

◀ MATHEMATICS ▶

HIGHLIGHTS

- ◆ THE DEPARTMENT OF MATHEMATICS DELIVERED 10% OF THE TOTAL STUDENT CREDIT HOURS AT MSU LAST YEAR.
- ◆ 2002 GRADUATE KAY KIRKPATRICK RECEIVED THE PHI KAPPA PHI AWARD, RECOGNIZING HER AS THE OUTSTANDING SENIOR AT MSU.
- ◆ PROFESSOR TED HODGSON RECEIVED THE PRESIDENT'S EXCELLENCE IN TEACHING AWARD, RECOGNIZING HIS SUPERIOR DEDICATION TO STUDENTS AND TEACHING.
- ◆ PROFESSOR MARTY HAMILTON WAS ELECTED A FELLOW OF THE AMERICAN STATISTICAL ASSOCIATION, HONORING HIS LIFELONG ACHIEVEMENTS IN STATISTICS.
- ◆ RECEIVED DEPSCOR GRANTS TOTALING \$914,000 FOR RESEARCH ON ATMOSPHERIC OPTICS AND ADVANCED IMAGING. THESE GRANTS WERE SPONSORED BY CURT VOGEL.

Books	3
Book Chapters	1
Refereed Articles	32
Presentations	82
FTE Faculty	30.5
Majors	158
Grant Expenditures	\$342,968

The Department of Mathematical Sciences is proud of its commitment to excellence in teaching. Our instructional role on campus and in Montana is multifaceted. We have the largest departmental instructional component at Montana State University. Last year we delivered about 10% of the total student credit hours at MSU. We offered 208 lower division classes to majors from all departments on campus. In addition, we offered 33 upper division classes and 31 graduate classes, many of which also complement programs in science and engineering across campus. We currently have 115 undergraduate students seeking a B.S. degree in one of four options (applied mathematics, mathematics, mathematics teaching, statistics). In addition we have 62 M.S. students and 22 Ph.D. candidates. At the 2002 commencement exercises, the department awarded 15 Bachelor of Science degrees. Among our graduates were seven students who graduated with highest honors, four who graduated with honors, and two who completed the University Honors Program. Also awarded were 14 Master of Science degrees and two Doctor of Philosophy degrees.

Our students received several awards this year. Kay Kirkpatrick was awarded the Dean's Award for Excellence, recognizing her as the outstanding senior in the College of Letters and Science. Kay also received the Phi Kappa Phi Outstanding Senior award, given to the outstanding senior at MSU. She also was selected to the All-USA College Academic Third Team. Jared Barber, John Cross, Charlie Doughty, Kay Kirkpatrick, and Carl Legleiter were Presidential Scholars. Erik Brohaugh was a Graduate Presidential Scholar. Jared Barber and Charlie Doughty were selected for the MSU Alumni Association and Bozeman Area Chamber of Commerce Awards for Excellence. Charlie Doughty also received the Christy Scholarship. Leo KILLSBACK received a Rockefeller Brothers Fund Fellowship for minority students entering the teaching profession. Erin Austin was selected as the Outstanding GTA in the College of Letters of Science.

Ted Hodgson received the President's Excellence in Teaching Award, one of three such awards granted by MSU. Lyle Andersen and Jennie Luebeck taught courses

for the Department of Education, helping prepare future teachers. Tomas Gedeon and Mark Pernarowski were involved in the delivery of interdisciplinary courses for the Complex Biological Systems program, a joint effort involving eight departments that is funded by the IGERT grant. Lyle Andersen, Maurice Burke, Ted Hodgson, and Linda Simonsen also delivered courses for the Intercollege Program for Science Education. That program's Master of Science in Science Education (MSSE), as well as our own Master of Science in Mathematics Education (MSME) program, incorporates a large distance delivery component to accommodate students who are unable to take courses in residence at MSU. Maurice Burke, Ted Hodgson, and Jennie Luebeck are also developing doctoral level, distance-learning courses in support of the Center for Learning and Teaching in the West (CLTW). Curt Vogel developed and taught a graduate course on inverse problems and adaptive optics for the Department of Electrical and Computer Engineering.

RESEARCH

Faculty in the Department of Mathematical Sciences had a productive year in advancing their research programs. Extensive funding was awarded by DEPSCoR, EPA, NSF, and NIH. In addition, research funding was provided by the Air Force, US Department of Education, IBM, the Montana Board of Research and Commercialization Technology, and the Pacific Northwest Canola Association. Our faculty are involved in numerous interdisciplinary research programs including the Biological Information Technology and Systems (BITS) grant, the Center for Biofilm Engineering (CBE), the Center for Computational Biology (CCB), the Center for Learning and Teaching in the West (CLTW), the Interagency Grizzly Bear Study Team, the Solar Physics Group, the Systemic Initiative in Montana Mathematics and Science (SIMMS), and the Western Transportation Institute (WTI). Cooperative on-campus projects involved the departments of Animal & Range Sciences, Cell Biology & Neuroscience, Chemical Engineering, Civil Engineering, Earth Sciences, Ecology, Education, Entomology, Land Resources & Environmental Sciences, Nursing, and Physics.

Lyle Andersen was involved in the Student Teacher and Researcher (STAR) project at 14 high schools in

Montana and both Lyle Andersen and Linda Simonsen are co-Directors of the PROMATH project for middle school teachers. Lyle Andersen and Ted Hodgson are part of the STEM project to revise the middle school mathematics curriculum in Montana. Robert Boik had a Ph.D. student, Jo Choochaow, finish this year. She has joined the faculty in the Department of Mathematical Sciences at Silpakorn University, in Bangkok, Thailand. John Borkowski is part of a team studying snow pack stability and avalanche risk. Maurice Burke is the editor of four books in the Navigations Series for the National Council of Teachers of Mathematics. Steve Cherry is a member of the Interagency Grizzly Bear Study Team, which involves researchers from MSU and the US Geological Survey. Jack Dockery and Isaac Klapper are part of a team at the Center for Biofilm Engineering developing models for biofilm material properties. Warren Esty was a Visiting Scholar at Wolfson College, Cambridge University, England and a Visiting Fellow at Wolfson College, Oxford University, England.

Tomas Gedeon is involved in a bioinformatics project with the Center for Computational Biology (CCB). Tomas Gedeon and Mark Pernarowski work with the CCB on research projects. In addition, they were involved in the Multidisciplinary Undergraduate Summer Research Program in Complex Biological Systems. Tomas Gedeon worked with Kristina Ferris, now at the University of Southern California. Tomas Gedeon and Mark Pernarowski worked with Matt Holzer from MSU on the reconstruction of attractors from time series. Tomas Gedeon was Matt's advisor for his Undergraduate Scholars Program research projects. One project was on the reliability of neurons and phase locking and one was on interspike interval threshold modulation for integrate-and-fire neurons. Marty Hamilton was elected a Fellow of the American Statistical Association, an extraordinary honor for his lifelong achievements in statistics. Marty continues to work extensively with the Center for Biofilm Engineering on antimicrobial testing. Ted Hodgson contributed to both the Montana Council of Teachers of Mathematics (MCTM) and the National Council of Teachers of Mathematics (NCTM) to study math education issues. Isaac Klapper continues to work with the Solar Physics Group. He was a visitor at the Institute for Theoretical Physics at the University of California at Santa Barbara and also a visitor at the Courant Institute of Mathematical Sciences at New York

University.

Jennie Luebeck is the mathematics consultant for e-Mentoring for Student Success, a Mathematics and Science Partnership project, which involves the National Science Teachers' Association and the New Teacher Center at the University of California at Santa Cruz. Jim Robison-Cox is working with MSU psychologists to study sexual bias and exclusion in leadership roles. Lisa Stanley is working with the Graduate Engineering Research Center in Shalimar, Florida, located adjacent to Eglin Air Force Base, developing new techniques for the optimal placement of sensors and actuators for control and guidance of small unmanned air vehicles. She also directed Chris Dagle in an Undergraduate Research Project in engineering design. Curt Vogel's work in atmospheric optics and giant telescopes involved scientists at the Maui Space Surveillance System and the Maui High Performance Computing Center, both on the island of Maui, Hawaii, at the Gemini Observatory in Hilo, Hawaii, and at the Center for Adaptive Optics at the University of California at Santa Cruz. His Ph.D. student, John Bardsley, finished and is currently on a postdoctoral appointment at the Statistical and Applied Mathematical Sciences Institute (SAMSI) in the Research Triangle in North Carolina. His postdoc, Luc Gilles, has joined the faculty in the Department of Electrical and Computer Engineering at Michigan Technological University, Houghton, Michigan.

Our faculty gave numerous addresses both nationally and internationally. Marcy Barge gave invited addresses on tiling spaces and quasicrystals at the University of Victoria, British Columbia, Canada and at Indiana University and Purdue University at Indianapolis, respectively. Ken Bowers gave an invited talk on biofilm modeling for porous media flow at the American Mathematical Society meeting in Salt Lake City, Utah. Steve Cherry spoke at the Ninth Annual Meeting of the Wildlife Society in Bismarck, North Dakota. Warren Esty gave two talks at St. Olaf College in Northfield, Minnesota.

Tomas Gedeon was invited to speak on neural coding at the Fifth International Conference on Differential Equations in Edmonton, Canada and at Georgia Tech in Atlanta, Georgia. Marty Hamilton spoke on the efficacy of antimicrobial biocides in Washington, DC at the Organization for Economic Cooperation and Development Workshop and later in the year at the Interagency Con-

ference on the Efficacy of Antimicrobials Against Spores. He also gave invited talks at the Pacific Northwest National Laboratory in Richland, Washington, and at Procter Gamble Corporation in Cincinnati, Ohio. Ted Hodgson gave invited talks at West Virginia University, Morgantown, West Virginia, and at the Annual Meeting of the National Council of Teachers of Mathematics in Las Vegas, Nevada.

Isaac Klapper was invited to speak on solar physics and fast dynamos at the Institute of Theoretical Physics, University of California at Santa Barbara, California, the Courant Institute of Mathematics at New York University, New York City, New York, and at the Annual Meeting of the American Physical Society Division of Plasma Physics in Orlando, Florida. Jennie Luebeck talked at the Annual Meeting of the National Council of Teachers of Mathematics in Las Vegas, Nevada. Jim Robison-Cox spoke at the 2002 Society for Industrial and Organizational Psychology Conference in Toronto, Canada. Lisa Stanley gave talks on continuous sensitivity equation methods at Argonne National Laboratory in Chicago, Illinois, and at the SIAM Annual Meeting in Philadelphia, Pennsylvania.

Curt Vogel gave invited talks on adaptive optics and giant telescopes at the AFOSR PRET Workshop in Maui, Hawaii, and later in the year returned to talk at the SPIE Conference on Astronomical Telescopes and Instrumentation. He also talked at the SIAM Annual Meeting in Philadelphia, Pennsylvania, and at the Center for Adaptive Optics Fall Retreat in Lake Arrowhead, California. He gave an invited address at the SAMSI Workshop on Inverse Problems, Research Triangle Park, North Carolina, and also in the Department of Electrical and Computer Engineering at North Carolina State University, Raleigh, North Carolina.

SERVICE

The Department of Mathematical Sciences serves the local and campus community, as well as the region, state and nation, in a variety of ways. All of the faculty contribute to department activities. In addition, many contribute to the college and university. Marcy Barge is a member of the Liberal Arts Degree Task Force. Gary Bogar is on Faculty Council. John Borkowski serves on the Core Equivalency Review Committee and the Montana Learning Community Advisory Committee. Ken

Bowers is the College of Letters and Science representative to the Graduate Council and serves on the Electronic Thesis and Dissertation Task Force. Maurice Burke is on the Advisory Board for the Master of Science in Science Education (MSSE). Steve Cherry serves on the University Core Curriculum Committee. Tomas Gedeon serves on the College of Letters and Science Promotion and Tenure Committee and the IGERT Executive Committee. He also served on the search committee for the new Computer Science Department Head. Marty Hamilton is on the Center for Biofilm Engineering Executive Committee.

Jennie Luebeck is on the University Teacher Education Committee and is the Mathematics Event leader for the Montana Science Olympiad. Mark Pernarowski is on the IGERT Curriculum Committee. Jim Robison-Cox was the chair of the University Teaching and Learning Committee and is on the Administrative Core Committee for the Center for Research of Chronic Health Conditions in Rural Dwellers. Linda Simonsen serves on the University Athletic Committee, the Big Sky Institute Education Subcommittee, is the CLTW Research Director, and the Project Director and Academic Developer for Teachers Integrating Mathematics and Environmental Science (TIMES). She also is an academic advisor for MSU Native American students and the Metric Estimation Event leader for the Montana Science Olympiad. This year she served on the search committee for the new Dean of the College of Letters and Science. Mary Ann Sojda is on the Women's Studies Minor Committee. Shae Thompson continues to provide tutoring to the American Indian Club. Curt Vogel is on the IGERT Graduate Recruitment Committee. Russ Walker continues to serve as the Associate Dean of the College of Letters and Science.

Throughout Montana, our faculty contribute to efforts to improve our state. Lyle Andersen is a consultant to the tribal colleges in Montana and to the American Indian Science Engineering Society (AISES). Lyle Andersen and Ted Hodgson worked with Dull Knife Community College and the West Point Military Academy on a college algebra development program. Maurice Burke is on the Mathematics Standards Review Committee, convened by the Superintendent of Public Instruction. Warren Esty is on the Mathematics Proficiency Admissions Standards Steering Committee, formed jointly by the Commissioner of Higher Education and the Superinten-

dent of Public Instruction, to establish levels of math proficiency for post-secondary education. Marty Hamilton is the current Vice-President and President-Elect of the Montana Chapter of the American Statistical Association. Sherry Heis is the Secretary and John Borkowski is the Chapter Representative for the Montana Chapter of the American Statistical Association. Ted Hodgson is on the Board of Directors of MCTM and the Mathematics Technology in Assessment Subcommittee convened by the Superintendent of Public Instruction. Jennie Luebeck is on the MCTM Planning Committee for the Professional Development Academy. Linda Simonsen is on the Board of Directors of MCTM.

Beyond the borders of Montana, several faculty contribute to their profession in a variety of ways. Lyle Andersen is on the National Advisory Committee for the Big Sky Institute for Science and Natural History and served on an NSF National Visitation Committee for the North Dakota Collaborative for Teacher Education Program. Marcy Barge was an organizer for the Special Session on Dynamical Systems at the International Spring Topology Conference at Texas Tech University in Lubbock, Texas. Robert Boik is an Associate Editor for Psychometrika and an Editorial Board member for Psychology Methods. John Borkowski is an Associate Editor for The American Statistician. Maurice Burke is on the National Advisory Boards for both The Teacher's Teaching with Technology Program and the SIMMS-IM Dissemination Grant. Jack Dockery served on an NSF/NIH review panel for the Division of Mathematical Sciences/National Institute for General Medical Sciences (DMS/NIGMS) program. Ted Hodgson served as an AP Statistics reader and helped develop assessment programs for the states of Louisiana and Maine. Linda Simonsen is part of the DFG/NSF (Germany and the United States) Mathematics and Science Education Research Group.

REFEREED PUBLICATIONS

A. Books

ESTY, W.

Precalculus, 3rd edition, W. Esty (2002).

STANLEY, L.

Design Sensitivity Analysis: Computational Issues of Sensitivity Equation Methods, L.G. Stanley and D.L.

Stewart, *SIAM Frontiers in Applied Mathematics* (2002).

VOGEL, C.

Computational Methods for Inverse Problems, C.R. Vogel, *SIAM Frontiers in Applied Mathematics* (2002).

B. Book Chapters

BURKE, M.

"Curriculum and Assessment: The SIMMS Integrated Mathematics Example," J. Lott, J. Hirstein, S. Walen, M. Burke, G. Allinger, M. Lundin, T. Souhrada, and D. Preble, Standards-Oriented School Mathematics Curriculum: What does the Research Say about Student Outcomes? Chapter 13, (2002).

C. Journal Articles

BARDSLEY, J.

"Computational Methods for a Large-Scale Inverse Problem Arising in Atmospheric Optics," L. Gilles, C.R. Vogel, and J.M. Bardsley, Inverse Problems, 18, 237-252, (2002).

BARGE, M.

"Coincidence for Substitution of Pisot Type," M. Barge and B. Diamond, Bulletin of the Mathematical Society of France, 130(4), 619-626, (2002).

BARKER, J.

"Management of Hemodialysis Catheter Related Bacteremia with an Adjunctive Antibiotic Lock Solution," K. Zipporah, D. Carlton, L. Bimbo, M.E. Taylor, D.F. Balkovetz, J. Barker, M. Allon, Kidney International, 61(3), 1136, (2002).

BOIK, R.

"Spectral Models for Covariance Matrices," R.J. Boik, Biometrika, 89, 159-182, (2002).

BORKOWSKI, J.

"Predicting Plant Community and Biomass Response to Picloram," S.A. Kedzie-Webb, R.L. Sheley, and J.J. Borkowski, Journal of Range Management, 55, 576-583, (2002).

BURKE, M.

"So That's Why $22/7$ is Used for Pi," M. Burke and D. Taggart, Mathematics Teacher, 95(3), 164-169, (2002).

"Using High Precision Arithmetic on the TI-92 Plus," M. Burke, Mathematics Teacher, 95(4), 300-301, (2002).

CHERRY, S.

"Estimating Total Human-Caused Mortality from Reported Mortality Using Data from Radio-Instrumented Grizzly Bears," S. Cherry, M. Haroldson, J. Robison-Cox, and C. Schwartz, Ursus, 13, (2002).

"Predicting Grizzly Bear Denning Areas in the Greater Yellowstone Ecosystem," S.R. Prodrunzy, S. Cherry, C.S. Schwartz, and L.A. Landenburger, Ursus, 13, (2002).

"Host Associations of Lianas in a Southeast Queensland Rainforest," L.D. Carsten, F.A. Jauola, T.D. Male, and S. Cherry, Journal of Tropical Ecology, 18, 107-120, (2002).

DOCKERY, J.

"Finger Formation in Biofilm Layers," J. Dockery and I. Klapper, SIAM Journal of Applied Mathematics, 62, 853-869, (2002).

ESTY, W.

"A Die Study of Some Silver Coinages of Sinkiang, China," W. Esty, and D.S. Smith, The American Journal of Numismatics, 13, 133-145 and plates 7-8, (2002).

"Mathematical Contexts and the Perception of Meaning in Algebraic Symbols," W.W. Esty and A. Teppo, The Future of the Teaching and Learning of Algebra, 2, 577-581, (2002).

GEDEON, T.

"Upper Semicontinuity of Morse Sets of a Discretization of a Delay-Differential Equation: A Complete Solution," T. Gedeon and G. Hines, Journal of Differential Equations, 179, 369-383, (2002).

"Chaotic Solutions in Slowly Varying Perturbations of Hamiltonian Systems With Applications to Shallow Water Sloshing," T. Gedeon, H. Kokubu, K. Mischaikow, and H. Oka, Journal of Dynamics and Differential Equations, 14, 63-84, (2002).

GILLES, L.

"A Multigrid Preconditioned Conjugate Gradient Method for Large-Scale Wave-Front Reconstruction," L. Gilles, C.R. Vogel, and B. Ellerbroek, Journal of the Optical Society of America A, 19, 1817-1822, (2002).

"Computational Methods for a Large-Scale Inverse Problem Arising in Atmospheric Optics," L. Gilles, C.R. Vogel, and J.M. Bardsley, Inverse Problems, 18, 237-252, (2002).

"A Computationally Efficient Wavefront Reconstructor for Simulations of Multi-Conjugate Adaptive Optics on Giant Telescopes," B. Ellerbroek, L. Gilles, and C.R. Vogel, Proc. SPIE 4839-116, Adaptive Optics System Technologies II, 989-1000, (2002).

"Layer-Oriented Multigrid Wavefront Reconstruction Algorithms for Multi-Conjugate Adaptive Optics," L. Gilles, B. Ellerbroek, and C.R. Vogel, Proc. SPIE 4839-118, Adaptive Optics System Technologies II, 1011-1022, (2002).

"Optical Switching in Nonlinear Chiral Distributed Bragg Reflectors with Defect Layers," L. Gilles and P. Tran, Journal of the Optical Society of America B, 19(4), 630-639, (2002).

HAMILTON, M.

"2002 Testing Antimicrobials Against Biofilm Bacteria," M. Hamilton, Journal AOAC International, 85, 479-485, (2002).

KLAPPER, I.

"Finger Formation in Biofilm Layers," J. Dockery and I. Klapper, SIAM Journal of Applied Mathematics, 62, 853-869, (2002).

"A General Theory of Connectivity and Current Sheets in Coronal Magnetic Fields Anchored to Discrete Sources," D.W. Longcope and I. Klapper, Astrophysical Journal, 579, 468-481, (2002).

"A Viscoelastic Fluid Description of Bacterial Biofilm Material Properties," I. Klapper, C.J. Rupp, R. Cargo, B. Purvedorj, and P. Stoodley, Biotechnology and Bioengineering, 80, 289-296, (2002).

"Biofilm Mechanics and Shear Induced Deformation and Detachment," P. Stoodley, R. Cargo, C.J. Rupp, S.

Wilson, and I. Klapper, Journal of Industrial Microbiology and Biotechnology, 29, 361-368, (2002).

KWAPISZ, J.

"A Priori Degeneracy of One-Dimensional Rotation Sets for Periodic Point Free Torus Maps," J. Kwapisz, Transactions of the American Mathematical Society, 354(7), 2865-2895, (2002).

ROBISON-COX, J.

"Estimating Total Human-Caused Mortality from Reported Mortality Using Data from Radio-Instrumented Grizzly Bears," S. Cherry, M. Haroldson, J. Robison-Cox, and C. Schwartz, Ursus, 13, (2002).

SIMONSEN, L.

"Research Issues for Mathematics Education in Rural Communities: Focus on Native Americans," K. Nelson, L. Simonsen, and E. Swanson, Proceedings of the ACCLAIM Research Symposium, 1-40, (2002).

VOGEL, C.

"A Multigrid Preconditioned Conjugate Gradient Method for Large-Scale Wave-Front Reconstruction," L. Gilles, C.R. Vogel, and B. Ellerbroek, Journal of the Optical Society of America A, 19, 1817-1822, (2002).

"Computational Methods for a Large-Scale Inverse Problem Arising in Atmospheric Optics," L. Gilles, C.R. Vogel, and J.M. Bardsley, Inverse Problems, 18, 237-252, (2002).

"A Computationally Efficient Wavefront Reconstructor for Simulations of Multi-Conjugate Adaptive Optics on Giant Telescopes," B. Ellerbroek, L. Gilles, and C.R. Vogel, Proc. SPIE 4839-116, Adaptive Optics System Technologies II, 989-1000, (2002).

"Layer-Oriented Multigrid Wavefront Reconstruction Algorithms for Multi-Conjugate Adaptive Optics," L. Gilles, B. Ellerbroek, and C.R. Vogel, Proc. SPIE 4839-118, Adaptive Optics System Technologies II, 1011-1022, (2002).

D. Presentations**BANFIELD, J.**

"The Capabilities of R," Center for Computational Biology, Montana State University, Bozeman, Montana,

April, 2002.

BARDSLEY, J.

"Nonnegatively Constrained Image Reconstruction," SIAM Annual Meeting, Philadelphia, Pennsylvania, July, 2002.

"Time Domain Electromagnetic Scattering Using Perfectly Matched Layers," Electromagnetics Meeting, Statistical and Applied Mathematical Sciences Institute, Research Triangle Park, North Carolina, October, 2002.

"Statistics, Constrained Optimization, and Astronomical Imaging," Departments of Mathematics and Computer Science, Wake Forest University, Winston-Salem, North Carolina, December, 2002.

"The Banks, Browning PML Implementation: Do We Use it to Solve the Inverse Problem?" Electromagnetics Meeting, San Antonio, Texas, December, 2002.

BARGE, M.

"The Topology of One-Dimensional Tiling Spaces," Aperiodic Order, Dynamical Systems, Operator Algebras and Topology, University of Victoria, British Columbia, Canada, August, 2002.

"Tilings and Quasicrystals," Mini-Conference, IUPUI, Indianapolis, Indiana, October, 2002.

"Topology of Quasicrystals," Math Department Colloquium, IUPUI, Indianapolis, Indiana, October, 2002.

BARKER, J.

"Statistical Properties of Pool Screening Estimators and Confidence Interval Methods," Department of Public Health Sciences and Epidemiology, John A. Burns School of Medicine, University of Hawaii, Honolulu, Hawaii, January, 2002.

BORKOWSKI, J.

"Simple Latin Square Sampling Plus/Minus k Designs," Annual Meeting of the Montana Chapter of the American Statistical Association, Butte, Montana, October, 2002.

"Strategies of Experimentation," College of Engineering, Montana State University, Bozeman, Montana, October, 2002.

BOWERS, K.

"Modeling Biofilm Growth in a Porous Medium," Special Session on Numerical Solutions of Modeling Problems, American Mathematical Society Western Section Meeting, Salt Lake City, Utah, October, 2002.

BURKE, M.

"Curriculum Design: The Cases of Mathematics and Science," CLTW Conference, Pingree Park, Colorado, July, 2002.

"Never Underestimate Counting," Montana Education Association - Montana Federation of Teachers (MEA-MFT) Educators' Conference, Missoula, Montana, October, 2002.

CHERRY, S.

"Extensions of the Mahalanobis Distance Technique," Ninth Annual Meeting of the Wildlife Society, Bismarck, North Dakota, September, 2002.

ESTY, W.

"Fluency in The Language of Mathematics," St. Olaf College, Northfield, Minnesota, October, 2002.

"Research on Word Problems," St. Olaf College, Northfield, Minnesota, October, 2002.

GEDEON, T.

"Neural Coding Problem: From Neuroscience to Bifurcation Theory," Fifth International Conference on Differential Equations, Edmonton, Canada, July, 2002.

"Neural Coding Problem and Optimization," Georgia Institute of Technology, Atlanta, Georgia, November, 2002.

HAMILTON, M.

"Assessment of a New Method for Biofilm Analysis: Solid State Cytometry for Counting Suspended, Disaggregated Bacteria," CBE Industrial Associates Conference, Bozeman, Montana, February, 2002.

"Performance Standards," Organization for Economic Cooperation and Development (OECD) Workshop on the Efficacy of Certain Antimicrobial Biocides, Washington, DC, April, 2002.

"Applied Statistical Thinking in Biofilm Research," Pacific Northwest National Laboratory, Richland, Washington, June, 2002.

"Applied Statistical Thinking in Microbiology," Proctor Gamble Corporation, Cincinnati, Ohio, June, 2002.

"Recent Developments in Regulatory Policy," CBE Industrial Associates Conference, Bozeman, Montana, July, 2002.

"Estimating the Ruggedness of a Laboratory Method: Experimental Design," CBE Industrial Associates Conference, Bozeman, Montana, July, 2002.

"Antimicrobial Product Claims," seminar on The Ecology, Economics, and Ethics of Biotechnology, at the Foundation for Research on Economics and the Environment, Elkhorn Ranch, Montana, September, 2002.

"Comparison of Available Test Methodologies," Inter-agency Conference on the Efficacy of Antimicrobials Against Spores, Washington, DC, October, 2002.

HODGSON, T.

"Students' Use of Multiple Representations in Mathematical Problem Solving," West Virginia University, Morgantown, West Virginia, March, 2002.

"Computer Algebra Systems in Advanced Algebra," Annual Meeting of the National Council of Teachers of Mathematics (NCTM), Las Vegas, Nevada, April, 2002.

HYDE, S.

"Robust Estimation of the Covariance Matrix," Annual Meeting of the Montana Chapter of the American Statistical Association, Butte, Montana, October, 2002.

KLAPPER, I.

"Long Time Evolution of Magnetic Field in 2 Dimensions," Seminar in the Program on Solar Magnetism and Related Astrophysics, Institute of Theoretical Physics, University of California at Santa Barbara, California, March, 2002.

"Towards a General Theory of Fast Dynamos," Courant Institute of Mathematics, New York University, New York City, New York, May, 2002.

"Constraints on Finite-Time Singularity Formation in 2D Incompressible MHD," Miniconference on Singu-

larities in Fluids and Plasmas, Annual Meeting of the American Physical Society Division of Plasma Physics, Orlando, Florida, November, 2002.

LUEBECK, J.

"Defying Distance: The Retention and Renewal of Rural K-12 Mathematics Teachers," Annual Meeting of the National Council of Teachers of Mathematics (NCTM), Las Vegas, Nevada, April, 2002.

"Preparing the Next Generation of Education Leaders," Annual Meeting of the Montana Council of Teachers of Mathematics (MCTM), Missoula, Montana, October, 2002.

PARKER, A.

"Neural Coding Through the Ages," Complex Biological Systems Seminar, Montana State University, Bozeman, Montana, February, 2002.

"Information Distortion and Neural Coding," First SIAM Conference on the Life Sciences, Boston, Massachusetts, March, 2002.

"Continuation and Bifurcation of the Distortion Problem," American Mathematical Society Sectional Meeting, Madison, Wisconsin, October, 2002.

"Symmetry Breaking Bifurcation of the Distortion Problem," American Mathematical Society Sectional Meeting, Madison, Wisconsin, October, 2002.

"Annealing and the Rate Distortion Problem," NIPS, Vancouver, Canada, December, 2002.

ROBISON-COX, J.

"Gender Bias and Discrimination: A Computer Simulation," 2002 Society for Industrial and Organizational Psychology Conference, Toronto, Ontario, Canada, April, 2002.

"Looking for Three-Way Interactions," Annual Meeting of the Montana Chapter of the American Statistical Association, Butte, Montana, October, 2002.

SIMONSEN, L.

"Teachers Integrating Mathematics and Environmental Science in Yellowstone," Montana Education Association - Montana Federation of Teachers (MEA-MFT) Educators' Conference, Missoula, Montana, October,

2002.

STANLEY, L.

"A Survey of Mathematical and Numerical Issues Related to the Use of Continuous Sensitivity Equation Methods," Argonne National Lab, Chicago, Illinois, August, 2002.

"A Sensitivity Equation Method for Elliptic Interface Problems," SIAM Annual Meeting, Philadelphia, Pennsylvania, July, 2002.

THOMPSON, S.

"Developing Academic Skills," American Association of University Women Transitions Conference, Bozeman, Montana, January, 2002.

VOGEL, C.

"Image Reconstruction Algorithms," AFOSR-sponsored PRET Workshop, Maui, Hawaii, January, 2002.

"Multiconjugate Adaptive Optics," SIAM Annual Meeting, Philadelphia, Pennsylvania, July, 2002.

"Tutorial Talks on Multiconjugate Adaptive Optics," AFOSR, Maui, Hawaii, August, 2002.

"Fast Algorithms for Extreme Adaptive Optics and Multiconjugate Adaptive Optics Wavefront Reconstruction," SPIE Conference on Astronomical Telescopes and Instrumentation, Waikoloa, Hawaii, August, 2002.

"Multiconjugate Adaptive Optics," OPTEC Annual Meeting, Bozeman, Montana, September, 2002.

"An Applied Mathematician's Perspective on Regularization Methods," SAMSI Workshop on Inverse Problems, Research Triangle Park, North Carolina, September, 2002.

"Multiconjugate Adaptive Optics," ECE Department Colloquium at North Carolina State University, Raleigh, North Carolina, September, 2002.

"Computation Mathematics for Novices," Center for Adaptive Optics Fall Retreat, Lake Arrowhead, California, November, 2002.

FUNDED EXTERNAL GRANTS

ANDERSEN, L.

"Six Through Eight Mathematics Curriculum Revision Project," NSF, PI: R. Billstein, co-PI: L. Andersen, T. Hodgson, and J. Williamson, \$1,610,000, (2002-2006).

"PROMATH: Professional Development for Middle School Math Teachers," DOE Eisenhower Awards, PI: L. Andersen, co-PI: L. Simonsen and L. Krussell, \$172,321, (2001-2003).

BANFIELD, J.

"Pacific Northwest Canola World Wide Web-Based Information System," USDA, Pacific Northwest Canola, co-PI: A. Lenssen, J. Banfield, G. Johnson, \$3,500, (2002-2003).

BORKOWSKI, J.

"Temporal Changes in Spatial Variability of Snow Stability," NSF, PI: K. Hansen, co-PI: E. Adams, K. Birke-land, and J. Borkowski, \$164,000, (2002-2005).

"Statewide Sampling Protocol and Management Strategy for Assessing Field Maintenance Activities," Montana Department of Transportation, J. Borkowski, \$12,541, (2002).

"Athletics and Eating Disorders in Native and Caucasian Youth," NIMH, PI: W. Lynch, co-PI: D. Heil and M. Haven, Consultant: J. Borkowski, \$140,000, (2002-2004).

CHERRY, S.

"Evaluation, Improvement, or Development of Indices to Monitor Abundance of Major Foods of Grizzly Bears in the Greater Yellowstone Ecosystem," Interagency Grizzly Bear Study Team, \$7,800, (2002).

DOCKERY, J.

"Modeling Antibiotic Susceptibility of Bacteria in Biofilm," NIH, PI: P. Stewart, co-PI: J. Dockery, I. Klapper, and P. Stoodley, \$846,000, (2002-2005).

GEDEON, T.

"Structural and Functional Analysis of Complex Biological Systems," NSF IGERT, PI: D. Dooley, co-PI: T. Gedeon, G. Jacobs, J. Miller, M. Pernarowski, and C. Vogel, \$2,699,300, (1999-2004).

"Topological Methods in Nonlinear Dynamics," NSF International, co-PI: T. Gedeon, \$38,700, (2001-2004).

"Neural Coding (Biological Information Technology and Systems)," NSF, PI: J. Miller, co-PI: T. Gedeon, B. Mumey, and R. Snyder, \$1,400,000, (2002-2006).

HAMILTON, M.

"Antimicrobial Test Methodology: Statistical Support," EPA, PI: M. Hamilton, \$850,000, (2002-2006).

"Interdisciplinary Graduate Student Support Program," NSF/EPSCoR, co-PI: A. Camper and M. Hamilton, \$40,000, (2002-2004).

"Suspended Coupon Biofilm Reactor," Montana Board of Commercialization and Technology, \$142,000, (2001-2003).

HODGSON, T.

"Six Through Eight Mathematics Curriculum Revision Project," NSF, PI: R. Billstein, co-PI: L. Andersen, T. Hodgson, and J. Williamson, \$1,610,000, (2002-2006).

"Center for Teaching and Learning in the West," NSF, PI: E. Swanson, co-PI: M. Anneking, T. Hodgson, B. Mayes, and G. Tuthill, \$9,980,000, (2001-2006).

KLAPPER, I.

"Initiation of Coronal Mass Ejections," AFOSR, PI: R. Canfield, co-PI: I. Klapper and D. Longcope, \$498,951, (2000-2003).

"Modeling Antibiotic Susceptibility of Bacteria in Biofilm," NIH, PI: P. Stewart, co-PI: J. Dockery, I. Klapper, and P. Stoodley, \$846,000, (2002-2005).

KWAPISZ, J.

"Symbolic Dynamics of Cocyclic Subshifts," NSF, PI: J. Kwapisz, \$69,000, (1999-2002).

"Torus Maps and Cocyclic Subshifts," NSF, PI: J. Kwapisz, \$71,719, (2002-2005).

PERNAROWSKI, M.

"Structural and Functional Analysis of Complex Biological Systems," NSF IGERT, PI: D. Dooley, co-PI: T. Gedeon, G. Jacobs, J. Miller, M. Pernarowski, and C. Vogel, \$2,699,300, (1999-2004).

ROBISON-COX, J.

"Reducing Occupational Disability in Rural Workers," NIH, PI: Pat Butterfield, \$87,051, (1998-2002).

"Messengers for Health," NIH, PI: Suzanne Christopher, \$1,500, (2001-2003).

"Center for Research on Chronic Health Conditions in Rural Dwellers," National Institute for Nursing Research, \$150,000, (2001-2006).

"Rural Chronically Ill Women: Online Support Network," National Institute for Nursing Research, \$202,500, (2002-2003).

SIMONSEN, L.

"PROMATH: Professional Development for Middle School Math Teachers," DOE Eisenhower Awards, PI: L. Andersen, co-PI: L. Simonsen and L. Krussell, \$172,321, (2001-2003).

STANLEY, L.

"Analysis and Computation of Shape Sensitivities for Elliptic Interface Problems," NSF Applied Mathematics, PI: L. Stanley, \$72,832, (2000-2003).

VOGEL, C.

"Computational Methods in Advanced Imaging Sciences," DEPSCoR/AFOSR, PI: C.R. Vogel, \$462,679, (2002-2005).

"Analysis, Modeling, and Simulation of Adaptive Optics Systems for Extremely Large Telescopes," Center for Adaptive Optics, PI: D. Gavel, co-PI: C.R. Vogel, \$500,000, (2002-2003).

"Computational Methods in Atmospheric Optics," DEPSCoR/AFOSR, PI: C.R. Vogel, \$452,047, (1998-2002).

"Structural and Functional Analysis of Complex Biological Systems," NSF IGERT, PI: D. Dooley, co-PI: T. Gedeon, G. Jacobs, J. Miller, M. Pernarowski, and C. Vogel, \$2,699,300, (1999-2004).

FUNDED INTERNAL GRANTS

BORKOWSKI, J.

"Avalanche Prediction by Spatial Extrapolation of Study Plot Stability," MONTS, co-PI: R. Aspinall, K. Birke-land, J. Borkowski, R. Brown, and K. Hansen, \$24,222, (2001-2002).

BOWERS, K.

"Student Recruitment and Retention in the Sciences," MSU Provost's Office, PI: S. Holmgren, co-PI: J. Adams, K. Bowers, K. Cargill, S. Eiger, S. Eversman, D. Mogk, and J. Schmitt, \$9,512, 2001-2002.

CHERRY, S.

"Whitebark Pine Monitoring," BEST, \$5,500, (2002).

ROBISON-COX, J.

"Promoting Optimal Nutrition through Assessment of Rural Elders in Montana," College of Nursing Office of Research, PI: K. Zulkowski, \$25,291.

"Complimentary Therapy in Rural Areas," College of Nursing Office of Research, PI: J. Shreffler-Grant, \$35,000.

SIMONSEN, L.

"Teachers Integrating Mathematics and Environmental Sciences (TIMES): A Pilot Project of the Big Sky Institute," Montana Space Grant Consortium, PI: L. Graulich, co-PI: J. Rotella, L. Simonsen, and M. Young, \$59,423, (2002).