

◀ MATHEMATICAL SCIENCES ▶

HIGHLIGHTS

- ◇ THE DEPARTMENT OF MATHEMATICAL SCIENCES HOSTED COMPUTATION, CONTROL, & BIOLOGICAL SYSTEMS VIII, JULY 29 - AUGUST 1, AN INTERNATIONAL CONFERENCE INVOLVING OVER 40 MATHEMATICIANS AND SCIENTISTS FROM AROUND THE WORLD, ORGANIZED BY PROFESSORS LISA STANLEY AND ISAAC KLAPPER.
- ◇ GRADUATE STUDENT ERIN AUSTIN WAS SELECTED AS THE OUTSTANDING GRADUATE TEACHING ASSISTANT IN THE COLLEGE OF LETTERS OF SCIENCE.
- ◇ PROFESSOR EMERITUS KEN TIAHRT RECEIVED THE FIRST EVER CHAPTER SERVICE AWARD FROM THE MONTANA CHAPTER OF THE AMERICAN STATISTICAL ASSOCIATION.
- ◇ THE DEPARTMENT OF MATHEMATICAL SCIENCES DELIVERED 10% OF THE TOTAL STUDENT CREDIT HOURS AT MSU LAST YEAR.

Books	1
Book Chapters	6
Refereed Articles	35
Presentations	78
FTE Faculty	31
Majors	175
Grant Expenditures	\$402,106

SUMMARY

TEACHING

The Department of Mathematical Sciences delivered about 10% of the total student credit hours at MSU last year. We have 133 undergraduate majors seeking a B.S. degree in one of four options (Applied Mathematics, Mathematics, Mathematics Teaching, Statistics). In addition we have 67 M.S. students and 23 Ph.D. candidates. At the 2003 commencement exercises, the department awarded 31 Bachelor of Science degrees. Among our graduates were nine students who graduated with highest honors, seven who graduated with honors, and two who completed the University Honors Program. Also awarded were 22 Master of Science degrees, six Doctor of Philosophy degrees, and one Doctor of Education degree.

Our students have received several awards this year. Jared Barber, Benjamin Bartle, John Cross, Charlie Doughty, Kori Smith, and Matthew Welch were Presidential Scholars. Jared Barber and Charlie Doughty were selected for the MSU Alumni Association and Bozeman Area Chamber of Commerce Awards for Excellence. Charlie Doughty was inducted into Septemviri and also received the Christy Scholarship. Erin Austin was selected as the Outstanding GTA in the College of Letters of Science.

RESEARCH

Faculty in the Department of Mathematical Sciences have had a productive year in advancing their research programs. 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 Science, Ecology, Education, Entomology, Land Resources & Environmental Sciences, Nursing, and Physics.

Several faculty were invited to give international lectures this year. Warren Esty spoke in Madrid, Spain. Tomas Gedeon was invited to the United Kingdom and gave lectures at Oxford University and the University of Southampton. He also gave a talk in Whistler, British Columbia while Marty Hamilton spoke in Victoria, British Columbia. Isaac Klapper gave lectures in Sydney, Australia, and both Montreal and Banff, Canada. Jarek Kwapisz spoke at Universite⁷ Joseph Fourier, Grenoble, France and Centre d'Orsay, Universite⁷ Paris-Sud, Paris, France. Jim Robison-Cox spoke at the Technische Universität, Wien, Vienna, Austria. Linda Simonsen spoke in Kiel, Germany. Curt Vogel spoke at the Australian National University in Canberra, Australia. Of more local interest, both John Borkowski and Steve Cherry, have begun separate funded research projects with the US Geological Survey concerning wildlife habitat in and around Yellowstone National Park. Each also has a separate funded project with the National Park Service involving habitat studies in Yellowstone. Lisa Stanley has begun a large Air Force funded project involving control and guidance of unmanned air vehicles while Curt Vogel continues funded work with the Air Force on atmospheric optics and giant telescopes. Finally, Maurice Burke is the editor of four books in the Navigations Series for the National Council of Teachers of Mathematics.

This year, Marcy Barge's Ph.D. student, Yurii Shvetsov, finished his degree. John Borkowski had two Ph.D. students finish. Boonorm Chomtee is now a professor in Thailand and Phil Turk also accepted a faculty position. Sanoe Koonprasert finished his Ph.D. under the direction of Ken Bowers and is now an Assistant Professor at King Mongkut's Institute of Technology in Bangkok, Thailand. Tomas Gedeon's Ph.D. student, Al Parker, finished his degree. Tomas also worked with Colette Campion, Matt Holzer, and Eric Siegfried on Undergraduate Scholars Program funded research projects. Ted Hodgson's doctoral student Kate Riley, finished and is now an Assistant Professor of

Mathematics Education at Cal Poly at San Luis Obispo. Isaac Klapper directed Todd Shaw in a graduate research project involving biofilm modeling. Mark Pernarowski's Ph.D. student Roger Griffiths finished and has accepted a job as Assistant Professor of Mathematics at Mercyhurst College in Erie, Pennsylvania. Lisa Stanley directed Michael Larkin in a graduate research project involving unmanned air vehicles and worked with Chris Dagle on an undergraduate research project in engineering design. Curt Vogel directed a team including postdoc, Mike Flanagan, and two graduate students, Mark Campanelli and Jennifer Thorenson, that investigated atmospheric optics and the use of giant telescopes.

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 and campus activities. In addition, our faculty contribute to numerous 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). Maurice Burke is on the Mathematics Standards Review Committee, convened by the Superintendent of Public Instruction. For the Montana Chapter of the American Statistical Association, Marty Hamilton was the President, Sherry Heis was the Secretary/Treasurer and John Borkowski was the Chapter Representative. Ted Hodgson is on the Mathematics Technology in Assessment Subcommittee convened by the Superintendent of Public Instruction while Ted and Linda Simonsen were on the Board of Directors of the Montana Council of Teachers of Mathematics.

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. Robert Boik is an Associate Editor for Psychometrika and an Editorial Board member for Psychological Methods. John Borkowski is an Associate Editor for The American Statistician and the Journal of Probability and Statistical Science. Maurice Burke is on the National Advisory Boards for both The Teacher's Teaching with Technology Program and the SIMMS-IM Dissemination Grant. Mark Pernarowski

served on an NSF-ITR review panel in computational biology. Linda Simonsen is part of the DFG/NSF (Germany and the United States) Mathematics and Science Education Research Group and also served on the Advisory Board for the Metro Math NSF Center in Philadelphia.

PUBLICATIONS

A. BOOKS / EDITED COLLECTIONS / FULL-LENGTH WORKS

HAMILTON, M.

The Biofilm Laboratory: Step-by-Step Protocols for Experimental Design, Analysis, and Data Interpretation, M. Hamilton, J. Heersink, K. Buckingham-Meyer, and D. Goeres, Cytergy, Bozeman, MT, (2003).

B. BOOK CHAPTERS

ANDERSEN, L.

“Measuring Montana: An Episode in Estimation,” T. Hodgson, L. Simonsen, L. Andersen, and J. Luebeck, 2003 Yearbook of the National Council of Teachers of Mathematics, 221-230, (2003).

HODGSON, T.

“Measuring Montana: An Episode in Estimation,” T. Hodgson, L. Simonsen, L. Andersen, and J. Luebeck, 2003 Yearbook of the National Council of Teachers of Mathematics, 221-230, (2003).

“Measuring the Mountain State,” T. Hodgson, Classroom Activities for Learning and Teaching Measurement, 37-44, (2003).

LUEBECK, J.

“Measuring Montana: An Episode in Estimation,” T. Hodgson, L. Simonsen, L. Andersen, and J. Luebeck, 2003 Yearbook of the National Council of Teachers of Mathematics, 221-230, (2003).

SHARP, J.

“Teacher Learning and Teacher Leadership,” C. Ohana and J. Sharp, Partnerships in Mathematics Education, 20-42, (2003).

SIMONSEN, L.

“Measuring Montana: An Episode in Estimation,” T. Hodgson, L. Simonsen, L. Andersen, and J. Luebeck, 2003 Yearbook of the National Council of Teachers of Mathematics, 221-230, (2003).

C. REFEREED JOURNAL PIECES

BANFIELD, J.

“The Box-Percentile Plot,” W. Esty and J. Banfield, Journal of Statistical Software, 8(17), 1-14, (2003).

BARGE, M.

“Asymptotic Orbits of Primitive Substitutions,” M. Barge, B. Diamond, and C. Holton, Theoretical Computer Science, 301(1-3), 439-450, (2003).

BOIK, R.

“Principle Components Models for Correlation Matrices,” R.J. Boik, Biometrika, 90, 679-701, (2003).

BORKOWSKI, J.

“A Comparison of Prediction Variance Criteria for Response Surface Designs,” J.J. Borkowski, Journal of Quality Technology, 35, 70-77, (2003).

“Using a Genetic Algorithm to Generate Exact Small Response Surface Designs,” J.J. Borkowski, Journal of Probability and Statistical Science, 1, 65-88 (2003).

“Simple Latin Square Sampling +k Designs,” J.J. Borkowski, Communications in Statistics – Theory and Methods, 32, 215-237, (2003).

ESTY, W.

“The Box-Percentile Plot,” W. Esty and J. Banfield, Journal of Statistical Software, 8(17), 1-14, (2003).

“Statistics in Numismatics,” W. Esty, Survey of Numismatic Research 1995-2001, International Association of Professional Numismatists, Special Publication, 921-927, (2003).

“The Assessment of Mathematical Logic: Abstract Patterns and Familiar Contexts,” W. Esty, A. Teppo, and K. Kirkpatrick, Psychology of Mathematics Education, Proceedings of the 27th Conference of the International Group for the Psychology of Mathematics Education, 283-290, (2003).

GEDEON, T.

"Analysis of Neural Coding Using Quantization with an Information-Based Distortion Measure," A. Dimitrov, J. Miller, T. Gedeon, Z. Aldworth, and A. Parker, *Network: Computation in Neural Systems*, 14, 151-176, (2003).

"Attractors in Continuous-Time Switching Networks," T. Gedeon, *Communications on Pure and Applied Analysis*, 2(2), 187-209, (2003).

"Attractor Reconstruction from Interspike Intervals is Incomplete," T. Gedeon, M. Holzer, and M. Pernarowski, *Physica D*, 178(3-4), 149-172, (2003).

"Annealing and the Rate Distortion Problem," A. Parker, T. Gedeon, and A. Dimitrov, *Advances in Neural Information Processing Systems*, 15, 969-976, (2003).

"Information Distortion and Neural Coding," T. Gedeon, A. Parker, and A. Dimitrov, *Canadian Applied Mathematics Quarterly*, 10(1), 33-70, (2003).

GILLES, L.

"Numerical Simulations of Multiconjugate Adaptive Optics Wavefront Reconstruction on Giant Telescopes," B. Ellerbroek, L. Gilles, and C.R. Vogel, *Applied Optics*, 42, 4811-4818, (2003).

"Preconditioned Conjugate Gradient Wavefront Reconstructors for Multi-Conjugate Adaptive Optics," L. Gilles, B. Ellerbroek, and C.R. Vogel, *Applied Optics*, 42, 5233-5250, (2003).

HAMILTON, M.

"A Computer Investigation of Chemically Mediated Detachment in Bacterial Biofilms," S. Hunt, M. Hamilton, J. Sears, G. Harkin, and J. Reno, *Microbiology*, 149, 1155-1163, (2003).

"A Microtiter-Plate Screening Method for Biofilm Disinfection and Removal," B. Pitts, M. Hamilton, N. Zelver, and P. Stewart, *Journal of Microbiological Methods*, 54, 269-276, (2003).

"Assessing Technician Effects When Extracting Quantities From Microscope Images," D. Webb, M. Hamilton, G.J. Harkin, S. Lawrence, A.K. Camper, and Z. Lewandowski, *Journal of Microbiological Methods*, 53, 97-106, (2003).

"Movement, Replication, and Emigration Rates of Individual Bacteria in a Biofilm," A.R. Rice, M. Hamilton, and A.K. Camper, *Microbial Ecology*, 45, 163-172, (2003).

HOLZER, M.

"Attractor Reconstruction from Interspike Intervals is Incomplete," T. Gedeon, M. Holzer, and M. Pernarowski, *Physica D*, 178(3-4), 149-172, (2003).

KIRKPATRICK, K.

"The Assessment of Mathematical Logic: Abstract Patterns and Familiar Contexts," W. Esty, A. Teppo, and K. Kirkpatrick, *Psychology of Mathematics Education, Proceedings of the 27th Conference of the International Group for the Psychology of Mathematics Education*, 283-290, (2003).

KLAPPER, I.

"Long Time Behavior of Magnetic Field in Two Dimensions," I. Klapper, *Proceedings of the Royal Society of London A*, 459, 1053-1062, (2003).

KWAPISZ, J.

"Combinatorics of Torus Diffeomorphisms," J. Kwapisz, *Ergodic Theory & Dynamical Systems*, 23(2), 559-586, (2003).

PARKER, A.

"Analysis of Neural Coding Using Quantization with an Information-Based Distortion Measure," A. Dimitrov, J. Miller, T. Gedeon, Z. Aldworth, and A. Parker, *Network: Computation in Neural Systems*, 14, 151-176, (2003).

"Annealing and the Rate Distortion Problem," A. Parker, T. Gedeon, and A. Dimitrov, *Advances in Neural Information Processing Systems*, 15, 969-976, (2003).

"Information Distortion and Neural Coding," T. Gedeon, A. Parker, and A. Dimitrov, *Canadian Applied Mathematics Quarterly*, 10(1), 33-70, (2003).

PERNAROWSKI, M.

"Attractor Reconstruction from Interspike Intervals is Incomplete," T. Gedeon, M. Holzer, and M. Pernarowski, *Physica D*, 178(3-4), 149-172, (2003).

SHARP, J.

“Comparing Crystals,” J. Sharp, K. Hoiberg, and S. Chumbley, *Science and Children*, 41(2), 33-37, (2003).

“Using a Pattern Table to Solve Contextualized Proportions Problems,” J. Sharp and B. Adams, *Mathematics Teaching in the Middle School*, 8(8), 432-441, (2003).

SIMONSEN, L.

“Setting a Research Agenda for Science Teacher Education via Distance Delivery,” E. Swanson, L. Simonsen, E. Gummer, K. Cochran, and D. Miller-Jones, *Proceedings of the National Association of Research in Science Teaching Conference*, (2003).

STANLEY, L.

“Optimal Shape Design Using Domain Transformations and Continuous Sensitivity Equation Methods,” L. Stanley, *System Modeling and Optimization*, *Proceedings of the IFIP 20th TC7 Conference on System Modeling and Optimization*, 301-316, (2003).

VOGEL, C.

“Numerical Simulations of Multiconjugate Adaptive Optics Wavefront Reconstruction on Giant Telescopes,” B. Ellerbroek, L. Gilles, and C.R. Vogel, *Applied Optics*, 42, 4811-4818, (2003).

“Simulations of Closed-Loop Wavefront Reconstruction for Multiconjugate Adaptive Optics on Giant Telescopes,” B. Ellerbroek and C.R. Vogel, *Adaptive Optics System Technologies II*, 206-217, (2003).

“Preconditioned Conjugate Gradient Wavefront Reconstructors for Multi-Conjugate Adaptive Optics,” L. Gilles, B. Ellerbroek, and C.R. Vogel, *Applied Optics*, 42, 5233-5250, (2003).

PRESENTATIONS

ANDERSEN, L.

“Looking to the Past as We Plan for the Future in Mathematics Education: Remembering What is Important from the Past,” North Dakota College Mathematics Teachers’ Group, Hankinson, North

Dakota, October 2003.

“Looking to the Past as We Plan for the Future in Mathematics Education: Preparing Students for the Future,” North Dakota College Mathematics Teachers’ Group, Hankinson, North Dakota, October 2003.

“Looking to the Past as We Plan for the Future in Mathematics Education: The Role of Technology in Math Education,” North Dakota College Mathematics Teachers’ Group, Hankinson, North Dakota, October 2003.

BORKOWSKI, J.

“Using a Genetic Algorithm to Generate Exact Response Surface Designs,” Montana Chapter of the American Statistical Association, Butte, Montana, September 2003.

“Strategies of Experimentation,” College of Engineering, Montana State University, Bozeman, Montana, September 2003.

“Using a Genetic Algorithm to Generate Exact Small Response Surface Designs,” Quality and Productivity Research Conference, Yorktown Heights, New York, May 2003.

BURKE, M.

“Technology and the Real Numbers: Studying Irrational Numbers at the High School Level,” Department of Mathematical Sciences Colloquium, University of Montana, Missoula, Montana, November 2003.

“Navigating Through Algebra in Grades 9-12,” Western Regional Conference of the National Council of Teachers of Mathematics Colloquium, Salt Lake City, Utah, October 2003.

“Navigating Through Measurement in Grades 9-12,” Western Regional Conference of the National Council of Teachers of Mathematics, Salt Lake City, Utah, October 2003.

“Using Technology to Study the Irrational Numbers,” Mathematics Department Colloquium, Weber State University, Ogden, Utah, October 2003.

“Navigating Through Mathematics with Measurement,” Annual Conference of the Montana Council of Teachers of Mathematics, Billings, Montana, October 2003.

CHERRY, S.

“Estimating Resource Selection Functions in Use-Availability Studies: Problems and an Alternative,” Montana Chapter of the American Statistical Association, Butte, Montana, September 2003.

DOCKERY, J.

“Biofilm Modeling,” IGERT Symposium, Northwestern University, Evanston, Illinois, May 2003.

EGUCHI, T.

“An Empirical Hierarchical Bayes Approach to Capture-Recapture Abundance Estimation,” Montana Chapter of the American Statistical Association, Butte, Montana, September 2003.

ESTY, W.

“Precalculus,” Annual meeting of the Montana Education Association – Montana Federation of Teachers, Billings, Montana, October, 2003.

“Statistical Analysis of Hoard Data in Ancient Numismatics,” The XIII International Numismatic Congress, Madrid, Spain, September, 2003.

GEDEON, T.

“Mathematical Properties of Information Distortion,” Neural Coding Workshop, Mathematical Biosciences Institute, The Ohio State University, Columbus, Ohio, February 2003.

“Boundary Value Problems via the Conley Index,” SIAM Dynamical Systems Conference, Snowbird, Utah, May 2003.

“Bifurcations in Information Distortion,” Symmetry Breaking Bifurcations in Biological Sciences Workshop, Banff International Research Station, Banff, Canada, June 2003.

“Symmetry Breaking Bifurcations, Normalized Cuts and the Neural Coding Problem,” Workshop on Nonlinear Dynamics and Life Sciences, University of Southampton, United Kingdom, October 2003.

“Symmetry Breaking Bifurcations, Normalized Cuts and the Neural Coding Problem,” Applied Analysis Seminar, University of Oxford, Oxford, United Kingdom, October 2003.

“Mathematical Properties of Information Bottleneck

and Information Distortion Methods,” Whistler, British Columbia, December 2003.

HAMILTON, M.

“CDC Biofilm Reactor: Ruggedness Test Results,” CBE Technical Advisory Conference, Bozeman, Montana, February 2003.

“Analysis and Repeatability of Biofilm Measurements,” CBE Biofilm Methods Workshop, Bozeman, Montana, April 2003.

“Moving Novel Research Tools to Market: The CDC Biofilm Reactor,” Montana State Board of Research Commercialization and Technology, Bozeman, Montana, May 2003.

“Statistical Data Analysis,” CBE Biofilms Methods Workshop, Bozeman, Montana, July 2003.

“Modeling Biofilm Systems,” Kodak Corporation representatives, Montana State University, Bozeman, Montana, May 2003.

“The CDC Biofilm Reactor Protocol,” AOAC-International Meetings, Atlanta, Georgia, September 2003.

“A Good Experiment is Repeatable,” Montana Chapter of the American Statistical Association, Butte, Montana, September 2003.

“Statistical Thinking in Biofilm Research,” CBE Biofilm Methods Workshop, Bozeman, Montana, October 2003.

“Standardized Methods for the Biofilm Laboratory: Statistical Guidance,” Biofilms 2003, American Society for Microbiology Conference, Victoria, British Columbia, Canada, November 2003.

HODGSON, T.

“Modeling in Grades 6-12: Making it Real,” Winter Meeting of the Indiana Mathematics Initiative, Bloomington, Indiana, December 2003.

“Modeling in Paleontology,” Winter Meeting of the Indiana Mathematics Initiative, Indianapolis, Indiana, December 2003.

“Just What is Appropriate Use of Technology?,” Annual Meeting of the Montana Education Association/Montana Federation of Teachers, Billings, Montana, October 2003.

“Professional Development for Middle Grades Teachers,” Dwight D. Eisenhower workshop for teachers in grades 5-8, Bozeman, Montana, September 2003.

HOLZER, M.

“Phase Locking in Integrate-and-Fire Models with Refractory Periods and Modulation,” SIAM Dynamical Systems Conference, Snowbird, Utah, May 2003.

HYDE, S.

“Robust Estimation of the Covariance Matrix,” Brigham Young University-Hawaii, Laie, Hawaii, November 2003.

KLAPPER, I.

“Biofilm Mechanics,” Minisymposium on Biofilms, Joint CAIMS/SIAM Annual Meeting, Montreal, Canada, June 2003.

“Biofilm Interfaces,” Minisymposium on Advances in Numerical Methods and Analysis for Interface Problems, International Congress on Industrial and Applied Mathematics, Sydney, Australia, July 2003.

“Introductory Remarks on Biofilms,” Computation, Control, and Biological Systems VIII, Montana State University, Bozeman, Montana, July 2003.

“A Perturbation Method for Approximating Solutions of Problems with Large Coefficient Jumps,” Workshop on Computational Techniques for Moving Interface Problems, Banff International Research Station, Banff, Canada, August 2003.

KOSIAK, J.

“Increasing Student Achievement in College Algebra Through On-line Collaborative Problem Solving,” University of Wisconsin-LaCrosse, LaCrosse, Wisconsin, December 2003.

“Using Computer Algebra Systems to Teach Symbolic Manipulation,” Annual meeting of the Montana Education Association – Montana Federation of Teachers, Billings, Montana, October 2003.

“Factors Influencing Professional Development for Teachers of Native American Students,” National Council of Supervisors of Mathematics, San Antonio, Texas, April 2003.

“Integrating Mathematics and Environmental Science in Yellowstone,” Annual meeting of the National Council of Teachers of Mathematics, San Antonio, Texas, April 2003.

“Collaborating for Effective Professional Development in Mathematics and Science Education in Rural Reservation Schools,” American Indian Higher Education Consortium, Fargo, North Dakota, April 2003.

KWAPISZ, J.

“Combinatorics of Torus Diffeomorphisms,” Topology Seminar, Institut Fourier, Université Joseph Fourier, Grenoble, France, February 2003.

“Theory of Rotations Sets for Toral Maps,” Special Dynamics Seminar, Centre d’Orsay, Université Paris-Sud, France, January 2003.

LUEBECK, J.

“Creating a Framework for Research on Mentoring via Distance Delivery,” New Teacher Center Research Forum, San Jose, California, February 2003.

PARKER, A.

“Phase Transitions in the Information Distortion,” Neural Information Processing Systems 2003 Workshop on Information Theory and Learning: The Bottleneck and Distortion Approach. Whistler, British Columbia, Canada, December 2003.

“Solving the Neural Coding Problem using Bifurcation Theory,” Computation, Control, and Biological Systems VIII, Montana State University, Bozeman, Montana, July 2003.

“A Bifurcation Theoretical Approach to Solving the Neural Coding Problem,” IGERT Symposium, Carnegie Mellon University, Pittsburgh, Pennsylvania, June 2003.

PERNAROWSKI, M.

“Return Map Characterizations for a Model of Bursting with Two Slow Variables,” Department of Mathematics Colloquium, University of Montana, Missoula, Montana, October 2003.

RILEY, K.

“An Investigation of Prospective Secondary Mathematics Teachers’ Conceptions of Proof,”

Mathematics Education and Mathematics in the 21st Century, Tucson, Arizona, February 2003.

“Prospective Secondary Mathematics Teachers’ Conceptions of Proof and Refutations,” MAA Conference on Research in Undergraduate Mathematics Education, Scottsdale, Arizona, October 2003.

“Preservice Teachers’ Conceptions of Proof,” Boise State University, Boise, Idaho, February 2003.

“Preservice Teachers’ Conceptions of Proof,” Cal Poly San Luis Obispo, San Luis Obispo, California, February 2003.

ROBISON-COX, J.

“Putting RGTK to Work,” Distributed Computing Conference 2003, Technische Universität, Wien, Vienna, Austria, March 2003.

SHARP, J.

“Iowa State University: Education and Engineering K-12 Collaboration,” Annual Meeting of the Institute of Electrical and Electronics Engineers, Miami, Florida, January 2003.

“The Negotiation of Values in State-Wide Mathematics Reform,” Annual American Educational Research Association Conference, Chicago, Illinois, April 2003.

“Division of Fractions: Contexts Matter!,” Annual National Council of Teachers of Mathematics Conference, San Antonio, Texas, April 2003.

“The Role of Context in Proportional Thinking,” Annual National Council of Teachers of Mathematics Conference, San Antonio, Texas, April 2003.

“A Meaningful Algorithm for the Division of the Fractions,” State Meeting of the Iowa Council of Teachers of Mathematics, Ames, Iowa, February 2003.

“African Drumming Polyrhythms: A Unique View of Ratios,” State Meeting of the Iowa Council of Teachers of Mathematics, Ames, Iowa, February 2003.

SHAW, T.

“The Modeling of Biofilm Flow and Interface Problems,” Computation, Control, and Biological Systems VIII, Bozeman, Montana, July 2003.

SHVETSOV, Y.

“Random Sum Estimators,” Montana Chapter of the American Statistical Association, Butte, Montana, September 2003.

SIMONSEN, L.

“Teachers Integrating Mathematics and Environmental Science in Yellowstone,” 81st Annual Meeting of the National Conference of Teachers of Mathematics, San Antonio, Texas, April 2003.

“Setting a Research Agenda for Science Teacher Education via Distance Delivery,” National Association of Research in Science Teaching Conference, Philadelphia, Pennsylvania, March 2003.

“Teacher’s Discourse Moves: A Framework for Analyzing Discourse in Mathematics Classrooms,” DFG/NSF Research Symposium, Kiel, Germany, March 2003.

STANLEY, L.

“Sensitivity Calculations for Elliptic Interface Problems,” SIAM Conference on Computational Science and Engineering, San Diego, California, February 2003.

“A Sensitivity Equation Method for Elliptic Interface Problems,” Computation, Control, and Biological Systems VIII, Bozeman, Montana, July 2003.

“Continuous Sensitivity Equation Methods and Implications for the Design of Control Systems,” AFOSR Contractors’ Meeting, Destin, Florida, September 2003.

VOGEL, C.

“Adaptive Optics,” CSIRO, Australian National University, Canberra, Australia, January 2003.

“An Order N Algorithm for Least Squares Wavefront Estimation,” AFOSR-PRET Workshop, Maui, Hawaii, January 2003.

“Multiconjugate Adaptive Optics,” SIAM Computational Science and Engineering Conference, San Diego, California, February 2003.

“Inverse Problems in Optics,” Maui Scientific Research Center, Maui, Hawaii, June 2003.

“Multiconjugate Adaptive Optics,” Computation, Control, and Biological Systems VIII, Montana State

University, Bozeman, Montana, July 2003.

"Mathematics for Adaptive Optics," CFAO Summer School on Adaptive Optics, Santa Cruz, California, August 2003.

GRANTS

A. 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 Project," Dwight D. Eisenhower Title II Grant Awards, PI: L. Andersen, Co-PI: L. Krussell and L. Simonsen, \$172,321, (2001-2003).

"PROMATH: Professional Development for Middle School Math Teachers," Extension Dwight D. Eisenhower Title II Grant Awards, PI: L. Andersen and L. Simonsen, co-PI: T. Hodgson and J. Sharp, \$54,820, (2003).

BANFIELD, J.

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

BORKOWSKI, J.

"Evaluating the Yellowstone Grizzly Bear Cumulative Effects Model," USGS – Interagency Grizzly Bear Study Team, PI: J.J. Borkowski, \$27,000, (2003-2004).

"Evaluating Wildlife Responses to Winter Human Use in Yellowstone National Park," National Park Service, PI: J.J. Borkowski, \$15,000, (2003-2004).

CHERRY, S.

"Evaluating Whitebark Pine Monitoring Protocols," National Park Service, PI: S. Cherry, \$10,000, (2003-2004).

DOCKERY, J.

"Modeling Antibiotic Susceptibility of Bacteria in Biofilm," NIH, PI: P. Stewart, co-PI: J. Dockery, I. Klapper, and P. Stoodley, \$846,000, (2002-2006).

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).

"Algorithms for Decoding and Modulations of Neural Spike Trains (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, co-PI: D. Goeres and M. Hamilton, \$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).

"PROMATH: Professional Development for Middle School Math Teachers," Extension Dwight D. Eisenhower Title II Grant Awards, PI: L. Andersen and L. Simonsen, co-PI: T. Hodgson and J. Sharp, \$54,820, (2003).

"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, (1999-2003).

"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.

"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).

"From Bias to Exclusion: Why So Few Women at the Top?," NSF, Co-PIs: R. Martell and J. Robison-Cox, \$86,819, (2003-2004).

SHARP, J.

"PROMATH: Professional Development for Middle School Math Teachers," Extension Dwight D. Eisenhower Title II Grant Awards, PI: L. Andersen and L. Simonsen, co-PI: T. Hodgson and J. Sharp, \$54,820, (2003).

SIMONSEN, L.

"PROMATH: Professional Development for Middle School Math Teachers Project," Dwight D. Eisenhower Title II Grant Awards, PI: L. Andersen, Co-PI: L. Krussell and L. Simonsen, \$172,321, (2001-2003).

"PROMATH: Professional Development for Middle School Math Teachers," Extension Dwight D. Eisenhower Title II Grant Awards, PI: L. Andersen and L. Simonsen, co-PI: T. Hodgson and J. Sharp, \$54,820, (2003).

"Wildlife Education in Big Sky: Enhancing Teaching Skills Through Environmental Education in the Northern Rocky Mountains," EPA, Environmental

Education Grants Program, PI: L.J. Graumlich, Co-PI: L. Simonsen, \$57,667, (2003-2004)

"Wildlife Education in Big Sky: Enhancing Environmental Education for Montana Teachers," Steel-Reese Foundation, PI: L.J. Graumlich, Co-PI: L. Simonsen, \$49,292, (2003-2004).

"Wildlife Education in Big Sky: Enhancing Environmental Education for Montana and Idaho's Teachers," Charlotte Martin Foundation, PI: L.J. Graumlich, Co-PI: L. Simonsen, \$49,292, (2003-2004)

"Wildlife Education in Big Sky: Enhancing Environmental Education for Montana and Wyoming's Teachers," Northern Environmental Support Trust, PI: L.J. Graumlich, Co-PI: L. Simonsen, \$15,000, (2003-2004).

STANLEY, L.

"Analysis and Computation of Shape Sensitivities for Elliptic Interface Problems," NSF Applied Mathematics, PI: L. Stanley, \$72,832, (2000-2004).

"Sensitivity Analysis for the Optimal Design and Control of Advanced Guidance Systems," DEPSCoR/AFOSR, PI: L. Stanley, \$500,000, (2003-2006).

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, (2002-2004).

"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).

"Summer Internship with the College of Optometry at the University of Houston," Center for Adaptive Optics MiniGrant, \$2,100, (2003).

"Inverse Problems in Neurobiological Imaging," NSF/EPSCoR, PI: C.R. Vogel, Co-PI: J. Miller, \$40,000, (2003-2004).

B. FUNDED INTERNAL GRANTS

KLAPPER, I.

“Biofilm Mechanics,” BEST Award, \$6,600, (2003).

KWAPISZ, J.

“X-Ray and Dynamical Spectra of Substitution Tilings,”
BEST Award, \$6,600, (2003).

SOJDA, M.

“GTA Teaching Workshop,” Provost’s Office, \$3,000,
(2003).