

◀ MATHEMATICAL SCIENCES ▶

2010

HIGHLIGHTS

- ◇ UNDERGRADUATE MAJOR ELISABETH BROWN RECEIVED AN AWARD FOR EXCELLENCE AND KELLY ALSUP AND BOVARD TIBERI SPENT THE SUMMER IN NORWAY ON AN NSF FUNDED RESEARCH PROJECT.
- ◇ GRADUATE STUDENT JON WIXSON WAS SELECTED AS THE OUTSTANDING GRADUATE TEACHING ASSISTANT IN THE COLLEGE OF LETTERS AND SCIENCE.
- ◇ SHAE THOMPSON WAS SELECTED AS THE COLLEGE OF LETTERS AND SCIENCE OUTSTANDING ADJUNCT.
- ◇ PROFESSOR JOHN BORKOWSKI WAS AWARDED A FULBRIGHT FELLOWSHIP.
- ◇ PROFESSORS TOMAS GEDEON AND MARK PERNAROWSKI WERE ON SABBATICAL.
- ◇ A DEPARTMENT COLLOQUIUM SERIES WAS INITIATED.

Books	12
Technical Manuscripts	1
Refereed Articles	36
Presentations	63
FTE Faculty	26.6
Majors	201
Grant Expenditures	\$132,218

SUMMARY

TEACHING

In 2008 the Department of Mathematical Sciences had 99 undergraduate majors seeking a B.S. degree in one of four options (Applied Mathematics, Mathematics, Mathematics Teaching, Statistics). In addition we have 71 M.S. students and 31 Ph.D. candidates. In 2008, the Department awarded 35 Bachelor of Science degrees. Among these B.S. degrees were six who graduated with highest honors (cumulative Grade Point Average (GPA) greater than or equal to 3.70), seven who graduated with honors (cumulative GPA of 3.25 through 3.69), and two who completed the University Honors Program. Also awarded in 2008 were 29 Master of Science degrees and two Doctor of Philosophy degrees.

Our students have received several awards this year. Matthew Beamer, Casey Donovan, and Kevin Rice were Presidential Scholars. Elisabeth Brown received a Bozeman Area Chamber of Commerce and MSU Alumni Association Award for Excellence. Kelly Alsup and Bovard Tiberi were funded by the National Science Foundation for eight-week summer research projects on carbon sequestration in Norway at the University of Bergen and the Norwegian University of Science and Technology in Trondheim. Spring semester 2008 John Kirtley made the President's List with a perfect 4.00 GPA and 27 other majors made the Dean's List with a GPA of 3.50 through 3.99. Fall semester 2008 the President's List included Matthew Beamer, Danielle

Burrington, Jennifer Classen, Casey Donovan, Alexis Lund, and Tessa Mosdal while the Dean's List included an additional 16 majors.

Jon Wixson was honored as the Outstanding GTA in the College of Letters of Science. Andrea Katz, Kim Nordby, and Carl Olimb were departmental Outstanding GTAs. Shae Thompson, who provides mathematics instruction through the TRiO Student Support Services program, was selected as the College of Letters and Science Outstanding Adjunct.

RESEARCH

Faculty in the Department of Mathematical Sciences have had a productive year in advancing their research programs. Our faculty are working on numerous interdisciplinary research programs involving the Center for Adaptive Optics (CAO), the Center for Biofilm Engineering (CBE), the Center for Computational Biology (CCB), the Defense Advanced Research Projects Agency (DARPA), the Interagency Grizzly Bear Study Team, the Montana Office of Public Instruction, the Montana Water Center, the National Council of Teachers of Mathematics (NCTM), the National Institutes of Health (NIH), the National Park Service, the National Science Foundation (NSF), the Northern Yellowstone Carnivore Working Group, the Optical Sciences Company (tOSC), the State of Montana Fish, Wildlife, & Parks Department, the U.S. Department of Education, the U.S. Fish and Wildlife Service, the U.S. Geological Survey (USGS), Yellowstone National Park, and the Whitebark Pine Monitoring Working Group. Cooperative on-campus projects involved the departments of Agricultural Economics & Economics, Animal & Range Sciences, Cell Biology & Neuroscience, Chemical Engineering, Civil Engineering, Earth Sciences, Ecology, Education,

Entomology, Land Resources & Environmental Sciences, Physics, and Psychology.

Several faculty were invited to give lectures abroad this year. Marcy Barge spoke at the Workshop on Topology of Tilings in Banff, Canada. John Borkowski was a Fulbright Fellow in the Department of Mathematics and Statistics at Thammasat University in Bangkok, Thailand and gave addresses at Thammasat University; King Mongkut University of Technology North Bangkok; Kasetsart University; and the National Institute of Development Administration, all in Thailand. He also spoke at Academia Sinica; the National Cheng Chi University; and the National Tsing Hua University in Taiwan. Warren Esty was invited to address the Conference on Quantifying Monetary Supplies in Greco-Roman Times in Rome, Italy. Tomas Gedeon presented a poster at the Gordon Conference on Theoretical Biology in Il Ciocco, Lucca, Italy; and spoke at the Conference on Sensors in Biology and Engineering in Paola, Italy; and the Conference on Mathematical Biology in Luminy, Marseille, France. Jarek Kwapisz spoke at the Conference on Combinatorial and Computational Aspects of Tilings at the Imperial College in London, England. Al Parker spent the 2007-08 year at the University of Otago in Dunedin, New Zealand and gave two addresses there.

Steve Cherry continued a research project with the U.S. Geological Survey concerning wildlife habitat in and around Yellowstone National Park. John Borkowski was funded by the National Park Service (NPS) for habitat studies in Yellowstone. Megan Higgs was funded by the NPS for a project predicting pregnancy status in bison in Grand Teton. Beth Burroughs and Jennie Luebeck were funded by the Department of Education for a Mathematics and Science Partnerships project to improve mathematics instruction in the public schools. Thomas Gedeon continued work on a National Science

Foundation (NSF) grant on optimal sensor receptor arrays and completed an NSF/NIH grant to study NCR-circuit dynamics. He also had NSF funding for two separate projects. One involved the fluid-structure interactions in arthropods and one studied the dynamics of biochemical oscillators. Lastly he had Defense Advanced Research Projects Agency (DARPA) funding to design physiologically complex networks. Mark Greenwood was funded by the USGS to investigate wetland hydrology and vegetation data. Kathi Irvine was funded by the Inventory and Monitoring Program of five networks in the NPS. Isaac Klapper was funded by NSF with an Interdisciplinary Grant in the Mathematical Sciences in order to devote an entire year working in the lab of Dave Ward in the Department of Land Resources and Environmental Science at MSU. Jennie Luebeck continued work on the Department of Education funded Creating Opportunities in Mathematics for Exemplary Teaching (COMET) project, for which she served as the Principal Investigator. Al Parker concluded a Postdoctoral Fellowship in New Zealand funded jointly by the new Zealand Institute of Mathematics, the University of Auckland, and the University of Otago. Mark Pernarowski visited the University of British Columbia in Vancouver, Canada to collaborate with Michael Ward on electrode modeling. Jim Robison-Cox continued work on a whirling disease project funded by the U.S. Fish & Wildlife Service. Curt Vogel was funded by NSF on a project involving adaptive optics scanning laser ophthalmoscopy and by the Optical Sciences Company to work on the Thirty Meter Telescope project.

This year two Ph.D. students graduated and many more were involved in exciting research ventures. Maurice Burke's Ph.D. student, Raquel Vallines Mira, finished her degree which studied effective mathematics teaching strategies for Native American students. Diana Colt completed her Ph.D. under Jennie Luebeck studying

online graduate mathematics courses. Thomas Gedeon worked with a team of graduate students including Jesse Berwald, Jake Brown, Mark Campanelli, Bree Cummings, Shaun Harker, and Kate Patterson on computational neuroscience and systems biology. Kathi Irvine worked with graduate student Kezia Manlove on water quality analysis for the Greater Yellowstone Network. Jarek Kwapisz worked with graduate students Veronica Baker, Andy Bouwman, David Buhannan, and Mark Mathison on problems in dynamical systems. John Borkowski directed Ph.D. student Wlpawan Laorun, at Thammasat University in Thailand working on number-theoretic methods in the generation of designed experiments. Maurice Burke worked with graduate students Taylor Jensen, Rejoice Mudzimiri, and Sara Segal on issues in mathematics education. Isaac Klapper's Ph.D. student, Shane Nowack, spent the year working in a biosciences laboratory. Jim Robison-Cox's Ph.D. student Ilai Keren worked on a project in land resources involving the preharvest application of herbicides on wheat crops.

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 contributed to department and campus activities. This year we instituted a new Colloquium Series, which was an outstanding success. The faculty panel that orchestrated this series was made up of Maurice Burke, Steve Cherry, Lisa Davis, and Russ Walker. In addition, our faculty contributed to numerous efforts to improve our state. Maurice Burke served on the State Mathematics and Science Teacher Initiative Committee. For the Montana Chapter of the American Statistical Association, Megan Higgs served as President, Kathi Irvine was the Vice-President, John Borkowski was the

Secretary/Treasurer and Mark Greenwood was the Chapter Representative. Jennie Luebeck served on the Montana Mathematics Standards Revision Team and was on both the Board of Directors of the Montana Council of Teachers of Mathematics and the Board of Directors of the Montana Learning Center for Mathematics and Science. Russ Walker was the MSU Unit Coordinator for the Montana University System (MUS) Transfer Initiative. As part of the Mathematics and Science Partnerships, David Yopp served as Inter-rater Reliability Trainer for four different projects in Montana.

Beyond the borders of Montana, several faculty members contributed to their profession in a variety of ways. Robert Boik is an Editorial Board member for *Psychological Methods*. John Borkowski is an Associate Editor for both *The American Statistician* and *The Journal of Probability and Statistical Science*. He is also on the Editorial Review Board for *The Journal of Quality Technology* and *The Thailand Statistician*. Maurice Burke is the Editor of *The Navigations Series* produced by the National Council of Teachers of Mathematics. Beth Burroughs served on the Mathematical Association of America's (MAA) Committee on the Mathematical Education of Teachers as well as on the Association of Mathematics Teacher Educators (AMTE) review task force on the NCTM. Tomas Gedeon is an Associate Editor for the *Journal of the American Institute of Mathematical Sciences*, the *Rocky Mountain Journal of Mathematics* and *Discrete and Continuous Dynamical Systems B*. David Yopp served as an external evaluator for the Idaho Mathematics and Science Partnerships program.

PUBLICATIONS

A. BOOKS / EDITED COLLECTIONS / FULL-LENGTH WORKS

B. TECHNICAL MANUSCRIPTS

BORKOWSKI, J.

"Predicting Bison Migration out of Yellowstone National Park using Simple Bayesian Models," C. Geremia, P. White, R. Wallen, J. Borkowski, J. Treanor, F. Watson, C. Potter, and R. Crabtree, *National Park Service Technical Report*, (2010).

HAMILTON, M.

"Enumerating Viable Cells by Pooling Counts for Several Dilutions," M. Hamilton and A. Parker, *Center for Biofilm Engineering Technical Report*, KSA-SM-06, (2010).

PARKER, A.

"Enumerating Viable Cells by Pooling Counts for Several Dilutions," M. Hamilton and A. Parker, *Center for Biofilm Engineering Technical Report*, KSA-SM-06, (2010).

C. REFEREED JOURNAL ARTICLES

BARGE, M.

"Cohomology of Substitution Tiling Spaces," M. Barge, B. Diamond, J. Hunton, and L. Sadun, *Ergodic Theory and Dynamical Systems*, 30, p. 1607-1627, (2010).

BERWALD, J.

"Modeling Complexity of Physiological Time Series In-Silico," J. Berwald, T. Gedeon, and K. Mischaikow, *Biosignals*, (2010).

BOIK, R.

"Model-Based Principal Components of Covariance Matrices," R. Boik, K. Panishkan, and S. Hyde, *British Journal of Mathematical and Statistical Psychology*, 63, p. 113-

137, (2010).

BORKOWSKI, J.

“Review of *Response Surface Methodology* by R. Meyers, D. Montgomery, and C. Anderson-Cook,” J. Borkowski, *Journal of the American Statistical Association*, 105, p. 879, (2010).

“k-tuple Simple Latin Square Sampling Designs,” J. Akanisthanon, K. Budsaba, and J. Borkowski, *Thailand Statistician*, 8, 93-107, (2010).

“Comparison of Model Selection Criteria for Classical Designed Experiments,” N. Yasongnoen, J. Borkowski, and K. Budsaba, *Thailand Statistician*, 8, 123-142, (2010).

BURKE, M.

“Growth Rates and the Marvelous Geometric Sequence,” M. Burke and T. Hodgson, *The Mathematics Teacher*, 103, p. 458-462, (2010).

BURROUGHS, E.

“Prospective Elementary Mathematics Teacher’s Conceptions of Decimals with Single Repeating Digits,” E. Burroughs and D. Yopp, *Investigations in Mathematics Learning* 3(1), p. 23-41, (2010).

“Pre-Service Teachers in Mathematics Lesson Study,” E. Burroughs and J. Luebeck, *Montana Mathematics Enthusiast*, 7(3), p. 391-400, (2010).

CHERRY, S.

“Contrasting Activity Patterns of Sympatric and Allopatric Black and Grizzly Bears,” C. Schwartz, S. Cain, S. Podruzny, S. Cherry, and L. Frattaroli, *Journal of Wildlife Management*, 74(8), p. 1628-1638, (2010).

DOCKERY, J.

“Senescence and Antibiotic Resistance in an Age-Structured Population Model,” P. De Leenheer, J.

Dockery, T. Gedeon and S. Pilyugin, *Journal of Mathematical Biology*, 61(4), p.475-499, (2010).

“The Chemostat with Lateral Gene Transfer,” P. De Leenheer, J. Dockery, T. Gedeon and S. Pilyugin, *Journal of Biological Dynamics*, 4(6), p.607-620, (2010).

“Mathematical Descriptions of Microbial Biofilm,” I. Klapper and J. Dockery, *Society for Industrial and Applied Mathematics Review*, 52, p.221-265, (2010).

GEDEON, T.

“Senescence and Antibiotic Resistance in an Age-Structured Population Model,” P. De Leenheer, J. Dockery, T. Gedeon and S. Pilyugin, *Journal of Mathematical Biology*, 61(4), p.475-499, (2010).

“The Chemostat with Lateral Gene Transfer,” P. De Leenheer, J. Dockery, T. Gedeon and S. Pilyugin, *Journal of Biological Dynamics*, 4(6), p.607-620, (2010).

“Somitogenesis Clock-Wave Initiation Requires Differential Decay and Multiple Binding Sites for Clock Protein,” T. Gedeon and M. Campanelli, *PLoS Computational Biology*, 6(4), e1000728, doi/10.1371/journal.pcbi.1000728, (2010).

“Modeling Complexity of Physiological Time Series In-Silico,” J. Berwald, T. Gedeon, and K. Mischaikow, *Biosignals*, (2010).

“Symmetry Breaking in Soft Clustering Decoding of Neural Codes,” A. Dimitrov, A. Parker and T. Gedeon, *Institute of Electrical and Electronic Engineers Transactions on Information Theory*, 56(2), p. 901-927, (2010).

“Hyperbolicity of the Fixed Point Set for the Simple Genetic Algorithm,” C. Hayes and T. Gedeon, *Theoretical Computer Science*, 411, p. 2368-2383, (2010).

“ODE, RDE and SDE Models of Cell Cycle Dynamics and Clustering in Yeast,” E. Boczeko, T. Gedeon, C. Stowers, and T. Young, *Journal of Biological Dynamics*, 4(4),

p. 328-345, (2010).

“Hantavirus Transmission in Sylvan and Peridomestic Environment,” T. Gedeon, C. Bodelon, and A. Kuenzi, *Bulletin of Mathematical Biology*, 72(3), p. 541-564, (2010).

“Oscillations in Monotone Systems with Negative Feedback,” T. Gedeon, *Society for Industrial and Applied Mathematics Journal on Applied Dynamical Systems*, 9(1), p. 84-112, (2010).

GREENWOOD, M.

“Carotenoid Pigmentation in Antarctic Heterotrophic Bacteria as a Strategy to Withstand Environmental Stresses,” M. Dieser, M. Greenwood, and C. Foreman, *Arctic, Antarctic and Alpine Research*, 42(4), p.396-405, (2010).

“An Assessment of Full Cross-Validation,” M. Greenwood and G. Gordon, *Interstat*, p. 1-12, (2010).

“Using Functional Linear Models to Test for Differences in Hydraulic Gradients in Prairie Pothole Wetlands with Application to Understand Climate Change,” M. Greenwood, T. Preston and R. Sojda, *Modeling for Environment's Sake: Transactions of the 5th Biennial Meeting of International Environmental Modeling and Software*, 8 pages, (2010).

“Relative Impact of Anthropogenic Modifications Versus Climate Change on the Natural Flow Regimes of Rivers in the Northern Rocky Mountains,” A. Arrigoni, M. Greenwood and J. Moore, *Water Resources Research*, 46, 16 pages, (2010).

HAMILTON, M.

“Use of Alternative Carrier Materials in Association of Analytical Communities (AOAC) Official Method SM 2008, 05, Efficacy of Liquids Sporocides Against Spores of *Bacillus Subtilis* on a Hard, Nonporous Surface, Quantitative Three-Step Method,” S. Tomasino, M.

Hamilton, and R. Pines, *Journal of Association of Analytical Communities (AOAC) International* 2010, 93(1), p. 259-276, (2010).

HAYES, C.

“Hyperbolicity of the Fixed Point Set for the Simple Genetic Algorithm,” C. Hayes and T. Gedeon, *Theoretical Computer Science*, 411, p. 2368-2383, (2010).

HIGGS, M.

“A Clipped Latent-Variable Model for Spatially Correlated Ordered Categorical Data,” M. Higgs and J. Hoeting, *Computational Statistics and Data Analysis*, 54, 1999-2011, (2010).

KLAPPER, I.

“Mathematical Descriptions of Microbial Biofilm,” I. Klapper and J. Dockery, *Society for Industrial and Applied Mathematics Review*, 52, p.221-265, (2010).

“Mathematical Model of Biofilm Induced Calcite Precipitation,” T. Zhang and I. Klapper, *Water Science and Technology*, 61(11), p. 2957-2964, (2010).

“Analysis of Adaptive Response to Dosing Protocols for Biofilm Control,” B. Szomolay, I. Klapper, and M. Dindos, *Society for Industrial and Applied Mathematics Journal on Applied Mathematics*, 70, p. 3175-3202, (2010).

KWAPISZ, J.

“Topological Friction for Aperiodic \mathbb{R}^m Actions,” J. Kwapisz, *Fundamenta Mathematicae*, 207(2) p. 175-178, (2010).

LUEBECK, J.

“Pre-Service Teachers in Mathematics Lesson Study,” E. Burroughs and J. Luebeck, *Montana Mathematics Enthusiast*, 7(3), p. 391-400, (2010).

“Mathematics Teaching: Putting Research into Practice

at All Levels,” J. Lott and J. Luebeck, *Putting Research into Practice at All Levels: Association of Mathematics Teacher Educators*, 7, p. 1-6, (2010).

PARKER, A.

“Symmetry Breaking in Soft Clustering Decoding of Neural Codes,” A. Dimitrov, A. Parker and T. Gedeon, *Institute of Electrical and Electronic Engineers Transactions on Information Theory*, 56(2), p. 901-927, (2010).

“Physiology of *Pseudomonas Aeruginosa* in Biofilms as Revealed by Transcriptional Profiling,” J. Folsom, L. Richards, B. Pitts, F. Roe, G. Ehrlich, A. Mazurie, A. Parker, and P. Stewart, *BioMed Central Microbiology*, 10 (294), doi:10.1186/1471-2180-10-294, (2010).

ROBISON-COX, J.

“Applying Species-Energy Theory to Conservation: A Case Study for North American Birds,” L. Bowers Phillips, A. Hansen, C. Flather, and J. Robison-Cox, *Ecological Applications*, 20(7), p. 2007-2023, (2010).

“Rout Population Responses to Whirling Disease Epizootics in Montana Rivers,” T. McMahon, J. Robison-Cox, J. Rotella, T. Horton, and B. Kerans, *Proceedings of the Wild Trout X Conference*, 1, p. 195-202, (2010).

VOGEL, C.

“Design of an Integrated Hardware Interface for Adaptive Optics Scanning Laser Ophthalmoscope Image Capture and Cone-Targeted Stimulus Delivery,” Q. Yang, D. Arathorn, P. Tiruveedhula, and C. Vogel, *Optics Express*, 18, p. 17841-17858, (2010).

“Modeling Parameter Estimation and Open-Loop Control of Microelectromechanical System Deformable Mirrors,” C. Vogel, G. Tyler, and Y. Lu, *Microelectromechanical System Adaptive Optics IV*, 7595, DOI: 10.1117/12.846363, (2010).

“Modeling and Parameter Estimation for Point-

Actuated, Continuous-Facesheet Deformable Mirrors,” C. Vogel, G. Tyler, Y. Lu, T. Bifano, R. Conan, and C. Blain, *Journal of the Optical Society of America-A*, 27, p. A56-A63, (2010).

YOPP, D.

“Prospective Elementary Mathematics Teacher’s Conceptions of Decimals with Single Repeating Digits,” E. Burroughs and D. Yopp, *Investigations in Mathematics Learning* 3(1), p. 23-41, (2010).

“Developing an Understanding of Logical Necessity,” D. Yopp, *Teaching Children Mathematics*, 16(7), p. 410-422, (2010).

ZHANG, T.

“Review of Mathematical Models for Biofilms,” Q. Wang and T. Zhang, *Communications in Solid State Physics*, 150(21-22), p. 1009-1022, (2010).

“Mathematical Model of Biofilm Induced Calcite Precipitation,” T. Zhang and I. Klapper, *Water Science and Technology*, 61(11) p. 2957-2964, (2010).

PRESENTATIONS

BARGE, M.

“Maximal Equicontinuous Factors for Pisot Family Tiling Spaces,” Canadian Mathematics Society Winter Meeting, Vancouver B.C., Canada, December, 2010.

“The Higher Dimensional Pisot Conjecture,” Towards New Interactions between Mathematics and Computer Science, Marseille, France, February, 2010.

“Topology of Quasicrystals,” Brigham Young University, Provo, Utah, November, 2010.

BORKOWSKI, J.

“Using a Genetic Algorithm (GA) to Generate Small

Exact Response Surface Designs,” 2010 Conference on Statistics and Applied Statistics, Chiang Mai Thailand, May, 2010.

“Using Weak and Strong Heredity to Generate Weighted Design Optimality Criteria for Response Surface Designs,” with P. Turk and B. Chomtee, 2010 Joint Statistical Meetings, Vancouver, B.C., Canada, August, 2010.

BURKE, M.

“The Symbolic Spreadsheet – I’ve Waited for this One,” Montana Educations Association – Montana Federation of Teachers, Helena, Montana, October, 2010.

“Common Core State Standards (CCSS): Challenges and Promise for the GeoGebra Community,” First International GeoGebra Conference of the North American Chapter, Ithaca, New York, July, 2010.

“The TI-Nspire CAS: Some Basics and Some Challenges.” Annual Conf. of the Alamo Council of Teachers of Mathematics, San Antonio, Texas, March, 2010.

“Technology + Research = Importance of Mathematics Teachers,” Department of Mathematics, University of Texas at San Antonio, San Antonio, Texas, March, 2010.

“Technology and the Search for Mathematical Patterns,” Annual Conference of the Alamo Council of Teachers of Mathematics, San Antonio, Texas, March, 2010.

“Technology + Research = Importance of Mathematics,” Teachers University of Texas at San Antonio, San Antonio, Texas, March, 2010.

“The TI-NspireCAS: Next Steps,” San Antonio, Texas, December, 2010.

“Common Core State Standards: Implications for Montana Teachers and Districts,” Belgrade High School, Belgrade, Montana, December, 2010.

BURROUGHS, E.

“How Can Coaching Knowledge be Measured?” with D. Yopp and J. Sutton, National Science Foundation 2010 Discovery Research K-12, Annual Meeting, Washington D.C., December, 2010.

“Middle School Misconceptions: Verbal Visual and Experiential Miscues and Their Unintended Consequences,” with J. Luebeck, National Council of Teachers of Mathematics (NCTM) Western Regional Conference, Denver, Colorado, October, 2010.

“Recipe for Change: Transforming a Rural District,” with J. Luebeck, Mathematics and Science Partnerships Conference, San Diego, California, February, 2010.

“Expanding Mathematics Learning Communities: A Preservice Perspective on Lesson Study,” with J. Luebeck, National Council of Teachers of Mathematics (NCTM) Western Regional Conference, Denver, Colorado, October, 2010.

“A Mathematics Coaching Research Design,” with D. Yopp and J. Luebeck, Association of Mathematics Teacher Educators 14th Annual Conference, Irvine, California, January, 2010.

“Targeted Field Experiences in Lesson Study and Inquiry for Pre-Service Mathematics Teachers,” with J. Luebeck, Association of Mathematics Teacher Educators 14th Annual Conference, Irvine, California, January, 2010.

“Reflection and Communication in Coaching,” National Council of Teachers of Mathematics (NCTM) 2010 Coaching Retreat, Helena, Montana, August, 2010.

“Creating a Professional Learning Community through Coaching,” with K. Nelson, J. Luebeck and D. Yopp, Annual Meeting National Council of Teachers of Mathematics, San Diego, California, April, 2010.

DAVIS, L.

“Sensitivity Computation for Prediction and Control of Partial Differential Equations Systems,” Emerging Topics in Dynamical Systems and Partial Differential Equations, Barcelona, Spain, June, 2010.

DOCKERY, J.

“Quorum Sensing and Biofilm Modeling,” Biofilms in Infectious Disease: Biology to Mathematical Models and Back Again, Ohio State University, Columbus, Ohio, March, 2010.

GEDEON, T

“State Dependent Delays in Gene Regulation,” Low Dimensional Structures in Dynamical Systems with Variable Time Lags, Palo Alto, California, June, 2010.

“Multi-Valued Characteristics Morse Decompositions and Periodic Orbits,” Fourth International Conference on Recent Advances in Applied Dynamical Systems, Jinhua, China, June, 2010.

“Modeling Dynamics of Gene Regulation,” Workshop on Applications of Computational Homology, Christchurch, New Zealand, August, 2010.

“Modeling Somitogenesis in Zebrafish,” Multi-scale Stochastic Modeling of Cell Dynamics, Banff, Canada, January, 2010.

“Introduction to Conley Theory,” Workshop on Applications of Computational Homology, Christchurch, New Zealand, August, 2010.

“Delays in Models of Gene Regulation,” University of Auckland, Auckland, New Zealand, August, 2010.

“Delays in Models of Gene Regulation,” Department of Physiology, Seminar, McGill University, Montreal, Canada, November, 2010.

GEYER, L.

“The Cheeger Constant and Mixing Time,” Discrete and Complex Analysis, Montana State University, Bozeman, Montana, July, 2010.

“Hausdorff Dimension and Rotation Domains,” The University of Washington, Seattle, Washington, 2010.

GREENWOOD, M.

“Permutation MANOVA for Functional Linear Models and Regionalized Follow-Up Tests,” Joint Statistical Meetings, Vancouver, B.C., Canada, August, 2010.

“Functional Linear Models to Test for Differences in Prairie Wetland Hydraulic Gradients,” with R. Sojda and T. Preston, Environmental Modeling and Software Society, Ottawa, Ontario, Canada, July, 2010.

“Wetlands of Red Rock Lakes National Wildlife Refuge: A Preliminary Understanding of Their Geohydrology and Ecology,” with R. Sojda, Montana Wetlands Council, Helena, Montana, January, 2010.

“Carotenoid Pigmentation in Antarctic Bacteria as a Strategy to Withstand Environmental Stresses,” with C. Foreman and M. Diesler, International Symposium on Microbial Ecology, Seattle, Washington, August, 2010.

“A Quantitative Comparison of the Reliability of Animal Detection Systems and Recommended Requirements for System Reliability,” with M. Huijsor, T. Allen, M. Blonk and S. Wang, National Rural Intelligent Transportation Society (ITS) Conference, Huntington, West Virginia, August, 2010.

“A Quantitative Comparison of the Reliability of Animal Detection Systems and Recommended Requirements for System Reliability,” Infra Eco Network Europe International Conference on Ecology and Transportation, Velence, Hungary, September, 2010.

“Where is the Help? Current and Future Statistical Consulting Infrastructure at Montana State University,”

Bioinformatics Users Group, Montana State University, Bozeman, Montana, March, 2010.

HIGGS, M.

“Modeling Categorized and Aggregated Dive Depth Data from Marine Mammals,” with J. VerHoef, Joint Statistical Meetings, Vancouver B.C., Canada, August, 2010.

“Discretized and Aggregated: Modeling Temporally Correlated Ordinal Multinomial Counts Describing Harbor Seal Dive Depths,” with J. VerHoef, The International Environmetrics Society Conference, Isla Margarita, Venezuela, June, 2010.

“Land Use Climate and Predation Effects on Elk Group Size and Brucellosis Seroprevalence,” with A. Brennan, P. Cross, S. Creel, and B. Scurlock, Wildlife Society Conference, Snowbird, Utah, October 2010.

“A Closer Look at Models Developed for Landscape Genetics,” with K. Manlove, The Joint Statistical Meetings, Vancouver, BC, Canada, August, 2010.

“Animated Statistical Graphics using RYes,” UseR!, with Autumn Laughbaum, Washington D.C. July, 2010.

“Land Use Climate and Predation Effects on Elk Group Size and Brucellosis Seroprevalence,” with A. Brennan, P. Cross, S. Creel, W. Edwards, and B. Scurlock, 10th Biennial Scientific Conference on the Greater Yellowstone Ecosystem, Mammoth Hot Springs, Wyoming, October, 2010.

“Elk Grouping Patterns and Brucella Transmission,” with A. Brennan, P. Cross, S. Creel, W. Edwards, and B. Scurlock, Wildlife Society Conference - Wyoming Chapter, Wyoming, November, 2010.

“New Methods for Distinguishing Females with Cubs of the Year in Yellowstone,” Yellowstone Ecological Subcommittee, Bozeman, Montana, October, 2010.

“Whitebark Pine Integrated Modeling Project Update,” Whitebark Pine Monitoring Group, Bozeman, Montana, January, 2010.

IRVINE, K.

“Where is the Help? Current and Future Statistical Consulting Infrastructure at Montana State University,” Users Group, Montana State University, 2010.

KLAPPER, I.

Importance of Layering in Ecology and Function of Microbial Biofilms,” Dynamics of Layering in Biological Systems Conference, Pasadena, California, January, 2010.

“Dormancy in Planktonic and Biofilm Cultures,” with B. Ayati, Biofilms in Infectious Diseases, Columbus, Ohio, March, 2010.

“The Importance of Downward Mobility in the Biofilm Lifestyle,” Fluid Dynamics: From Theory to Experiment, Montana State University, Bozeman, Montana, June, 2010.

“Electrodiffusion in Microbial Biofilms,” Society for Industrial and Applied Mathematics Annual Meeting, Pittsburgh, Pennsylvania, July, 2010.

“An Exclusion Principle for Biofilm Models,” Society for Industrial and Applied Mathematics Conference on Life Sciences, Pittsburgh, Pennsylvania, July, 2010.

“Physical-Chemical Based Modeling of Biofilm Induced Mineralization,” with T. Zhang, Thirteenth International Symposium on Microbial Ecology, Seattle, Washington, August, 2010.

“Competitive Exclusion in Sessile Microbial Community Models,” with B. Szomolay, Thirteenth International Symposium on Microbial Ecology, Seattle Washington, August, 2010.

“Continuum Models of Biofilms, Medical Device-

Biological Interactions at the Material-Tissue Interface,”
Minneapolis, Minnesota, September, 2010.

“Discrete Speciation in a Continuous Environment,”
Biocomplexity XI: The Evolution of Cooperation,
Bloomington, Indiana, December, 2010.

“Modeling Niche Partitioning of Synechococcus
Species in Yellowstone Hot Spring Microbial Mats,”
with S. Nowack, P. Ward and E. Becraft, Thirteenth
International Symposium on Microbial Ecology, Seattle,
Washington, August, 2010.

KWAPISZ, J.

“Rigidity and Mapping Class Group for Self-Similar
Tiling Spaces,” National Meeting of Canadian
Mathematical Society, Vancouver, Canada, December,
2010.

“Aperiodic Tilings and Tiling Spaces,” Colloquium,
University of Oregon, Eugene, Oregon, November,
2010.

LAUGHBAUM, A.

“A Closer Look at Models Developed for Landscape
Genetics,” with K. Manlove, The Joint Statistical
Meetings, Vancouver, BC, Canada, August, 2010.

LINDAMAN, B.

“Infinitely Hard: A Discussion of Calculus Students’
Conceptions of Repeating Decimals,” Rocky Mountain
Mathematical Association of America (MAA) Meeting,
Fort Collins, Colorado, April 2010.

“Teaching Geometry Dynamically,” Montana Education
Association – Montana Federation for Teachers Annual
Meeting, Helena, Montana, October, 2010.

“Reasoning...in 3-D!,” National Council of Teachers of
Mathematics Regional Conference,” With J. Hastings,
Denver, Colorado, October, 2010.

LUEBECK, J.

“A Mathematics Coaching Research Design,” with D.
Yopp and E. Burroughs, Annual Conference
Association of Mathematics Teacher Educators, Irvine,
California, January, 2010.

“Creating a Professional Learning Community Through
Coaching,” with K. Nelson, E. Burroughs, and D. Yopp,
National Council of Teachers of Mathematics Annual
Meeting and Exposition, San Diego, California, April,
2010.

“Middle School Misconceptions: Verbal Visual and
Experiential Miscues and Their Unintended
Consequences,” with E. Burroughs, National Council of
Teachers of Montana (NCTM), Western Regional
Conference, Denver, Colorado, October, 2010.

“Recipe for Change: Transforming a Rural District,”
with E. Burroughs, U.S. Department of Education
Mathematics and Science Partnerships, Conference, San
Diego, California, February 2010.

“Expanding Mathematics Learning Communities: A
Preservice Perspective on Lesson Study,” with E.
Burroughs and K. Nelson, National Council of Teachers
of Montana (NCTM) Western Regional Conference,
Denver, Colorado, October, 2010.

“Targeted Field Experiences in Lesson Study and
Inquiry for Pre-Service Mathematics Teachers,” with E.
Burroughs, Association of Mathematics Teacher
Educators 14th Annual Conference, Irvine, California,
January, 2010.

“Montana Council of Teachers of Mathematics
Instructional Coaching Workshop II,” Montana
Learning Center, August, 2010.

MANLOVE, K.

“A Closer Look at Models Developed for Landscape

Genetics,” with M. Higgs, The Joint Statistical Meetings, Vancouver, BC, Canada, August, 2010.

NOWACK, S.

“Modeling Niche Partitioning of Synechococcus Species in Yellowstone Hot Spring Microbial Mats,” with I. Klapper, D. Ward, and e. Becraft, Thirteenth International Symposium on Microbial Ecology, Seattle, Washington, August, 2010.

PARKER, A.

“Accelerating Gibbs Sampling Using Matrix Decompositions,” Workshop on Statistical Inference and Partial Differential Equations (SIPE), Dunedin, New Zeland, January, 2010.

“Drawing Samples from High Dimensional Gaussians using Polynomials,” American Statistical Association Montana Chapter Meeting, Montana State University, Bozeman, Montana, September 2010.

“Statistically Assessing Limits of Detection and Performance Standards,” Biofilm Science & Technology, Bozeman, Montana, July 2010.

“Importance of Statistical Design and Analysis,” Biofilm Science & Technology Meeting Workshop, Montana State University, Bozeman, Montana, 2010.

“A Modified Center for Disease Control Biofilm Reactor to Produce Mature Biofilms on the Surface of Polyetheretherketone Membranes for an In Vivo Animal Model Application,” with D. Williams, K. Wookbury, and R. Bloebaum, Biofilm Science & Technology Workshop, Montana State University, Bozeman, Montana, July 2010.

“A Modified Center for Disease Control Biofilm Reactor to Produce Mature Biofilms on the Surface of Polyetheretherketone Membranes for an In Vivo Animal Model Application,” with D. Williams, K. Wookbury,

and R. Bloebaum, 110th American Society for Microbiology Meeting, San Diego, California, May, 2010.

YOPP, D.

“How Can Coaching Knowledge be Measured?” National Science Foundation, Annual Meeting 2010 Development and Research K-12, Washington D.C., December, 2010.

“Creating a Professional Learning Community through Coaching,” with E. Burroughs and J. Sutton, with K. Nelson, J. Luebeck and E. Burroughs, National Council of Teachers of Mathematics Annual Meeting, San Diego, California, April, 2010.

“Recipe for Change: Transforming a Rural District,” Mathematics and Science Partnerships, Conference, San Diego, California, February 2010.

“A Mathematics Coaching Research Design,” Association of Mathematics Teacher Educators 14th Annual Conference, Irvine, California, January, 2010.

ZHANG, T.

“Phase-Field Model of Biofilm,” 2010 Rocky Mountain Mathematical Association of America Meeting, Colorado State University, Fort Collins, Colorado, April, 2010.

“Phase-1 Field Model of Biofilm-Flow Interaction,” Mini Symposium of Fluids with Dynamic Microstructure. Society for Industrial and Applied Mathematics Annual Meeting, Pittsburgh, Pennsylvania, July, 2010.

“Mathematical Model of Biofilm Induced Calcite Precipitation,” Seventh International Conference on Differential Equations and Dynamical Systems, Tampa, Florid, December 2010.

“Mathematical Model of Biofilm Induced Calcite Precipitation,” Mini Symposium of Bacterial Biofilms: Models, Analysis and Simulation, Society for Industrial

and Applied Mathematics Conference on the Life Sciences, Pittsburgh, Pennsylvania, July 2010.

“Physical-Chemical Based Modeling of Biofilm Induced Mineralization.” Mini Symposium of Modeling of Complex Fluids: From Passive to Active Systems Society for Industrial and Applied Mathematics Conference on Mathematical Aspects of Materials Science, Philadelphia, Pennsylvania, **September** 2010.

“Mathematical Model of Biofilm Induced Calcite

GRANTS

Precipitation,” Illinois Institute of Technology, Chicago, Illinois, 2010.

A. FUNDED EXTERNAL GRANTS

BURKE, M.

“Before It’s Too Late-VI,” Montana Office of the Commissioner of Higher Education, Co-PIs: M. Burke and D. Erickson, \$30,000, (2010).

BURROUGHS, E.

“Examining Coaching in Elementary Mathematics Classrooms,” National Science Foundation, PI: D. Yopp, Co-PIs: E. Burroughs, J. Sutton, and M. Broderson, \$3,500,000, (2009-2014).

“Elementary and Secondary Education Act (ESEA), Title II-B Mathematics & Science Partnerships: Broadwater & Bozeman Project,” U.S. Department of Education through the Montana Office of Public Instruction, Co-PIs: E. Burroughs and J. Luebeck, 50,000, (2008-2011).

CHERRY, S.

“Modeling Habitat-Specific Probability of Occurrence for Grizzly Bears (*Ursus Arctos*) in the Greater Yellowstone Ecosystem,” U.S. Fish and Wildlife Service

and U.S. Geological Survey, PI: K. Keating, Co-Pis: C. Schwartz and S. Cherry. \$187,700 (2008-2011).

GEDEON, T.

“Predictive Biology: Adaptability, Robustness, Fundamental Laws Biology,” Defense Advanced Research Projects Agency, PI: S. Levin and T. Gedeon, \$71,560, (2009-2010).

“Dynamics and Synchronization of Biochemical Oscillators,” National Science Foundation - Division of Mathematical Sciences, PI: T. Gedeon, \$156,770, (2008-2012).

“Fluid-Structure Interaction in Arthropod Mechanoreceptors,” National Science Foundation, PI: T. Gedeon, CoPIs: J. Miller and J. Heys, \$399,943 (2008-2011).

GREENWOOD, M.

“A Stress Reduction Strategy for Decreasing CVD Risk by Reducing C-Reactive Protein,” American Heart Association Pacific Mountain Affiliate, PI: M. Miles, Co-PI: M. Greenwood, \$131,352, (2009-2011).

“Analysis of Multiple Time Scales in Wetland Hydrology,” U.S. Geological Survey, PI: M. Greenwood, Co-PI: R. Sojda, \$ 37,483, (2009-2011).

“Investigating Patterns in Wetland Hydrology and Vegetation Data,” U.S. Geological Survey, PI: M. Greenwood, Co-PI: R. Sojda, \$17,625, (2008-2010).

“Examining Coaching in Elementary Mathematics Classrooms,” National Science Foundation, PI: D. Yopp, Co-PIs: J. E. Burroughs, Sutton, and M. Brodersen, \$3,500,000, (2009-2014).

HIGGS, M.

“Reassessing Methods to Distinguish Unique Female Grizzly Bears with Cubs-of-the-Year in the Greater

Yellowstone Ecosystem,” Northern Rocky Mountain Science Center, U.S. Geological Survey, PI: M. Higgs, \$23216, (2009-2010).

“Integrated Analysis Modeling and Synthesis of the Impacts of Blister Rust and Mountain Pine Beetle Mortality to Whitebark Pine in the Greater Yellowstone Ecosystem” Northern Rocky Mountain Science Center, U.S. Geological Survey, Co-PIs: K. Irvine and M. Higgs, \$50,000, (2008-2011).

“New Analytical Methods using Ordered Categorical Data Models with Temporal Autocorrelation for Dive Depth Data from Time-Depth Recorders in Marine Mammals,” National Oceanic and Atmospheric Administration-National Marine Mammal Laboratory (NOAA-NMML), Co-PIs: M. Higgs and J. VerHoef, \$25,000, (2009-2010).

“Analysis of Bison Disease Demographic Habitat Use & Migration Data,” National Park Service, Grand Teton National Park, PI: M. Higgs, \$10,000, (2008-2011).

IRVINE, K.

“Investigating Graphical Models for Predicting Wetland Vegetation: Bayesian Belief Networks and Bayesian Graphical Models,” U.S. Geological Survey, PI: K. Irvine, \$36,416, (2009-2011).

“Integrated Analysis Modeling and Synthesis of the Impacts of Blister Rust and Mountain Pine Beetle Mortality to Whitebark Pine in the Greater Yellowstone Ecosystem” Northern Rocky Mountain Science Center, U.S. Geological Survey, Co-PIs: K. Irvine and M. Higgs, \$50,000, (2008-2011).

“Statistical Assistance for National Parks Inventory and Monitoring Program,” National Park Service, PI: K. Irvine, \$90,337, (2008-2010).

KLAPPER, I.

“Microbial Ecology and Diversity: Genomics and Metagenomics in a Yellowstone Hot Spring,” National Science Foundation, PI: I. Klapper, Co-PI: P. Lutz, \$99,986, (2008-2010).

“Collaboration in Mathematical Geosciences (CMG) Research: Impact of Mineral Precipitating Biofilms on the Physical and Chemical Characteristics of Porous Media,” National Science Foundation, PI: I. Klapper, Co-PIs: T. Zhang, R. Gerlach, A. Cunningham, and A. Mitchell \$750,002, (2009-2013).

“Microbial Communities: Theory and Practice,” National Science Foundation, PI: I. Klapper, Co-PIs: D. Ward and R. Carlson, \$250,000, (2010-2013),

“Conference on Fluid Dynamics: From Theory to Experiment,” National Science Foundation, PI: I. Klapper, \$23,295, (2010).

LUEBECK, J.

“Examining Coaching in Elementary Mathematics Classrooms,” National Science Foundation, PI: D. Yopp, Co-PIs: E. Burroughs, J. Sutton, and M. Broderson, \$3,500,000, (2009-2014).

“Elementary and Secondary Education Act (ESEA), Title II-B Mathematics & Science Partnerships: Broadwater & Bozeman Project,” U.S. Department of Education through the Montana Office of Public Instruction, Co-PIs: E. Burroughs and J. Luebeck, 50,000, (2008-2011).

VOGEL, C.

“Deformable Mirror Modeling and Control for Adaptive Optics” National Science Foundation-The Optical Sciences Company, PI: C. Vogel, \$25,000, (2010).

YOPP, D.

“Examining Coaching in Elementary Mathematics Classrooms,” National Science Foundation, PI: D.

Yopp, Co-PIs: E. Burroughs, J. Sutton, and M. Broderson, \$3,500,000, (2009-2014).

ZHANG, T.

“Collaboration in Mathematical Geosciences (CMG) Research: Impact of Mineral Precipating Biofilms on the Physical and Chemical Characteristics of Porous Media,” National Science Foundation, PI: I. Klapper, Co-PIs: T. Zhang, R. Gerlach, A. Cunningham, and A. Mitchell \$750,002, (2009-2013).

B. FUNDED EXTERNAL GRANTS

DAVIS, L.

“Using Sensitivity Analysis to Quantify Computational Uncertainty,” ADVANCE Leadership Award Grants for Women Faculty, \$7,980, (2009-2010).

GEDEON, T.

“Effect of Random Perturbations on Synchrony of Biochemical Oscillations,” Montana State University Centers of Biomedical Research Excellence (COBRE) Grant, PI: T. Gedeon, Co-PI: J. Heys, \$50,000, (2010-2011).

GREENWOOD, M.

“Medium-Term Forecasts of Forest Structure and Function in **the** Greater Yellowstone Ecosystem: Response to and Recovery from Insect Herbivory,” Interdisciplinary Research/Creativity Grant, PI: P. Stoy, Co-PIs: S. Powell and M. Greenwood, \$7,500, (2010).

LINDAMAN, B.

“Calculus and Series,” Montana State University Buyout for Enhancing **Scholarship** and Teaching (BEST), \$5,727, (2010).

