Robinson, see *The Collected Works of Julia Robinson*, just published by the AMS and edited by Solomon Feferman of Stanford University. It includes his biographical memoir for the National Academy and puts Julia's mathematical work in its historical context. Ω



EXCERPTS FROM A BOWMAKER'S DIARY

JOHN NEU AND TOM GODDARD

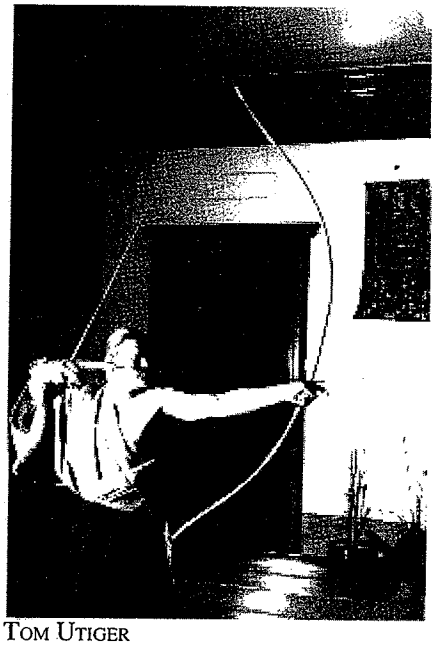
1. The Balance of the Asymmetric Yumi

JOHN NEU

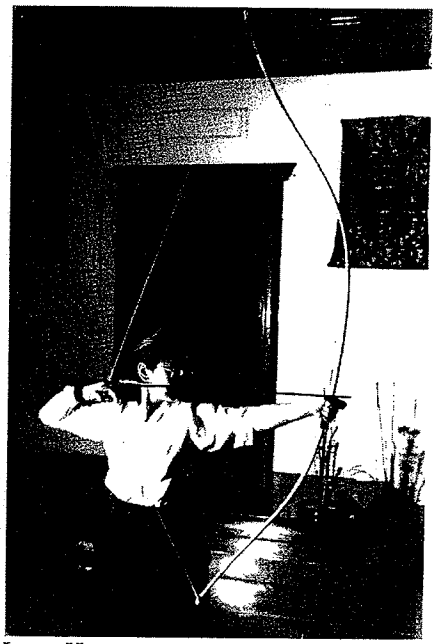
TOM GODDARD

From ancient times, the traditional bow of Japanese archery, known as the *yumi*, is asymmetric. What is meant by "asymmetry" is clear in the photographs which show Kyudo instructors (figure 1) Tom Utiger and Lucy Halverson at full draw, just before launching the arrow. Kyudo (Kyu = "bow", do = "way") is the art of archery meditation. Why is yumi asymmetric? Various conjectures are offered. For instance, if one *insists* on using a two-meter long bow as a horse-warrior's weapon (as the yumi was in the 11th century) then the short lower limb seems necessary.

Figure 1:



TOM UTIGER



LUCY HALVERSON

Now here is an interesting piece of information encountered in the pursuit of our own agenda which was, and always is, to make the yummiest (no pun!) most original bow we can. One of us (Tom Goddard) has been numerically modeling archery shots for three years, and one focus of the investigations is the *force* that the bow exerts *on the hand which holds it*. For a symmetrically shaped bow, as shown in figure 2, the relevant physics is easy to understand.

At the beginning of the shot, the limbs and arrow accelerate towards the target. There is a large reaction force imparted by the grip on the hand towards the archer. This disagreeable sensation is called *handshock*. At the "end" of the shot, the arrow is leaving the bow, having received all the momentum it's going to get, and the limbs are violently decelerated as the string maps back into a straight line. By conservation of momentum, the grip now tries to hurdle forward. The bow falls to the ground unless captured by a restraining device like a wrist strap, or by simply grabbing the grip tightly.

In Kyudo, the bow is held in a very light, delicate manner called "tenoche." Given the spirit and intentions of Kyudo meditation, a forceful grabbing of the yumi is inconceivable. Now if one applies the delicate "tenoche" grip of Kyudo to shoot a symmetric long bow like in figure 2, this is what happens: The bow simply rips past the delicately placed fingers of the tenoche grip and drops to the floor. This has been observed by one of us (J.Neu) who is a three year (raw beginner) student of Kyudo.

The problem of handshock prompted us to ask, where *does* one place the grip of the bow so as to minimize or altogether eliminate handshock? The answer, from numerical experimentation, is, about 1/3 of the way from the bottom limb tip. When such an asymmetric bow is shot, the handle basically pivots in the hand, with almost *no* back and forth motion. The situation is analogous to the free vibrations of a beam. The *center* of the beam vibrates back and forth with a large amplitude, and there are two *off-center nodes*. The motion about each node is a mere pivoting, with no back and forth displacement of the node itself. Figure 3 depicts the time sequence of a yumi's configurations during the launching of the arrow, as determined by Tom's numerical simulation. The presence of the two nodes, and particularly the node at the grip, is clear. Ω

Figure 2:

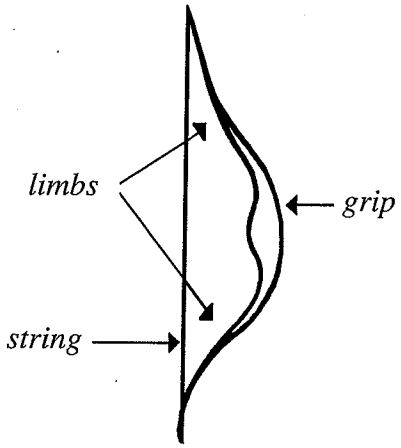
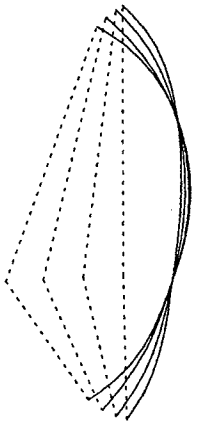


Figure 3:



Editor's Note: Part 2 will follow in the next issue.

THE NOETHERIAN RING

CHRISTINE HEITSCH

This past summer, the 25th anniversary of the American Women in Mathematics (AWM) culminated in the Julia Robinson Celebration of Women in Mathematics, a three-day conference in early July held at the Mathematical Sciences Research Institute (MSRI) in Berkeley, California. The goals of the celebration reflected on a national scale what the Noetherian Ring strives to achieve at a departmental level. While the conference talks showcased the recent achievements of distinguished women mathematicians, our weekly meetings provide a peer forum for female graduate students to present research topics in our areas of study and expertise.

During the conference, breaks between talks and "poster sessions" (when participants display their research on a poster and are available for discussion), as well as the picnic, banquet, and other more informal social functions, facilitated networking among women in various fields and positions in mathematics. At Noetherian Ring meetings, the weekly talk is preceded by half an hour of precisely this sort of convivial exchange of information. While the support and advice of more advanced students are particularly cherished, each person (male or female) attending the meetings is valued for contributing to the community of women in mathematics at Berkeley.

While informal mentoring may develop between women graduate students, finding role models beyond graduate school can be difficult. Through generous faculty donations, the Noetherian Ring developed a "Speaker Series" to address this issue; at least once a semester, we invite a prominent woman mathematician to speak at the departmental colloquium. In recent years continuing support for these visits was due to the generosity of the Visiting Professorship for Women in Science (VPW) faculty who allocated money to the Noetherian Ring from their grants. With speakers such at Margaret Wright (who spoke last Spring) and Fan Chung (who visited this Fall) presenting the results of their work, these talks enable the whole department to enjoy some exciting mathematics.

For many of the Noetherian Ring members, the first colloquium ever attended is that of "our" invited speaker, and this experience often leads to future attendance. Noetherian Ring members who attend the colloquium dinner afterwards benefit from the opportunity of engaging in dialogue with the speaker and interacting with the other faculty present. Other social events, such as a luncheon earlier in the day, the daily departmental tea, or the reception after the colloquium, all present opportunities for Noetherian Ring members to converse with the speaker and benefit from her wisdom and experiences.

As with most Noetherian Ring functions, the central focus is mathematics. However, we also benefit from the support, the solidarity, and the strengthening of the network of women mathematicians. Unfortunately, neither mathematics nor mentoring is without its price. The VPW funds are not without limit, and the department's financial situation is already strained. Thus, the Noetherian Ring has decided to begin raising funds for a university endowment, the interest of which would be used to support our Speaker Series in the years to come. Through these invited talks, we have had the chance not just to listen to, but to become acquainted with fine mathematicians from all over the world. With your support, we hope to continue this endeavor. Ω

FROM LEFT TO RIGHT, FRONT ROW: LILY KHADJAVI, MONICA VAZIRANI, KASHI ABHYANKAR, JULIE MITCHELL, RINAT KEDEM *(FAR RIGHT) BACK ROW:* KAREN EDWARDS, MARILYN KOSHLAP *(IN BACK)*, KIM WHITTLESEY, JESSICA STADDON, CHRISTINE HEITSCH, GILLIAN ELSTON *(IN BACK)*, CONCETTA GOMEZ

If you wish to make a donation to the endowment, please contact the Noetherian Ring c/o U.C. Berkeley Department of Mathematics, or email nring@math.berkeley.edu.

GRADUATE PROGRAM

DON SARASON, VICE CHAIR FOR GRADUATE AFFAIRS

In the 1960's and 1970's, when support for mathematics and for higher education was more generous than now, the Department's graduate student population hovered around 450, a figure which often astounded visitors. Entering classes of over 90 were common; occasionally that figure exceeded 100.

Those days have vanished, the victim of financial exigencies. The Department is currently striving to stabilize at under 200 graduate students, with entering classes in the neighborhood of 30. Large strides in this direction were achieved during the past few years by Rob Kirby, my predecessor as Vice Chair. In addition to shrinking Ph.D. admissions, Kirby instituted a policy of guaranteeing incoming students up to five years of support, contingent on satisfactory progress.

The potential benefits of these changes are clear. With fewer graduate students, faculty should be able to serve them better, in particular, to monitor their progress more closely. Financially secure graduate students should be able to worry more about mathematics and less about survival.

Something has been lost, of course. Although one of the "elite" mathematics departments, Berkeley has not in the past pursued an elitist admission policy. Among top-flight departments we played a unique role in that we were willing to take chances on applicants with unusual backgrounds, and on applicants from unprestigious schools. We admitted many such applicants, often without initial support, and many succeeded in our program. Our flexibility with admissions is now diminished.

Still, we are not about to imitate Harvard and Princeton, admitting just a handful of potential superstars each year. Although smaller than before, our program will still be one of the largest, maybe the largest, in the country. And we expect the Mathematics Opportunity Committee to continue to function as effectively as in the past, despite our reduced size, and despite our new Regents' policy about affirmative action in admissions. The Department will, in the future, as in the past, keep its eye out for unusual applicants who appear likely to succeed in our program. Ω

FACULTY, STUDENTS WIN AWARDS & HONORS

AMERICA'S VERSION OF THE NOBEL PRIZE AWARDED TO BERKELEY MATH PROFESSORS

Equating the National Medal of Science as America's version of the Nobel Prize, President Clinton early this summer honored Stephen Smale, Professor Emeritus of Mathematics and Richard M. Karp, Professor Emeritus of Computer Science and Mathematics, declaring them (along with 6 others in the nation) as the nation's champions of research and innovation.

Professor Smale is distinguished for his pioneering work in many areas of mathematics and its applications. Honored in 1966 with the prestigious Field's Medal, member of the National Academy of Sciences, and fellow of the American Academy of Arts and Sciences, Smale's work spans a range of topics which have lead to major discoveries in the fields of topology, dynamical systems, mathematical economics and the mathematics underlying algorithmic computer computations.

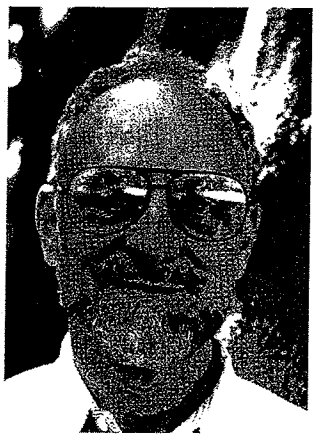
PROFESSOR STEPHEN SMALE

Professor Karp, retired from UC Berkeley and currently teaching at the University of Washington, Seattle, is acclaimed for linking theoretical computer science to real-world problems. Awardee of the highest computer science award, the Turing Award, member of the National Academy of Engineering and the National Academy of Sciences, and fellow of the American Academy of Arts and Sciences, Karp, while at UC Berkeley in the 1970's, developed the field of complexity theory, an effective means of determining the inherent difficulties of problem-solving with computers. Other substantial contributions include the theory of NP-completeness and parallel computation. Ω

PROFESSOR RICAHARD KARP

PROFESSORS ELECTED TO ACADEMY OF ARTS AND SCIENCE

Elwyn Berlekamp, professor of mathematics at UC Berkeley, has been recognized by the Academy of Arts and Science for his research on coding theory, in which his work on error correcting codes couples theoretical results with the development of important practical methods, and for his research on combinatorial game theory.



PROFESSOR ELWYN BERLEKAMP

Hendrik Lenstra, professor of mathematics at UC Berkeley, has been recognized by the Academy of Arts and Science for his research in number theory, especially his research in algorithmic number theory—the analysis and implementation of computational procedures based on number theoretic considerations. Ω

PROFESSOR HENDRIK LENSTRA

PRESS NOTES ABOUT UNDERGRADS...

CHRISTINA HONG

Hector O. Magno, a sophomore, was awarded the **1996 National Science Foundation Incentives in Excellence Scholarship Prize.** This award of $1,000, given to an undergraduate underrepresented minority student other than the current seniors, recognizes a student's scholastic excellence and encourages advanced studies in mathematics.

Wung-Kum Fong was one of the three runners-up for the **1996 Alice T. Schafer Prize.** A senior majoring in math, she is described as an "exceptional student," "stronger than many graduate students" at Berkeley. Since its inception in 1990 by the executive committee of the AWM (Association for Women in Mathematics), the Alice T. Schafer Prize commends outstanding undergraduate women for their excellence in mathematics. She will enter the PhD program in math at MIT this fall.

Sergey Kirshner received an Honorable Mention for the **1995 William Lowell Putnam Mathematical Competition** for placing in the top 50 out of 2400 participants.

A team of three UC Berkeley undergraduates, (Benjamin Rudiak-Gould (Physics), **Amit Sahai (Mathematics),** and Scott McPeak (EECS)), solved a total of six problems in a total 712 minutes to win the **Twentieth Annual International Collegiate Programming Contest.**

Organized by the Association for Computing Machinery, 1001 teams competed at 17 regional contests on four continents. The 43 top teams competed in the contest finals at the ACM Computing Week Conference in Philadelphia, on February 17, 1996. (This was the same meeting featuring the IBM Deep Blue - Gary Kasparov Chess Challenge.) Teams that solved equal numbers of problems were judged on the basis of the total time required to solve them. The Harvard team placed second, solving six problems in 797 minutes. Next came the University of Waterloo (Canada). Sofia University (Bulgaria) won the European Championship placing fourth overall. Solving five problems each to attain fifth place were MIT and the University of Queensland (Australia), the latter taking the Asia-Pacific Championship.

Microsoft Computer Corporation sponsored the event, providing equipment, software, and over $30,000 in prizes, of which the Berkeley team will receive $15,000. Ω

STAFF HONORED

MANAGER'S REPORT

CAROLYN KATZ

Mathematics has again had a very impressive representation for staff awards. In 1995-96 a number of individuals received the Letters and Sciences' Distinguished Service Award (DSA), along with a substantial check.

Distinguished Service Awards

- ☺ **Bibi Basha** was recognized for her contributions in evaluating our academic personnel process and developing our Faculty Information Guide.
- ☺ **Haruko Bruce**, for her service to our Visiting Scholars program and our recruitment process.
- ☺ **Deborah Craig**, for her outstanding speed and facility in technical mathematical typing and her assistance to faculty.
- ☺ **Christina Hong**, for her excellent project work with the development and coordination of the Fall 95 Mathematics Placement Exam Project as well as her outstanding service to students and faculty.
- ☺ **Marsha Snow,** for her contributions to the Placement Exam Project and her meritorious service to the many faculty and students who visit the department's Main Office.
- ☺ **Kathleen Valerio**, for her many outstanding contributions to improving administrative processes in the Mathematics Department, including teaching evaluations and computing related projects.

BIBI BASHA

HARUKO BRUCE

DEBORAH CRAIG

CHRISTINA HONG

Berkeley Staff Assembly Excellence In Management Award

- ☺ **Lou Maull** was recipient of this special campus award to recognize her performance as the Personnel and Finance Unit Supervisor. This award was particularly meaningful because her staff enthusiastically nominated her for it.

LOU MAULL

MARSHA SNOW

KATHLEEN VALERIO

Finally, I'd like to give acknowledgment and thanks to staff on our two major team projects who were nominated for campus awards. The staff gave energy and time for these projects which were above normal expectations for their jobs.

Team Awards Nominated

- ☺ **Mathematics Computing Team** - Dave Hernes, Lou Maull, Kathleen Valerio, and Faye Yeager
- ☺ **Mathematics Awards Team** - Catalina Cordoba, Bibi Basha, Bernice Gangale, Lou Maull, Melanie Seepol, and Gail Yoshimoto

MATHEMATICS COMPUTING TEAM WITH CHANCELLOR TIEN: (LEFT TO RIGHT) KATHLEEN VALERIO, CAROLYN KATZ, DAVE HERNES, CHANCELLOR TIEN, JOY TAN & PAUL LEE (COLLEGE OF LETTERS & SCIENCE TECHNICAL STAFF), AND LOU MAULL. (FAYE YEAGER NOT PICTURED)

We have a truly wonderful staff and I'm very pleased that so many were formally recognized by L&S and the campus. I thank all of the Mathematics staff for their dedication and support. We have come very close to realizing my personal goal of recognizing all staff for their achievements through the formal awards process over these past several years. Ω

M.U.S.I.C. for MATH STUDENTS

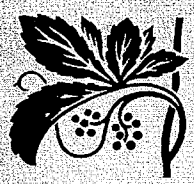
The Mathematics United Student Information Center (MUSIC) project was started this summer (1996) to provide graduate students with many needed and desired resources. Located in the south end of room 708, which must be accessed via a punch-lock on the doorknob, will be a space devoted to both computing and information sharing, roughly half of the space to each.

With some funding and help from the Department, many students volunteered (led by Julie Mitchell) to make the project become a reality. There are currently six NeXT station computers in the room, and ten Macintosh computers with Internet and Unix server access will be installed when the needed hardware arrives.

Future plans include collection of printed materials of interest to graduate students and organization of informational binders. In particular, guidelines for qualifying exams and prelims, as well as information on admissions and funding will be compiled. There will be a desk for career information, as well as a phone (with calling card access only) for use by students searching for jobs.

Space has been set aside for reference books and recent publications. Thanks to Bill Kahan, an extensive set of Math Reviews, much of which predates listings available on MathSciNet, is now part of our donated library. We hope students and faculty will contribute additional items to this collection. In particular, we are interested in obtaining books and recent/favorite publications written by our faculty members. If you are interested in helping with any of the above items, or for more information, contact one of the following people:

Books/Articles — Julie Mitchell
Qual/Prelim Info. — Vinay Kathotia
Computers — Tom Insel
Door Code — Dave Hernes
Job Information — Alexandre Chorin Ω



CALCULUS COMPUTING LABORATORY

A wonderful new computing laboratory has been completed in the basement of Evans Hall, for use by students taking a special calculus lecture section. The room is very secure, has top-of-the-line Mac Power PC's, and is beautifully furnished. Graduate students (Julie Mitchell, Christine Heitsch, Alex Gottleib, and Aaron Abrams) worked hard to develop materials for the lab and prepare for training graduate student instructors for Fall 1996. An open house on Friday, August 23, 1996, was attended by Vice-Chancellor Carol Christ. The extensive renovation was completed on schedule and was ready for implementation in time for the '96 Fall semester. Chair Calvin Moore worked hard to bring it to fruition, assisted by staff Dave Hernes and Paulo de Souza.

The Department introduced in Fall '96 a new four-semester sequence of calculus courses (1AM, 1BM, 53M, 54M), which parallels the existing sequence(1A, etc.). The new M courses have the same three hours of faculty lectures per week as the traditional courses, but will substitute three hours of instruction per week in the specially designed computer class laboratory (a studio classroom) led by a Graduate Student Instructor (GSI), for the traditional discussion/recitation section meetings. Enrollment in these M courses are limited to about 700, of the 4500 overall enrollments in this sequence, solely because of computer laboratory seating limitations. It is our intent in the future to add additional labs and to expand enrollment in the M courses to include a larger percentage of the 4500 total.

This studio class laboratory is a splendid facility, and we invite you to inspect it should you visit the Department. The Department invested some of its own funds in the project, and we were also able to obtain substantial contributions from Dean Buford Price of Physical Science, from Dean David Hodges of the College of Engineering, and from Dean Alexis Bell of the College of Chemistry, for which the Department is very grateful. In addition Jack McCredie, Associate Vice Chancellor for Information Systems and Technology, was extremely helpful. We wish to thank the Apple Computer Company for their generous donation of equipment (Power Macs) for the Laboratory. Finally, the continuing interest and financial support from Berkeley Chancellor Chang-Lin Tien was essential for the success of the project.

The primary focus of the computer laboratory component is for students to work on computer-based instructional modules and projects under the guidance of the GSI. Students work individually and in groups in a collaborative learning style. The emphasis is on creating an active learning experience where students can experiment and can visualize concepts using the instructional materials. The pedagogical principles of the laboratory include the following:

1. The labs should help carry out the "Rule of Three Plus One." Technology is a powerful tool in helping students synthesize different representations of mathematical ideas. In particular, the lab activities will help students relate the algebraic, graphical, and numerical aspects of a topic and encourage them to express these ideas verbally. The computational power of computers will also help students see the applications of their mathematical work in real rather than artificial settings.

2. The labs should encourage exploration. One of the great potential uses for computers is the creation of interesting environments for mathematical exploration. For topics heavy in computation and/or graphing, the computer allows speedy exploration, open-endedness, and flexibility impossible by hand.

3. The labs should encourage group work and human contact. Not only should the labs encourage group learning and working, but the GSI should also be closely involved. Real learning happens not only in a student's mind, but also from communication of students with their fellow students and GSIs. Labs also give GSIs a chance to interact individually with students and see their thinking process. GSIs will be explicitly trained to watch for the student's possible misconceptions and encourage clear thinking.

4. The labs should not seem outside the flow of the course. While we will attempt to enhance and evaluate students' conceptual understanding, students will be evaluated for computational and algorithmic skills, just as in the traditional calculus classroom. Thus, it is especially important for GSIs to explicitly tie the lab activity to particular mathematical ideas and abilities. Ω

ALUMNI NEWS

ROLANDO A. DANAO (Ph.D. 1975) is currently professor of mathematical economics in the School of Economics at the University of the Philippines in Quezon City. He has received the University's Outstanding Faculty Award. Professor Danao continues to publish papers on the linear complementarity problem.

MORTON D. DAVIS (MA 1956; Ph.D. 1961) is a professor of mathematics at City College of New York.

CHARLES E. GARRETT (AB 1971) is currently Vice-President for Academic Affairs at John Cabot University in Rome, Italy.

STEPHEN C. GORDON (AB 1971) after teaching high school mathematics from 1972-78 changed careers to public accounting. He currently lives and works in Palo Alto, California as a certified public accountant.

SCOTT H. HOCHWALD (Ph.D. 1984) is an associate professor at the University of North Florida in Jacksonville.

BARBARA A. KERN (AB 1958) currently works as an independent contractor senior software engineer in Oklahoma City. Her speciality is real-time software.

DAVID NADLER (Ph.D. 1979) is doing contract programming for EDS Unigraphics (CAD/CAM "stuff"). David lives in Anaheim and would love to hear from any friends from his Berkeley days. His email is dnadler@ni.net.

HENRI PICCIOTTO (AB 1970; MA 1972) teaches high school mathematics at the Urban School of San Francisco. He has been involved in K-12 math education since graduate school and has written a number of books for grades 6-12, including some on geometric puzzles and beginning algebra. In addition, Henri speaks at conferences and does consulting for other schools and school districts. He is the current editor of the "Activities" column in "The Mathematics Teacher", the journal of the National Council of Teachers of Math.

JOYCE A. PUTNAM (AB 1962) joined the programming team for the Computation group at Livermore Laboratory after graduating with her AB. In 1964 Joyce took a position at the Culham Laboratory near Oxford, as well as matriculated in the Advanced Mathematics certificate program at Oxford University. She was offered an RA at the Courant Institute of Math Sciences at NYU. When she returned to Berkeley two years later, Joyce took a position in the Chancellor's offices for systems. Currently she is back at Lawrence Berkeley National Laboratory working in the Energy and Environment Division on computers she says "we only dreamed of in 1962".

M. SUSAN RICHMAN (AB 1962) is an Associate Professor and Chair of the Mathematical and Computer Sciences department at Penn State, Harrisburg.

FRONA B. VICKSELL (MA 1959) currently works as a Navigation Software Engineer at North Star Technologies in Acton, Massachusetts. She enjoys her work in real-time software for collision avoidance, marine navigation, and avionics. She married Ross and has two daughters. She asks, "What happened to our fellow students?" *[Editor's comment: So, if you graduated in the late 50's, write to us what you are doing these days!]*

ROGER P. WARE (AB 1965) is a mathematics professor at Penn State. Ω

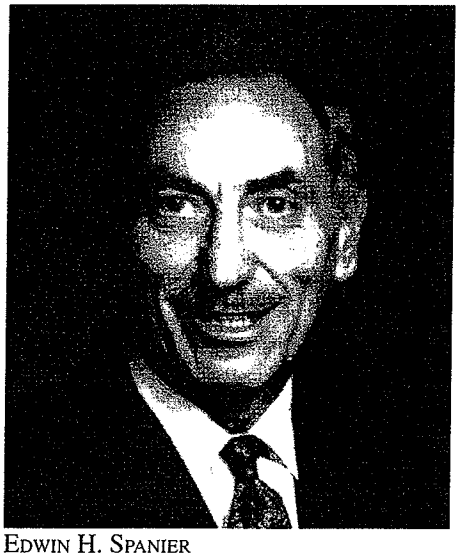
FACULTY REMEMBERED

MEMORIAL FOR EDWIN H. SPANIER, 1921-1996

PROFESSOR JEROME SPANIER

Edwin H. Spanier was born in Washington, D.C. in 1921 and educated at the Universities of Minnesota and Michigan. Spanier made his mark early in the mathematical community with his Ph.D. dissertation in the then rapidly expanding field of algebraic topology. Spanier's research in algebraic topology has been of lasting importance, not only in geometrical investigations, but in many other mathematical fields that use topological tools. Spanier-Whitehead duality theory and Alexander-Spanier cohomology are basic theoretical tools; the latter has recently been used to solve problems in dynamical systems theory. In 1966 Spanier published the first comprehensive textbook in algebraic topology: it is still in wide use as a text and standard reference.

After gaining his doctorate at the University of Michigan in 1947, under the direction of Norman Steenrod, Spanier held a postdoctoral fellowship at the Institute for Advanced Study in Princeton, N.J. In 1948 he joined the faculty of mathematics at the University of Chicago. He left Chicago in 1959 to accept appointment



EDWIN H. SPANIER

as Professor of Mathematics in Berkeley where he taught and continued his research until his retirement in 1991. Shortly after his move west, Spanier undertook the study of formal languages, a subject of importance in computer science. While continuing his research in topology, he published a series of papers about formal languages, many of them jointly with Seymour Ginsburg of the University of Southern California. During his long and distinguished career, Spanier held numerous visiting positions at universities and research institutes throughout the world, including a Guggenheim Fellowship in 1952-53 and a Fulbright Distinguished Lectureship in 1972.

Spanier moved to Scottsdale, Arizona in 1993 and is survived there by his wife, Marianne. In California he leaves three children, Rita Wolenik of Rancho Palos Verdes, Gail Petrek, and Lawrence Spanier, both of Danville, and eight grandchildren. His sister, Leila Rutstein, resides in Silver Spring, Maryland, and his brother, Jerome Spanier, lives in Claremont, California.

A memorial for Edwin Spanier was held November 24, 1996 at the Faculty Club on the UC Berkeley Campus.

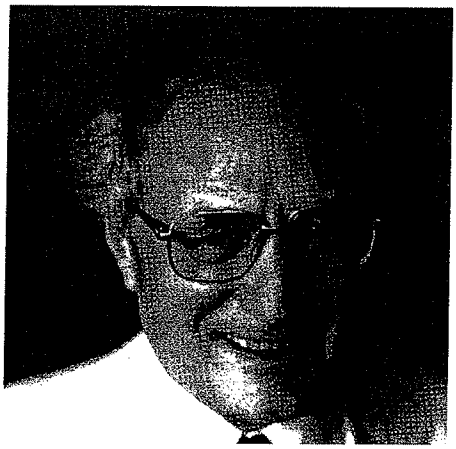
FACULTY REMEMBERED

Obituary for Hans-Joachim Bremermann, 1926-1996

ROBERT SANDERS

Hans-Joachim Bremermann was a pioneering biomathematician whose interests ranged widely from artificial intelligence and the limits of computer computation to the purpose of sexual reproduction. He was also professor emeritus of biophysics and mathematics at the University of California at Berkeley.

A native of Bremen, Germany, Bremermann made significant contributions to many areas of mathematics, most importantly in models of biological processes. He was a pioneer in complexity theory and genetic algorithms, and is well known for his models of parasite-host interactions.



HANS-JOACHIM BREMERMANN

He was one of the original creators of genetic algorithms, computer programs that evolve or change in a manner similar to Darwinian evolution. This work led to the concept known as the Bremermann limit, a theoretical limit to any computation.

His theory of sexual reproduction emerged from theoretical musing on why animals would choose to gamble on sexual reproduction when asexual cloning seems a more certain way of assuring survival of offspring. His conclusion was that sexual reproduction arose as response to microscopic parasites, a way of slightly altering the offspring's genetics to throw parasites off track and provide an edge in the constant battle with pathogens.

He also applied discoveries about how bacteria locate food and avoid poisons to create the Bremermann optimizer, a "dumb" but efficient way to perform a search. This concept was later applied to learning by neural networks, artificial circuits designed to mimic networks of brain cells.

In the years before his death, Bremermann worked with immunologists on mathematical models of how HIV interacts with the immune system to cause AIDS.

He also was at work on the theory of dreams, which he proposed as the key to the human brain's ability to recognize patterns. He proposed that the shifting images in our dreams are a window into how the brain analyzes and stores visual patterns. In July 1995, he spoke about his theory of dreams in an invited lecture at the Dalai Lama's 60th birthday celebration in India.

A member of the UC Berkeley Department of Mathematics for more than 30 years, Bremermann gradually diverged from pure mathematics. He joined the Department of Medical Physics in 1970 and eventually ended up in the division of biophysics and cell physiology in the Department of Molecular and Cell Biology. He retired in 1991.

Born September 14, 1926, Bremermann remained in Bremen with his family through World War II. In 1946, he enrolled in the University of Munster where he studied the mathematics of several complex variables and the theory of computation. After obtaining his doctorate in mathematics in 1951, he was able to arrange two years of postdoctoral studies in the United States, at Stanford and Harvard. He was twice invited to conduct research at the Institute for Advanced Study in Princeton, first as a mathematician in 1955 and again as a physicist in 1958.

It was at the Institute, then the "center of the world in mathematics," that Bremermann became involved with programming one of the first computers, MANIAC, constructed by mathematician John von Neumann. During this time he became intrigued by the limits of computing, beginning a life-long interest in developing algorithms or short-cuts for solving complex problems.

In 1959, Bremermann joined the Department of Mathematics at UC Berkeley and quickly took over a seminar in artificial intelligence. In the 1960's he began to collaborate with the Panoramic Research Group in Palo Alto, California, on the first artificial intelligence groups.

In 1995 he received a lifetime achievement award from the Evolutionary Programming Society for his contributions to the foundations of the field and for his work on genetic algorithms. A Fellow of the American Association for the Advancement of Science, Bremermann was a member of the American Mathematical Society as well as a number of other scientific societies in mathematics, artificial intelligence, and biophysics and a founding editor of the *Journal of Mathematical Biology*.

Bremermann was well known as a warm and patient mentor who nurtured 26 students through their Ph.D. degrees. Many of these students presented Bremermann last year at a banquet in his honor with a Festschrift volume of papers published as a special issue of the journal *BioSystems*.

Hans-Joachim Bremermann died February 21, 1996 of cancer in Berkeley, California. He is survived by his wife Maribel Bremermann, a native of Spain whom he met while at Stanford in 1954. She is a professor emeritus of romance literature at San Francisco State University.

A memorial service was held on March 17, 1996 in the Faculty Club on the UC Berkeley campus.Ω

Chair's Message *(cont. from page 1)*

worksheets for the classes that started in the Fall 1996. (Please see the separate article about this computer class laboratory in this Newsletter.) The second way of implementing this approach is in ordinary classrooms with worksheets but without computers. We will continue to offer calculus courses in the standard or traditional format. We will then have an opportunity to evaluate these formats. Based on the Treisman experience, we hope that student learning will be enhanced, that students will have a better understanding of the concepts of calculus, a better understanding of the geometrical aspects of calculus, and be able to solve more difficult problems.

Faculty News

I am very pleased to announce that we successfully recruited three new senior faculty members who joined the department as full professors on July 1, 1996. These are Michael Christ, who works in classical analysis, Theodore Slaman, who works in logic, and John Steel, who also works in logic. Please see articles about each of these new faculty members in this Newsletter. This last year clearly was an unusually successful year for recruitment, and we are making progress on rebuilding the faculty after the losses due to the University's early retirement program. We have some distance to go to rebuild up to about 60 faculty, and we will be actively recruiting new faculty for the next several years.

I am pleased to announce that Assistant Professor Alexandre Givental was promoted to the rank of Associate Professor, with tenure, effective July 1, 1996.

Several faculty were honored during the year. Some highlights include the following: Steve Smale, Professor Emeritus of mathematics, and Richard Karp, Professor Emeritus of Computer Science and of Mathematics were awarded the National Medal of Science by President Clinton -- they join Professor Emeritus Shiing-Shen Chern and Professor Emeritus I. M. Singer as members of the Department who have received this honor. Professors Elwyn Berlekamp and Hendrik Lenstra were elected to the American Academy of Arts and Sciences. This brings to 21 the number of our faculty who have been so honored.

Graduate Program

The number of entering graduate students in the Fall of 1996 was a little over 30. This number is substantially smaller than the numbers of students admitted several years ago, which was 60 or more. This comparison highlights the Department's continuing actions to reduce the size of the Ph.D. program to less than half of its former maximum size. The goal is to bring the program down to under 200 students. Most important, we have started a policy

(continued on page 16)

Alumni News & Update Form *(please type or print, using a separate sheet if necessary)*

Name:
Last _____ First _____ MI _____
Degree & Year graduated: _____
Address Correction:

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Location:

Personal and Professional News:

Ideas for our Newsletter:
What items in this issue were of particular interest to you?

What other types of articles or information would you like to read in future issues?

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Rondi Phillips, Editor
Department of Mathematics #3840
University of California, Berkeley, CA 94720-3840
Tel. (510) 642-4024
Fax # (510) 642-8204
Email: rondi@math.berkeley.edu

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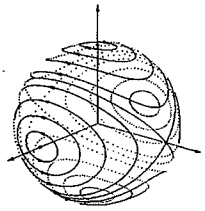

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The Department of Mathematics wishes to thank all alumni, parents, students, faculty, staff and friends who support the Department.

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Chair Message (cont. from page 14)

of guaranteeing five years of support to all students contingent only on making good progress in the program. We believe that these changes will promote student-faculty interaction and will represent an overall improvement in the program. The Mathematics Opportunity Committee (MOC) continues its functions: the department is committed, through outreach, admissions, financial support, and academic advising and support, to provide opportunities for graduate mathematics study at Berkeley for students who have demonstrated exceptional mathematical promise despite having encountered in their earlier education limited resources or other circumstances that may have affected their preparation. The Department remains especially interested in helping women and underrepresented minority students to successfully complete graduate study at UC Berkeley.

Fund Raising

I want to thank all of you who have made contributions to the Department, and I want to encourage many more of you to make contributions, not only an on annual basis, but also to entertain the possibility of providing an endowment that will fund a program or activity on an ongoing basis. It is clear that resources from the State alone, in the long run, will not be sufficient for what we need to do in order to maintain and improve our research and teaching programs, and to maintain our top national ranking. Private donations have been and will continue to be essential for us to achieve these goals. I am pleased to announce that the Department has within the last year received in excess of two million dollars in gifts or pledges of gifts for endowment funds.

Our greatest needs are for funds to provide graduate fellowships, for funds to provide postdoctoral fellowships to bring promising recent doctorates to Berkeley, and for funds to support and upgrade our computer infrastructure. I look forward to talking to many of you in more detail about the needs of the Department and how you can help. Ω

CAL DAY: SATURDAY, APRIL 19, 1997

CAL DAY is UC Berkeley's Open House to the public as well as the campus community and alumni. Come visit the Department of Mathematics in 1015 Evans Hall or "Ask the Mathematician" in front of Evans on the Mining Circle.

U. C. Berkeley Charter Day Celebrations will take place from 11:00 am - 12:30 pm in Dwinelle Plaza. Chancellor Tien will be giving his farewell address.

Production Team

Editor: Rondi Phillips

Copy Editors: Deborah Craig, Lou Maull

Production Artist: Rondi Phillips

Consultants: Carolyn Katz, Deborah Craig

Photographers: George Bergman, Paul Brown

Contributors: Haruko Bruce, Deborah Craig, Tom Goddard, Christine Hertsch, Christina Hong, Carolyn Katz, Lou Maull, Calvin Moore, John Neu, Rondi Phillips, Jim Propp, Constance Reid, Robert Sanders, Don Sarason, Jerome Spanier

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Submit articles to: Rondi Phillips, Editor, Department of Mathematics, #3840, Berkeley, CA 94720-3840 or, email: rondi@math.berkeley.edu

Correction Box

From Fall 1995 newsletter, the Editor wishes to acknowledge the following corrections:

Page 3 in "Message from the Chair" fund from "Dennis" Ross Richman should be "David" Ross Richman.

Page 11 in "An Interview with Miss Sarah Hallum", second column: D. H. Lehmer came to UC Berkeley in 1940, **not** his father, D. N. Lehmer.

Berkeley *Mathematics* Newsletter

Department of Mathematics #3840
970 Evans Hall
University of California at Berkeley
Berkeley, CA 94720-3840

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