fsumath
FLORIDA STATE UNIVERSITY
Fall 2008

Saying Farewell to a Legend

Christopher Hunter

1934 - 2008

In the world of academia many individuals are drawn to a niche in which they excel — be it teaching, scholarship, service or administration. The individual whose success spans the range of these areas is a rare and coveted treasure. **Christopher Hunter** was just such a person. As a trusted mentor, colleague and leader he embodied the "complete package" and his influence contributed to the high esteem in which the Florida State University Department of Mathematics is held today. Therefore, it is with great respect and fondness that we celebrate his life's contributions and bid him farewell.

Under the recommendation of an interdisciplinary Committee on Applied Mathematics, Christopher Hunter came from Massachusetts Institute of Technology (MIT) to Florida State University in 1970 for the explicit purpose of organizing and directing a program in applied mathematics. Over the next few decades under Hunter's leadership and vision, the program grew in its ability to accommodate a wide range of mathematical applications through the addition of degree options and the hiring of such renowned professors as Christopher Tam, Robert O. Lawton Distinguished Professor, Louis Howard, McKenzie Professor of Mathematics, and Yousuff Hussaini, TMC Eminent Scholar Chair in High Performance Computing. Hunter devoted himself to the development and success of the program and garnered national recognition through promoting faculty research and securing consistent support from the National Science Foundation. As a direct result of his efforts and commitment the program remains strong and continues to grow.

continued on page 3

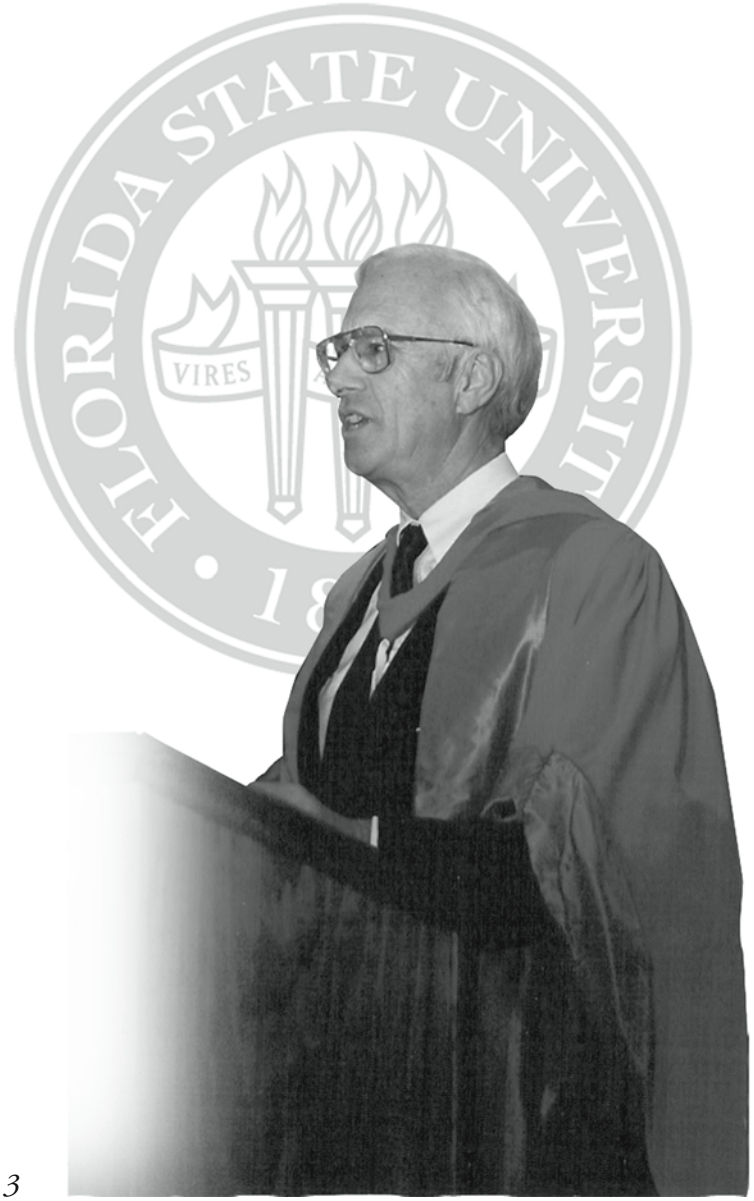


Table of Contents

A View from the Chair...

Welcome to the Fall 2008 edition of FSUMath. I am sorry to report that Chris Hunter, one of our most distinguished faculty, a former chair and McKenzie Professor, passed away during the spring semester this year. This issue of the newsletter is dedicated to Chris's memory and constitutes a celebration of his contributions to the department over the last four decades. In addition to a cover story that offers a short professional biography, DeWitt Sumners, professor emeritus and former chair, and Eddie Qian, Chris's former doctoral student, offer tributes to Chris's memory — one from the view of a colleague, the other from that of a student. Most engaging, though, is Chris's autobiographical essay written shortly after his retirement in 2003 and reproduced here. We bid a fond farewell to Chris and offer our condolences to his family, students and friends.

As I begin my fourth year as chair, the challenges the department faces are significant. We have lost six faculty to the new Department of Scientific Computing (DSC) and will lose a couple more this year to other factors. The university is struggling to accommodate a reduction in its base operating budget of roughly 12% that is likely to grow as the fiscal situation of the state of Florida worsens. One result is a hiring freeze for this year, likely to be continued for the next year. I can report, though, that the department — through wise management of its resources — finds itself well-funded for this economic downturn and is positioned not only to survive intact but even to thrive during these tough economic times. We have made significant investments in infrastructure over the past year with purchases of major computing equipment that should sustain us through the next three years. We have saved for this rainy day and have funds to support research and travel and we have a more than sufficient budget to support our 100 or so teaching and research assistants. When hiring returns, we will be well-positioned to argue for hires in all four areas.

We welcome to the department Kyle Gallivan, professor of Applied Mathematics and Kathleen Petersen, assistant professor in Topology, our newest graduate faculty. Kyle transferred his tenure from the Computer Science Department to ours when DSC was formed, and Kathleen arrives in January 2009 from a semester at the Fields Institute. We welcome also Pennington LeNoir our new assistant-in Mathematics who will be responsible, with our other teaching faculty, for instruction in basic mathematics courses. Congratulations to Giray Ökten for receiving tenure and to Mark van Hoeij for his promotion to professor, both effective in August 2008.

Research in the department continues to thrive, with significant work published this past year in all four areas, much of it supported by competitive grants. Our Financial Math Program continues to be a strong draw for graduate students and the past two years have seen increased interest in our Biomathematics Program. We have experienced growth in the Pure Mathematics Program and have seen sustained interest in the Applied Program. All in all, doctoral training is going full steam ahead in the department.

Here's wishing you and yours a Merry Christmas and a Happy New Year!

Philip Bowers

Christopher Hunter (Cont'd)

Pictured from left, Chris Hunter, Eutiquio Young, Robert Gilmer, Joe Mott, Perrin Wright and John Bryant, at their retirement party in spring 2003

Hunter was not so absorbed in his own program that he neglected the relevance of other areas of mathematics. He was a great believer in the importance of each branch of the field and a proponent of collaboration that would benefit them all. Therefore, it was fitting that he was appointed department chair in 1993, the first applied mathematician to serve in that role. Known as an even-handed and fair administrator, Hunter remained chair for the maximum allowable term of six years with the enthusiastic support of the faculty. Hunter was gifted at recognizing talent which allowed him to hire many bright young minds that have since become leaders in the field. According to DeWitt Sumners, Professor Emeritus, "Hunter was successful as department chair because he was willing to listen to his faculty and able to mediate disputes." He also worked to build a strong relationship with Larry Abele, the dean of the College of Arts and Sciences at the time, which helped cultivate support for faculty in areas such as promotion and tenure.

After stepping down from the position of chair in 1999 Hunter successfully returned to the faculty. His interest as a researcher was in how mathematics can be used to understand the physical world, with particular regard to galactic dynamics and astrophysics. As a teacher Hunter held students to high standards and is responsible for mentoring many promising scholars (see list of students, p. 5). The only endeavor at which Hunter did not excel was retirement. His love of learning, devotion to the field of mathematics and continued grant activity kept him active even after his official position with the university ended in 2003.

Christopher Hunter's innovation and leadership have far-reaching influence on the FSU Department of Mathematics and the discipline at large. As a pioneer of his craft, he has paved the way for the many mathematical discoveries and breakthroughs yet to come. The department, university and field of mathematics have lost a true champion but his legacy will live on in the next generation of mathematicians. **m**

continued on page 5

The Life of Christopher Hunter

1934	Born, Manchester, England
1952 – 1954	Served as a National Serviceman in the British Army
1960	Received his Ph.D. from Trinity College, Cambridge and moved to the United States for postdoctoral work at the Massachusetts Institute of Technology (MIT)
1961	Married Hilda Salmon
1962 – 1964	Returned to England to serve as a research fellow at Trinity College, Cambridge
1964	Returned to MIT as faculty
1970	Became founding director of Florida State University's Program in Applied Mathematics
1991	Named McKenzie Professor of Mathematics
1993	Appointed chair of the Florida State University Department of Mathematics
1993	Received an honorary Doctor of Science degree from Cambridge University
1995	Received the Brouwer Award of the Dynamical Astronomy of the American Astronomical Society
2003	Retired
2008	Died, Tallahassee, Florida

Give Back to Mathematics

by Steve Paris
Coordinator, Program in Actuarial Science

The program in Actuarial Science, established by the Department of Mathematics under the leadership of Dr. Bettye Anne Case in 1997, continues to thrive. The introductory course has become so popular that we are now offering it twice a year, in summer and fall. In spring 2008 there were 98 undergraduate majors which accounts for close to 50% of all undergraduates majoring in mathematics. Our students are serving summer internships with and being hired by prestigious companies such as Blue Cross Blue Shield of Florida, JP Morgan, NCCI, Towers Perrin and Watson Wyatt.

Majors begin preparing for a series of actuarial exams in their junior year and their professional marketability is heavily influenced by whether or not they pass. We are committed to providing our students with the tools they need to be successful and have begun offering seminars to help them prepare for examination. It is evident that these seminars are having an impact. Of the nine 2008 graduates, seven passed at least one actuarial exam and 12 majors in total received passing scores during the last exam administration alone.

Not only are students faced with mastering the content for these exams, they are also challenged by the cost. In addition to purchasing study materials, students must pay $175.00 for each exam which can be difficult on an undergraduate budget. Last year we were fortunate to receive a generous donation from Towers Perrin that allowed us to reimburse 50% of the examination fee to passing students. Our goal is to offer full reimbursement to those who pass in the hopes of encouraging more students to prepare for and take the exams. Many successful programs that we aspire to emulate — such as those at the Universities of Michigan, Iowa and Texas at Austin — offer similar reimbursement plans. We ask our alumni to consider supporting us in this effort to promote our students and advance our program to the next level of success. To make a tax-deductible donation for this purpose please contact Steve Paris, Coordinator, Program in Actuarial Science, (850) 644-4419, paris@math.fsu.edu. **m**

Introduction to Actuarial Mathematics (Steve Paris, front row, 5th from left)

Remembering Christopher Hunter

A Colleague's Perspective

I first met Chris Hunter in 1970 when he came to Florida State to interview for the position of director of a new Program in Applied Mathematics. Under the leadership of then chair Orville Harrold, the department decided to enhance the area of applied mathematics and Chris came highly recommended. It was the right decision to build in applied mathematics and an even better one to hire Chris Hunter to lead the effort. As the founding director, he put the program on the map.

Chris and I had much in common — we both received doctoral degrees from the University of Cambridge and we both believed mathematics to be a unified discipline consisting of a wide spectrum of research areas with no impenetrable walls separating any one from the other. Chris eventually became department chair and was gifted at persuading the often opposing views and personalities in pure and applied mathematics to co-exist, if not flourish.

I followed Chris in that position serving as department chair from 1999-2005. On my first day as chair, Chris came into my new office sporting a huge grin. He was again free to research and teach without the daily mini-crises every chair faces. Chris taught me invaluable lessons on how to herd that particular set of cats!

Chris was a pillar in the research life of the department. He enjoyed continuous support from the National Science Foundation from his arrival at Florida State until the age of 70 after he retired — an achievement that is unmatched in our department. In 1993 he received an honorary Doctor of Science degree from Cambridge University and two years later won the prestigious Brouwer Award from the American Astronomical Society.

I have many fond memories of Chris, from our work in the department to my visit with him during his sabbatical in Oxford, and his death came as a great shock. Not only was he a highly successful academic, he was a charming and friendly individual, a leader who is greatly missed. **m**

DeWitt Sumners
Professor Emeritus

Hunter's legacy may be most evident in the lives of those he mentored. FSU Mathematics graduates who worked with Hunter across the years are:

- Ahmed Dia (M.S., 1972)
- Jeffrey Kobin (M.S., 1972)
- Charles C. McAliley (M.S., 1972)
- Ram Singh (M.S., 1972)
- Karen L. Tenne (M.S., 1972)
- George H. Branch (M.S., 1973)
- Paul M. Hanna (M.S., 1973)
- Gary S. Kitson (M.S., 1973)
- Michael S. Smith (M.S., 1973)
- Bruno Guerrieri (M.S., 1974)
- James L. Highham (M.S., 1974)
- David Nourollah Riahi (Ph.D., 1974)
- James M. Thoreen (M.S., 1974)
- Bryan J. Travis (Ph.D., 1974)
- Henry Cooper (M.S., 1975)
- Gustav Klebingot (M.S., 1975)
- Theresa Kress (M.S., 1975)
- Paul Lee (M.S., 1975)
- Michael Merritt (M.S., 1976)
- Lee Tadelman (M.S., 1978)
- Barbara Schreur (Ph.D., 1979)
- Lea Ming Lee (M.S., 1981)
- Bruno Guerrieri (Ph.D., 1982)
- David Sang Myung Lee (Ph.D., 1984)
- Scott Boyer (M.S., 1987)
- Mohammed Tajdari (M.S., 1987)
- Zhaolong Chao (M.S., 1990)
- Mohammed Tajdari (Ph.D., 1990)
- Jin Wu (M.S., 1991)
- Shunping Zhuang (M.S., 1991)
- Lin Mei (M.S., 1992)
- Edward (Enping) Qian (Ph.D., 1993)
- Charles Geib (M.S., 1995)
- Chitra Jain (M.S., 1995)
- Bill Richmond (M.S., 1995)
- Fangyuan Nan (M.S., 1996)

"It was the right decision to build in applied mathematics and an even better one to hire Chris Hunter to lead the effort."

continued on page 8

Program Highlight: Biomathematics

Biomedical Mathematics at FSU began in 1990 when DeWitt Sumners, Robert O. Lawton Distinguished Professor, received funding from the Office of Naval Research, the National Science Foundation and the Hughes Foundation. At that time, the research in the discipline was funded by a national collaboration known as Mathematics and Molecular Biology with its headquarters at the University of California at Berkeley. Eventually, those headquarters moved to Florida State and in 2000 a two-year Master's degree program in Computational Biology was launched. In the eight years since its inception the program changed its name from Computational Biology to Biomedical Mathematics to, currently, Biomathematics and added both Ph.D. and undergraduate-specialization options.

Biomathematics is an interdisciplinary initiative in which students collaborate with Florida State University's Institute of Molecular Biophysics, Department of Biological Science, Department of Scientific Computing and National High Magnetic Field Laboratory as well as with researchers at other universities. The focus of the field is to model natural biological processes through the application of mathematics. The faculty are heavily funded in such relevant areas of research as mathematical physiology, computational anatomy, game-theoretic modeling, fluid dynamics and human brain mapping, among others.

The Program in Biomathematics has become increasingly popular among prospective graduate students. According to Jack Quine, Charles W. McArthur Professor and the program's director, "We have more students than faculty to take them." There are approximately 30 students in the graduate program and over 30 undergraduates pursuing specialization. Students are drawn to the field because of the wide range of career options available to them upon graduating. Biomathematicians are not limited to academia but are highly marketable in such important and lucrative fields as cancer and brain research, pharmaceuticals, and psychometrics. Many graduates are employed by entities such as research laboratories, the United States Environmental Protection Agency and the National Institutes of Health. DeWitt Sumners indicates that this depth of diversity is precisely the point and largely why the program was started. "The department needed to have a scope of various interests to attract a wider spectrum of students," he said. "This program offers a genetic diversity of mathematics that produces individuals who can go into any number of areas. They have options and more opportunities." **m**

Biomathematics Faculty

Richard Bertram
Mathematical physiology
Protein structure determination

Nick Cogan
Fluid dynamics
Biofilms

Monica Hurdal
Human brain mapping

Mike Mesterton-Gibbons
Models of animal behavior and social structure

Washington Mio
Computational Anatomy
Human Brain Mapping

Jack Quine
Protein structure from solid-state NMR data

DeWitt Sumners (Professor Emeritus)
DNA topology
Human brain mapping

Who Hires Biomathematicians?

- Biomathematical Research Groups
- Biomathematics Institutes
- Biotechnology Firms
- National Institutes of Health
- Cancer Research Centers
- Centers for Disease Control & Prevention
- State Departments of Environmental Protection
- Colleges & Universities
- Pharmaceutical Firms
- Research Laboratories
- Hospitals/Medical Centers
- U.S. Army Medical Research & Materiel Command
- Large-scale Sequencing Centers
- U.S. Environmental Protection Agency
- U.S. Food & Drug Administration

Where are our Graduates?

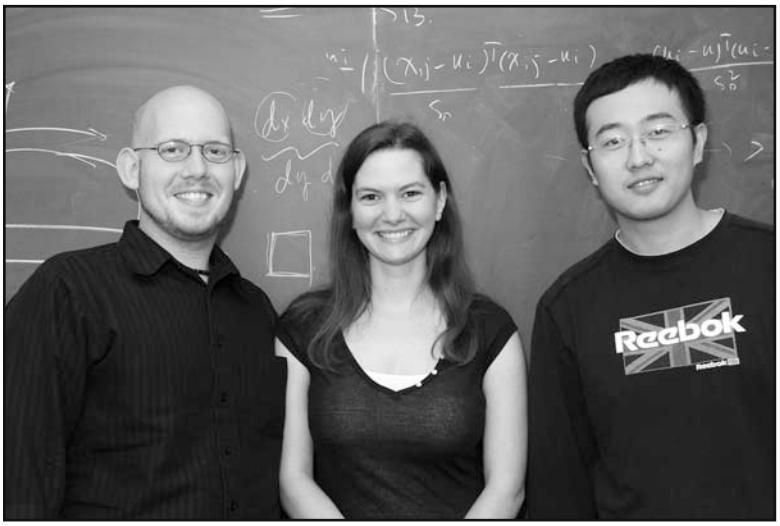
Srisairam Achuthan (Ph.D., 2006)
Postdoctoral fellowship at the University of New Orleans, Louisiana State University Health Sciences Center

Javier Arsuaga (Ph.D., 2000)
San Francisco State University, Assistant Professor, Department of Mathematics

Irma Cruz-White (Ph.D., 2003)
Chipola College, Associate Professor, Department of Mathematics

Isabel Darcy (Ph.D., 1997)
University of Iowa, Associate Professor, Department of Mathematics

Jeffrey K. Denny (Ph.D., 2000)
Mercer University, Associate Professor, Department of Mathematics



Pictured from left: Joseph Rhoads, Deborah Smith and Xinyang Liu, current Biomathematics graduate students

Ivo Dinov (Ph.D., 1998)
University of California, Los Angeles, Associate Professor, Department of Statistics, Center for Computational Biology, and Laboratory of Neuro Imaging

Christian Laing (Ph.D., 2007)
Postdoctoral fellowship at New York University, Departments of Chemistry, Mathematics, and Computer Science

Jennifer Mann (Ph.D., 2007)
Postdoctoral fellowship at the University of Texas at Austin, Department of Mathematics

Lee Singleton (Ph.D., 2007)
Whatcom Community College, Assistant Professor, Department of Mathematics

Partha Srinivasan (Ph.D., 2005)
Cleveland State University, Assistant Professor, Department of Mathematics; Postdoctoral fellowship at Mathematical Biosciences Institute

Natalia Toporikova (Ph.D., 2007)
Postdoctoral fellowship at Georgia Tech University, Interdisciplinary Bioengineering Graduate Program

Mariel Vazquez (Ph.D., 2000)
San Francisco State University, Assistant Professor, Department of Mathematics

Remembering Christopher Hunter

A Student's Perspective

Chris Hunter served as my major professor from 1987-1993. I was his first student in galactic dynamics, an area that no other professor in the department or university was pursuing. It was not until years later that I realized how the scarcity of support in this field had made Chris somewhat reluctant to take on a student. But true to his thoughtful and pioneering nature, he took a risk on me.

As always, Chris had a plan. He was determined to ensure that my education was rich and varied. He collaborated with researchers around the world and provided me with opportunities to meet them so that my knowledge and interests could be broadened. Whether driving me to astronomy conferences, arranging personal visits with presenters or inviting me to dinners with collaborators, he was constantly enhancing my exposure to the field.

Chris was a gracious and humble man. This was clearly demonstrated when after a few years of preparation I was able to make some research progress and, in my excitement, hastily drafted a paper. At the time, Chris was on a short visit to the Netherlands but when he returned, I immediately showed him my work. After a week of eagerly awaiting feedback I received my paper, which was covered in red ink. Sensing my possible reaction to his edits he included a note telling me not to be discouraged. His encouragement and critique were invaluable and when the paper was ready for submission his contributions were such that he could have been co-author, but when I proposed the idea, he kindly disagreed.

During my years at Florida State I was supported by teaching assistantships as well as research assistantships that were funded by Chris's NSF grants. This provided me financial support and freedom to conduct research which allowed me to graduate as a published author. The job market was tough for a new Ph.D. and Chris helped me again by arranging a postdoctoral fellowship with Professor Tim de Zeeuw at the University of Leiden. Later, he encouraged me to apply for a National Science Foundation fellowship and it is certainly due to our co-authored papers and the recommendation letters from our collaborators that I was awarded a fellowship to continue my research at MIT in 1994.

Through the years I have periodically returned to Tallahassee to give presentations on financial mathematics. Chris often introduced me, wittily reminding the audience and myself that my thesis in galactic dynamics was a topic that is light-years away from the realm of finance. This spring, I was again invited to the annual Financial Math Festival. Though Chris was unable to attend due to illness, he invited me to his home for a visit.

Chris was waiting for me in his living room when I arrived on that beautiful Saturday afternoon. He showed me the newest edition of *Galactic Dynamics* — a book that is widely used by students and researchers in the field — pointing out that it contained some of our joint papers. In exchange, I gave him a book that I co-authored in quantitative finance. We reminisced about past acquaintances and caught up on the news of current colleagues. His eyes twinkled when he spoke of some recent work being done by one of his collaborators. His voice, though full of excitement and energy, was interrupted by frequent coughing. When I departed I wished him well, never imagining that he would pass away the next day.

Chris was one of the kindest and most thoughtful people I have ever known. He was a mentor to me in every sense of the word. The memory of him and of our last afternoon together will stay with me forever. **m**

> *"Chris was one of the kindest and most thoughtful people I have ever known."*

Edward Qian
Ph.D., 1993

continued on page 12

Student Research

Xinyang Liu
Biomathematics
Lead author of **Models of Normal Variation and Local Contrasts in Hippocampal Anatomy** which was published in the Spring Series Lecture Notes in *Computer Science*. The paper was presented at the 2008 International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI) in New York .

Joseph Rhoads
Biomathematics
Co-author of **A Phantom Bursting Mechanism for Episodic Bursting** which was published in the *Bulletin of Mathematical Biology*. Rhoads also presented his research on parallel computing on the graphics processing unit at the annual meeting of the Society for Mathematical Biology.

Jaun Gutierrez and Deborah Smith
Biomathematics
Co-authors of **Shape Analysis for Automated Sulcal Classification and Parcellation of MRI Data** which was published in the *Journal of Combinatorial Optimization*. Gutierrez and Smith also presented **Geometric Invariants for Classification of Cortical Sulci** at the 2008 International Conference on Image Processing.

Fei Hua
Applied Mathematics
Co-author of **Coupled Stokes-Darcy Model with Beavers-Joseph Interface Boundary Condition** which was published in *Communications in Mathematical Sciences.*

Emmanuel Salta and Ahmet Göncü
Financial Mathematics
Co-authors of **On Pricing Discrete Barrier Options Using Conditional Expectation and Importance Sampling Monte Carlo** which was published in *Mathematical and Computer Modeling.*

Ahmet Göncü
Financial Mathematics
Co-author of **Transformation Methods and Error Bounds for Low-discrepancy Sequences in Pricing Derivatives** which was presented at the proceedings of the Workshop in Memory of Professor Hayri Körezlioğlu, Institute of Applied Mathematics, Middle East Technical University, Ankara, Turkey, 2008.

Matt Willyard
Financial Mathematics
Co-author of **Parameterization Based on Randomized Quasi-Monte Carlo Methods** which was presented at the 2008 IEEE International Symposium on Parallel and Distributed Processing.

Manan Shah (Ph.D., 2008)
Financial Mathematics
Co-author of **Computation of the Endogenous Mortgage Rates with Randomized Quasi-Monte Carlo Simulations** which was published in *Mathematical and Computer Modeling*.

Dimitre Tzigantchev (Ph.D., 2006)
Pure Mathematics
Author of **Predegree Polynomials of Plane Configurations in Projective Space** which was published in *Serdica Mathematical Journal.*

Congratulations to our 2007-2008 Graduates

Wan-Kan Chan, Ph.D.	*Applied and Computational Mathematics*
Haomin Lin, Ph.D.	*Applied and Computational Mathematics*
Juan Moreno, Ph.D.	*Financial Mathematics*
Hoa Nguyen, Ph.D.	*Applied and Computational Mathematics*
Andrew Novocin, Ph.D.	*Mathematics*
Yuki Saka, Ph.D.	*Applied and Computational Mathematics*
Manan Shah, Ph.D.	*Financial Mathematics*
Eunjoo Yoo, Ph.D.	*Financial Mathematics*
Wuming Zhu, Ph.D.	*Financial Mathematics*

Geography Lessons, Broadly Defined

by Professor Bettye Anne Case
Associate Chair for Graduate Studies and
Olga Larson Professor of Mathematics

One of the most fascinating things about my job is getting to know students from so many different places. This was never more clear than on a Saturday night in October when some colleagues and I attended a dissertation defense celebration with three students who hailed from three different countries; Bulgaria, Greece and Turkey. We decided to make a list of the countries we believed are represented in our department. Curious about our accuracy, I later e-queried our current 137 graduate students to see what state or country they call home. Their responses show that we play host to 21 states and Puerto Rico, and over 30 foreign countries. I am exceedingly proud of the diversity of cultures present in the Department of Mathematics that enhances not only our experience but that of the entire university. **m**

Alabama
Arkansas
Bulgaria
Colombia
Connecticut
Ethiopia
Florida
France
Georgia (USA)
Ghana
Greece
Hong Kong SAR, China
Illinois
India
Iowa
Jamaica
Japan
Kenya
Korea
Lebanon
Louisiana
Maryland
Mexico
Michigan
Minnesota
Missouri
Nepal
New Jersey
New York
New Zealand
Nicaragua
Nigeria
North Carolina
Oklahoma
Pennsylvania
People's Republic of China
Puerto Rico
Philippines
Russia
Saint Lucia
Saudi Arabia
Senegal
South Africa
South Dakota
Syria
Taiwan
Tanzania
Tennessee
Texas
Thailand
Turkey
Virginia

Welcome to our newest members!

The addition of new members to our faculty often represents growth and an infusion of new perspectives. This allows evolution within the department and brings fresh ideas to ongoing research objectives. Welcome to our newest faculty members and researchers!

Kyle Gallivan
Professor, Applied Mathematics
Ph.D., University of Illinois at Urbana-Champaign, 1983

Guang Hua Ji
Postdoctoral Researcher, Applied Mathematics
Ph.D., Chinese Academy of Sciences, 2005

Pennington LeNoir
Assistant-in Mathematics
Ph.D., North Carolina State University, 1989

Mariano Rivera Meraz
Visiting Associate Professor, Imaging Sciences
Ph.D., Center for Research in Optics, Leon GTO Mexico, 1997

Jason Osborne
Visiting Assistant-in Applied Geometry
Ph.D., North Carolina State University, 2007

Kathleen Petersen
Assistant Professor, Topology
Ph.D., University of Texas at Austin, 2005

Introducing
The Florida State University Mathematics Lecture Series

The first annual lecture series sponsored by the Department of Mathematics will be launched in spring 2009.

April 16, 2009
Public Lecture

April 17, 2009
Mathematics Lecture Series Inaugural Lecture
Professor Gunnar Carlsson of
Stanford University

For additional information visit
www.math.fsu.edu

My Life in Mathematics

by Christopher Hunter

Upon his retirement and at the request of the Department of Mathematics, the following narrative was written by Christopher Hunter. These are his own words describing his long and fruitful career.

I can never remember a time when I had any doubt as to what my career would be. Mathematical talent was apparent at an early age, and, because my father was a mathematician, I knew that mathematics was a source of gainful employment. My father, William Hunter, was Senior Lecturer in Mathematics at the Manchester College of Technology. I think that, by inclination, he was a pure mathematician. His results for the "Easier" Waring's problem of Number Theory for fourth powers have yet to be improved upon. His job made him aware of applications, and another of his papers is on the form assumed by a steadily rotating thread, inspired by a problem from the cotton industry for which Manchester was then famous. My father died before I was fifteen, and so we were never able to talk after I had attained some mathematical maturity.

The Great Court at Trinity College, Cambridge, England where Hunter was a student and later served as a research fellow.

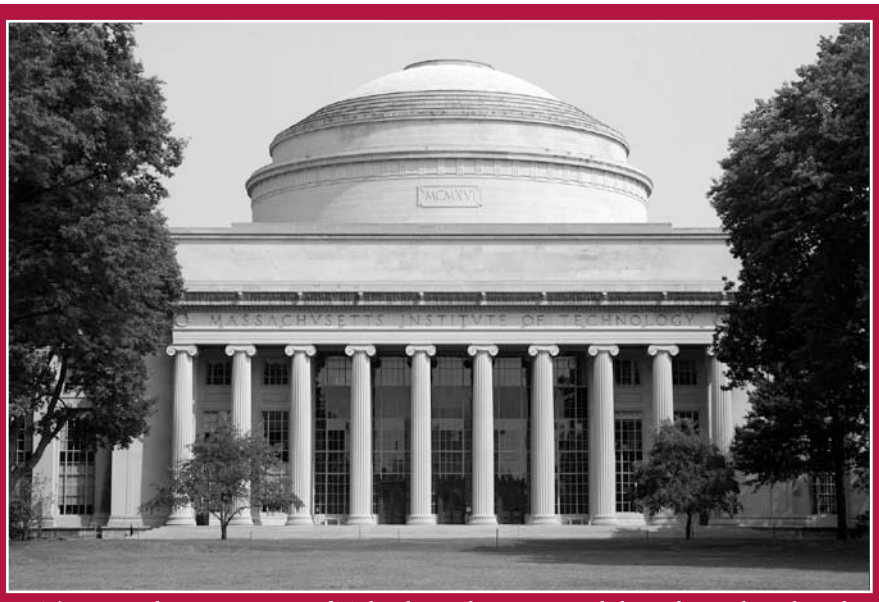
I knew by the time that I entered Cambridge University that it is the power of mathematics in applications that interests me most. I have since worked in a number of different areas of application. I have also written a number of papers that are primarily mathematical, even proving some theorems, but their original inspiration typically had its origin in some application. My first work was on the topic of cavitation, the boiling of a liquid and consequent formation of cavities that occurs when its pressure drops sufficiently. This topic was then of interest to the British Admiralty because the subsequent collapse of the cavities is a violent and noisy phenomenon which can damage propeller blades and betray the position of a submarine. The specific problem on which I worked was that of the influence of the compressibility of the liquid on the collapse. Although liquids are not very compressible, neglect of compressibility, as in Lord Rayleigh's solution which is given in Lamb's "Hydrodynamics", implies that pressure pulses propagate infinitely rapidly. The inclusion of compressibility allows one to study the shock wave that forms after the cavity has collapsed and causes the damage and the noise.

The resolution of this problem, like that of many subsequent ones, required computation. Luckily EDSAC II, a roomful of vacuum tubes which provided over two kilobytes of memory, was available and was sufficient for the task. It allowed me to study the spherically

continued

symmetric flow with a machine-filling 109-point grid which collapsed along with the infalling flow. The computations showed that the collapsing flow tends to a self-similar form, which can be described analytically, and describes the shock that is formed at the instant of collapse. This was also the first of many instances for me in which computation has indicated the mathematical analysis that needs to be done. As for the Admiralty, they finessed their problems by improving the design of propellers so as to avoid cavitation.

My major professor, Ian Proudman, urged me to broaden my interests during my final year of graduate work. I looked first at waves propagated up a river from the rise and fall of the tide at its mouth, and then the propagation of waves in elastic arteries from the pumping of the heart, but neither developed into lasting interests. The predominant interest in my subsequent research has been in astrophysical problems. My first introduction to them occurred just as I was about to leave Cambridge for a postdoc at MIT. Leon Mestel, a distinguished astrophysicist, had tried to interest Keith Moffatt in investigating the process by which a gravitationally unstable gas cloud fragments to form many protostars, rather than collapsing as a single mass. Realizing the geometrical similarity of this flow to that of my cavitation problem, Keith passed the problem on to me. Although the two flows are quite different as to their scale and their physics, I accepted the challenge and that began my involvement with problems first of astrophysical fluid dynamics and later of stellar dynamics. The distinguishing feature in all cases is that gravity is the dominant force.



The Massachusetts Institute of Technology where Hunter did postdoctoral work and served as faculty before coming to Florida State University for the duration of his career.

I went to MIT to work with Gerry Whitham, an expert on nonlinear waves, but he left for Caltech after a year. Instead, Alar Toomre, another new Ph.D. in fluid dynamics, and I, came under the influence of C.C. Lin. C.C., who already had a distinguished record in fluid dynamics, was then becoming interested in spiral structure in galaxies and in explaining it as a wave phenomenon. The three of us began learning some astrophysics together. Problems of the dynamics of galaxies, and particularly of waves, modes, and instabilities have been a major interest for all three of us ever since. Our interests and ideas have generally not coincided, and an influential paper on the dynamics of the bending of the Galaxy by Alar and myself is the sole instance of joint work between the three of us. I am happy to be known in some circles as the Hunter of Hunter and Toomre.

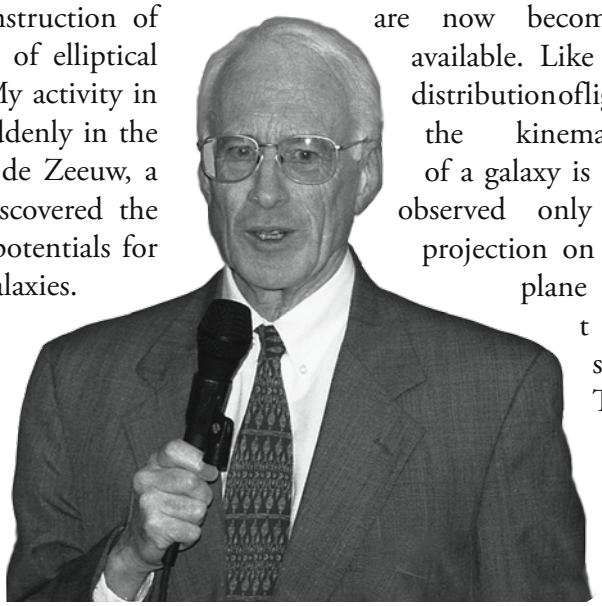
When I came to FSU in 1970, I expected to be drawn back into fluid dynamics. My first two Ph.D. students, Nourollah Riahi and Bryan Travis, wrote dissertations of fluid dynamical topics. However, the pull of astronomy was too strong for me to resist, and I continued working on astrophysical problems. That pull was reinforced during the year 1976-77 spent on leave at the Joint Institute for Laboratory Astrophysics at the University of Colorado. My third Ph.D. student, Barbara Schreur, was the first who worked on an astrophysical problem, that of the effect of a passing star on the Oort cloud of comets. Barbara was unusual in that she came with a strong background in this topic, obtained while she worked as a research assistant at the University of Arizona when her husband Jay got his Ph.D.

My next three Ph.D. students

continued

were Bruno Guerrieri, Sang Lee, and Mohammad Tajdari. All worked on topics related to computer-generated perturbation expansions. My interest in this topic was aroused by the work of Stanford professor Milton Van Dyke on their use in fluid dynamics. His basic idea is to delegate the laborious and mechanical task of generating a long perturbation expansions to a computer. This turns out to be the easy part of the problem. After determining the region in which this expansion is valid, one seeks ways to extend the expansion to a larger region. Extension techniques have to be based on a knowledge of the analytical structure of the solutions in complex parameter space, even though only real values of the parameter are of physical interest. The snag is that understanding this structure may lead one into complex parameter space, and hence far afield from the original real problems. For that reason my interest waned after Mohammad graduated in 1990, though ten years later I did find an interesting new application to polytropic models of stars.

I have been interested for a long time in the construction of self-consistent models of elliptical and barred galaxies. My activity in this area increased suddenly in the mid-1980s after Tim de Zeeuw, a young Dutchman, discovered the suitability of Stäckel potentials for modelling elliptical galaxies. He invited me to collaborate with him in constructing self-consistent models using them, and we have been collaborating ever since. The essential problem is to find a combination of stars in orbit that reproduces the density that is needed to cause the gravitational field that one assumed in the first place when computing the orbits. Mathematically, this requires the solution of integral equations. A further challenge is to build models which are consistent with kinematic observations of the line-of-sight velocities and dispersions which are now becoming available. Like the distribution of flight, the kinematics of a galaxy is also observed only in projection on the plane of the sky. The problems are complicated by the fact that the three-dimensional shapes of most elliptical galaxies, which are seen only in projection on the sky, may well be triaxial.



The Wescott Building at Florida State University.
Hunter devoted over 33 years to the FSU Department of Mathematics.

My last two Ph.D. students, Eddie Qian and Balša Terzić, both worked on astrophysical problems. The major contribution of Eddie's dissertation was to show how contour integrals can be used to provide distribution functions for axisymmetric galaxies. This contour integral method has been quite widely used, including in a joint FSU-Leiden collaboration to produce a model for the galaxy M32 with a central black hole. Balša began as an assistant on a multi-student project to study bifurcations in scalefree galaxies with central cusps. Such galactic models are relevant because the increasing accuracy of observations shows how common central cusps are. Balša then went on to construct

continued

a wide range of dynamical models for triaxial scalefree galaxies with central cusps.

My research activity gradually ground to a halt during my six years as Chair. It was a great relief to have a six-month sabbatical in Oxford in the spring of 2000, and an even greater one to find that my mind was still capable of doing mathematics. I shared an office with Wyn Evans, who suggested that we look at some problems of gravitational lensing. Gravitational lensing is a phenomenon which occurs because light rays are bent when they pass close to a massive object such as a galaxy, and the light is slowed down. A consequence is that a galaxy, which happens to lie between us and a distant quasar, can cause us to see multiple images of that quasar. Wyn enticed me by saying that there were interesting mathematical results to be derived, and that we would not have much competition. The second part turned out not to be true, as one of our first results was published by others before we got it into print. However, that first result led us to many others which we were the first to discover and publish.

I plan to remain active in research. My NSF support continues a year beyond my retirement and a great deal remains to be done. Old interests continue, and Doug Windham is working on a master's thesis on some applications of our ideas on gravitational lensing. Mir Abbas Jalali began working with me as a postdoc in January 2003 on waves and instabilities in flat stellar disks. He will help me complete work begun long ago, but which has been repeatedly interrupted. A fast and efficient method which I developed for the spectral analysis of orbits, and which Balša used to construct his triaxial models, has many more potential uses and has yet to be fully exploited. Lastly, I have begun to realize that the widespread occurrence of prominent disks in galaxies such as the Milky Way or S0 galaxies can induce chaos in the orbits of stars which cross up and down through the disk. These interests should keep me going for a few more years.

And so they did.

Fall 2008

Writer/Editor:
Nash McCutchen

Designer:
Nash McCutchen
Connie Harris

Department Chair:
Philip Bowers

Dean:
Joseph Travis

*The **fsumath** newsletter is available in alternative format by contacting the Department of Mathematics or the University ADA director, campus mail code 2410. For people who are hearing or speech impaired, contact the phone number through the Florida Relay Service at 1-800-935-8770 (voice) or 1-800-955-8771 (TDD).*

850-644-2202
www.math.fsu.edu

fsumath
FLORIDA STATE UNIVERSITY

208 Love Building
Florida State University
Tallahassee, FL 32306-4510

Non-Profit Org.
U.S. Postage
PAID
Tallahassee, Florida
Permit No. 55

Many of our graduates have kept in touch with the Department and we invite all other alumni to do the same. In fact, we would like to add your name and contact information to our alumni database and include your information on our website. To be included, email alumni@math.fsu.edu.

Keep Us Posted!

We'd like to hear from you! Please return this form, with a note about your present affiliation, to the address below.

Name _____

Address _____

FSU Degree(s) _____

Employer _____

Your News _____

_____

_____

You can support the students and faculty of FSU's Department of Mathematics with a tax-deductible gift to enhance our teaching and research efforts.

Checks payable to **FSU Foundation Mathematics Fund No. 0223** may be sent to Dr. Philip Bowers, Chair, FSU Department of Mathematics, 208 Love Bldg., 1017 Academic Way, Tallahassee, FL 32306-4510 or FSU Foundation, 2010 Levy Ave. PO Box 3062739, Tallahassee, Florida 32306-2739. Questions may be directed to Dr. Bowers by phone (850.645.3338) or email (bowers@math.fsu.edu).

Please help us support the students who hope to follow in your footsteps.