Mathematical Sciences 2013

Highlights

◊ Undergraduate Major David Halat was awarded the College of Letters and Science Award for Academic Excellence.

◊ Professor Mark Greenwood and undergraduate major Katelyn Webber and Professor Warren Esty and undergraduate Brett Green were awarded the Chamber of Commerce and MSU Alumni Association Award for Excellence.

◊ Graduate Student Olga Vsevolozhskaya won the Letters and Science graduate Teaching Award.

◊ Graduate student Sydney Akapame was awarded a Kopriva Graduate Student Fellowship.

◊ Professor John Borkowski was awarded an honorary doctorate from Thermmasat University, Thailand.

◊ Professor Marcy Barge received the Letters and Sciences Award for Meritorious Research and Creativity.

Technical Manuscripts	10
Refereed Articles	38
Presentations	80
FTE Faculty	19
Majors	232
Grant Expenditures	$1,028,102

Summary

TEACHING

In fall of 2013, the Department of Mathematical Sciences had 107 undergraduate majors seeking a B.S. degree in one of our four options: Applied Mathematics, Mathematics, Mathematics Teaching or Statistics. In addition we had 50 M.S. students and 36 Ph.D. candidates. In 2013 the Department awarded 26 B.S. degrees. Among these B.S. degrees were nine who graduated with highest honors (cumulative Grade Point Average (GPA) greater than or equal to 3.70), nine who graduated with honors (cumulative GPA of 3.25 through 3.69), and three who completed the University Honors Program. Also awarded in 2013 were 15 Master of Science degrees and five Doctor of Philosophy degrees.

Our students received several awards this year. Devin Ferris, David Halat, Jake Hall, Edward Vernarsky, and Katelyn Webber were honored as Outstanding Seniors with Distinction. Alyssa Peck is awarded the Ellis R. Ott Scholarship. Professor Warren Esty and Brett Green as well as Professor Mark Greenwood and Katelyn Webber received Bozeman Area Chamber of Commerce and MSU Alumni Association Awards for Excellence. Thirteen seniors were inducted into Pi Mu Epsilon, a National Honorary Mathematics Society. Spring semester 2013, 15 students made the President's List of which Fan Gaoyang, Tyler Forrester and Katelyn Weber were honored for a perfect 4.0 GPA and 18 others majors made the Dean's List with a GPA of 3.50 through 3.99. Fall semester 2013 the President's List included Wesley Bennice, Marshall

Boyland, Samuel Gardner, Andrew, Zane Huttinga, Kimmell and Megan Lewis. The Dean's List included an additional 26 majors. In 2013 we had five Ph.D. students finished their dissertations while many more were engaged in exciting research ventures. Olga Vsevolozhskaya was honored as the Outstanding GTA in the College of Letters and Science. Elizabeth Arnold, Emilie Naccarato, Terrill Paterson, Christiana Watts and Jennifer Weeding were departmental Outstanding GTAs. Graduate student Sydney Akapame was awarded a Kopriva Graduate Student Fellowship. Professor John Borkowski was awarded an honorary doctorate from Thermmasat University, Thailand.

RESEARCH

The faculty research programs in the Department of Mathematical Sciences were outstanding in 2013. Our exceptional faculty members initiated several new multidisciplinary research opportunities while continuing their work on existing programs which involve research with several organizations including: the Center for Biofilm Engineering (CBE), the Defense Advanced Research Projects Agency (DARPA), the Montana Office of Public Instruction, the National Council of Teachers of Mathematics (NCTM), the National institute of Health (NIH), the Mathematical Association of America (MAA), National Science Foundation (NSF), the State of Montana Fish, Wildlife, & Parks Department, the U.S. Department of Education, the U.S. Fish and Wildlife Service (USFWS), the U.S. Geological Survey (USGS), Yellowstone National Park, and the Whitebark Pine Monitoring Working Group. The Department of Mathematical Sciences engaged in research involving a variety of different departments on campus. These collaborative research projects involved the departments of Animal & Range Sciences, Chemical & Biological Engineering, Chemistry, Civil Engineering, Earth Sciences, Ecology, Education, History & Philosophy, Immunology & Infectious Diseases, and Land Resources & Environmental Sciences.

Many of our faculty members gave lectures abroad in 2013. Jenny Green, Mark Greenwood, John Borkowski and Olga Vsevolozskaya presented at Joint Statistical meeting in Montreal, Canada. Jarek Kwapisz presented a series of lectures at
Centre International de Ressources Microbiennes, Marseille, France. John Borkowski presented a series of lectures in Vietnam, Thailand and China. Tomas Gedeon gave a seminar in Edmonton, and Isaac Klapper presented at an International conference on porous media in Prague, Czech Republic.

The National Science Foundation (NSF) continued to fund Beth Burroughs, Mark Greenwood, Jennie Luebeck, and Warren Esty who acted as an Advisory Board Member for a five-year examination of mathematics coaching. Jennie Luebeck was funded by the Montana Office of Public Instruction to investigate Standard-based teaching reviewing of educators across Montana. Lisa Davis and Tomas Gedeon were funded by the National Science Foundation to develop mathematical models to pause-induced delays in bioprocesses. Tomas Gedeon received funding from two institutions for separate research endeavors, the National Institutes of Health to study hepatocellular aging and Defense Advanced Research Projects Agency to investigate biochronicity. The U.S. Geological Survey financed Megan Higgs to research of stream health within headwater streams. Isaac Klapper was funded by the Collaboration in Mathematical Geosciences Program to study biofilms in porous media, and the National Science Foundation to synthesize theory and practice in microbial community research. Tianyu Zhang received support from the National Science Foundation to study multiphase flow and dynamics in biofilms.

In 2013 The Mathematical Sciences Department saw five

Ph.D. students finish their dissertations: Andy Bouwman earned his Ph.D. while working with Jarek Kwapisz on problems in dynamical systems. Heather Moreland received her Ph.D. under Jack Dockery's advisement. Olga Vsevolozskaya received her Ph.D. in Statistics under the direction of Mark Greenwood. Kim Nordby earned his Ph.D. while working with of Jennie Luebeck on topics related to mathematical education. Lisa Davis directed student Jennifer Thorenson who earned her Ph.D. in topics of numerical mathematics.

We had a variety of Ph.D. and M.A. students who actively participated in research under the guidance of our talented faculty in 2013. Megan Higgs advised Ph.D. students Katie Banner and Michael Lerch in research related to Bayesian Analysis. Mark Greenwood continued working with Jennifer Weeding on projects in applied statistics. John Borkowski continued to provide guidance to Ph.D. student, Patchanok Srisuradetchai. Beth Burroughs students Juan Arellano and Shari Samuels continued their research in secondary mathematics education while Jennie Luebeck worked with Ph. D. students Elizabeth Arnold and Elizabeth Fulton on topics associated with math education. Lisa Davis directed Tamara Heberling on mathematical modeling. Tomas Gedeon with three graduate students: Jake Brown, Ryan Waters and Diana Schepens on projects in mathematical and systems biology. Lukas Geyer directed graduate students Rob Malo and Joe Manlove on topics in complex dynamics. Jarek Kwapisz worked with graduate student Hannah Bergen on problems in dynamical systems. Isaac Klapper's Ph.D. students, Shane Nowak and Ben Jackson continue thier work on topics associated with biofilm. Adam Wilander a new Ph.D. student started working with Mark Pernarowski. Tianyu Zhang directed Dan Kanewske, Nate McClanahan and Michael Broome on projects in computational mathematics.

SERVICE

The Department of Mathematical Sciences served the local and campus community, as well as the region, state and nation in a variety of ways. Megan Higgs, Beth Burroughs, and Lisa Davis participated in the Expanding Your Horizons program in which middle school girls learned about and encouraged to pursue career opportunities in science, technology, engineering, and mathematics (STEM). LeAnn Yenny directed the Math to Excite project whose goal it was to help middle school girls increase their interest in mathematics. Megan Higgs functioned as vice-President and John Borkowski as the Secretary/Treasurer for the Montana Chapter of the American Statistical Association. Beth Burroughs offered her service to the Mathematical Association of America, Committee on the Mathematical Education of Teachers.

Our faculty offered their talent in writing, editing and managing to several organizations. John Borkowski participated as the Editorial Review Board for the *Journal of Quality Technology* and the *Thailand Statistician.* Ken Bowers acted as Faculty Advisor for Pi Mu Epsilon as well as The Committee Member of OCHE Mathematics Faculty Learning Outcomes Council. Beth Burroughs served on the Mathematical Association of America's (MAA) Committee on the Mathematical Education of Teachers as well as on the Board of Directors of the Rocky Mountain Mathematics Consortium. Mark Greenwood was an Associate Editor for the *Journal of Environmental Statistics,* on the Council of Sections Representative for the Section on Statistical Graphics, and on both the American Statistical Association and the Editorial Review Board for *Interstat.* Megan Higgs contributed her skills as treasurer for the Section on Statistics and the Environment. Jenny Green is an associate journal editor for the Journal of Statistics Education.

Publications

A. BOOKS / EDITED COLLECTIONS / FULL–LENGTH WORKS

BORKOWSKI, J.

"R Version 2.15.3.," J. Borkowski, and P. Srisuradetchai, *Skillings.Mack R package*, (2013).

ESTY, W.

"Proof: Introduction to Higher Mathematics, 6th ed.," W. Esty, N. Esty, p. 420 , (2013). http:// www.math.montana.edu/courses/m242/

ROBISON-COX, J.

"Stat 216 TEAL Course Pack," J. Robison-Cox, *MSU Mathematical Sciences Department,* (2013).

"Randomization Web Applications," J. Robison-Cox, (2013). http://www.math.montana.edu/~jimrc/ randomization/

B. TECHNICAL MANUSCRIPTS

BANNER, K.

"Haul-out Trends for Weddell Seals with Time of Day and Tide at Big Razorback Haul-out, Erebus Bay, Antarctica," K. Banner, M. Higgs, J. Rotella, J. DeVoe, M. LaRue, and R. Garrott, *Polar Biology,* (2013).

GREENWOOD, M.

"Montana US Highway 93 South Wildlife Crossings Research, 2013 First Quarter Progress Report," P. Cramer, R. Hamlin, K. Gunson, and M. Greenwood, *Montana Department of Transportation*, (2013).

HIGGS, M.

"An Evaluation of Factors Affecting Translocation Success and Survival of Nuisance Grizzly Bears in the Great Yellowstone Ecosystem," M. Haroldson, F. van Manen, C. Schwartz, and M. Higgs, (2013).

"Correlation among Varying Coefficients in Hierarchical Models: Computational, Analytical, and Practical Issues," M. Lerch and M. Higgs, 2013).

"Haul-out Trends for Weddell Seals with Time of Day and Tide at Big Razorback Haul-out, Erebus Bay, Antarctica," K. Banner, M. Higgs, J. Rotella, J. DeVoe, M. LaRue, and R. Garrott, *Polar Biology,* (2013).

"Predictors of human-caused Grizzly Bear Mortalities in the Greater Yellowstone Ecosystem," M. Haroldson, F. van Manen, C. Schwartz, M. Higgs, K. Gunther, K. Frey, S. Cain, M. Bruscino, and B. Alber, (2013).

"Simulation-basaed Models through Resampling of Ancillary Data: Female Grizzly Bears with Cubs-of-the-year," M. Higgs, (2013).

LERCH, M.

"Correlation among Varying Coefficients in Hierarchical Models: Computational, Analytical, and Practical Issues," M. Lerch and M. Higgs, (2013).

PARKER, A.

"Using R to Assess Resemblance, Repeatability, and Reproducibility for Quantitative and Semi-quantitative Disinfectant Methods," A. Parker and M. Hamilton, *Center for Biofilm Engineering,* vol. 13, (2013).

"Using R to Calculate Confidence Intervals for the Repeatability and Reproducibility Standard Deviations and the Intra-laboratory Correlation Coefficient of a Disinfectant Test Method," M. Hamilton and A. Parker, *Center for Biofilm Engineering*, 14th ed., (2013).

"Interlaboratory Study to Establish Precision Statements for ASTM E2871-13: Standard Test Method for Evaluating Disinfectant Efficacy against Pseudomonas Aeruginosa Biofilm Grown in CDC Biofilm Reactor

using the Single Tube Method," A. Parker, *ASTM International,* RR:35-1008 ed., (2013).

C. REFEREED JOURNAL ARTICLES

BORKOWSKI, J.

"Adaptive Cluster Sampling: An Introduction," J. Borkowski, P. Turk, *Proceedings of the International Conference on Applied Statistics,* (2013).

"Using a Genetic Algorithm to Generate Ds-Optimal Designs for Mixture Experiments," J. Borkowski, S. Thongsook, and K. Budsaba, *Proceedings of the International Conference on Applied Statistics,* (2013).

BOUWMAN, A.

"Expository Article: Young Person's Guide to Translation Surfaces of Genus Two: McMullen's Connected Sum Theorem," A. Bouwman, J. Kwapisz, *Rocky Mountain Journal of Mathematics, 43*(1), p. 37–53, (2013). http://dx.doi.org/10.1216/RMJ-2013-43-1-37

BUHANAN, D.

"Cocyclic Subshifts from Diophantine Equations," J. Kwapisz, D. Buhanan, *Dynamical Systems,* 29(1), p. 56-66, (2013). http://www.tandfonline.com/doi/abs/10.1080/14689367.2013.844225#.UvVZjzddXZg

BURROUGHS, E.

"Teaching Mathematics with Women in Mind," J. Deshler, and E. Burroughs, *Notices of the AMS,* 60(9), p. 1156-1163, (2013).

"Gender Bias?," E. Burroughs, J. Deshler, *College Mathematics Journal,* 44(2), p. 88, (2013).

DAVIS, L.

"Parameter Sensitivity of an Eddy Viscosity Model: Analysis, Computation and Its Application to Quantifying Model Reliability," L. Davis and F, Pahlevani, *International Journal of Uncertainty Quantification,* 3(5), p. 397-419, (2013).

DOCKERY, J.

"Pulsed Gradient Spin Echo Nuclear Magnetic Resonance Measurement and Simulation of Two-Fluid Taylor Vortex Flow in a Vertically Oriented Taylor-Couette Device," A. Broadbent, J. Mullin, S. Codd, J. Dockery and J. Seymour, *Applied Magnetic Resonance, 42*, p. 137-152, (2012).

GEDEON, T.

"Predicting Critical Transitions in Dynamical Systems Using Active Learning," K. Spendlove, J. Berwald, T. Gedeon, *Mathematical and Computer Modeling of Dynamical Systems,* 19(6), 557-574, (2013). DOI:10.1080/13873954.2013.801866

"Encapsulation of an Enzyme Cascade within the Bacteriophage P22 Virus-Like Particle," D. Patterson, B. Schwartz, R. Waters, T. Gedeon, and T. Douglas, *American Chemical Society: Chemical Biology, 9* (2), p. 359–365, (2013). DOI: 10.1021/cb4006529

GREEN, J.

"Primarily Statistics: Developing an Introductory Statistics Course for Pre-service Elementary Teachers," J. Green and E. Blankenship, *Journal of Statistics Education, 21*(3), (2013). www.amstat.org/publications/jse/v21n3/green.pdf

GREENWOOD, M.

"Effect of Temperature on Embryo Development and Larval Survival in Pallid and Shovelnose Sturgeon, with Application to Predicting Spawning Distributions in the Wild," K. Kappenman, M. Webb, M. Greenwood, *Journal of Applied Ichthyology*, 29(6), 1193-1203, (2013).

"Empricism and/or Instrumentalism?" P. Bandyopadhyay, M. Greenwood, G. Brittan, and K.

Aho, *Erkenntnis,* (2013). DOI: 10.1007/s10670-013-9567-8

"Object-oriented Crop Classification using Multitemporal ETM+ SLC-off Imagery and Random Forest," J. Long, R. Lawrence, M, Greenwood, L. Marshall, and P. Miller, *GIScience & Remote Sensing, 50*(4), p. 418-436, (2013).

"Combining Functions and the Closure Principle for Performing Follow-up Tests in Functional Analysis of Variance," O. Vsevolozhskaya, M. Greenwood, G. Bellante, S. Powell, R. Lawrence, and K. Repasky, *Computational Statistics & Data Analysis, 67*, p. 175-184, (2013).

"Statistical Classification of Vegetation and Water Depths in Montane Wetlands," J. Sharp, R. Sojda, M. Greenwood, D. Rosenberry, and J. Warren, *Ecohydrology, 6*(2), p. 173-181, (2013).

"Physicochemical and Biological Dynamics in a Coastal Antarctic Lake as it Transitions from Frozen to Open Water," M. Dieser, C. Foreman, C. Jaros, J. Lisle, M. Greenwood, J. Laybourn-Parry, P. Miller, Y. Chin, and D. McKnight, *Antarctic Science, 25*(5), p. 663-675, (2013).

"Evidence for the Effect of Homes on Wildfire Suppression Costs," P. Gude, K. Jones, R. Rasker, and M. Greenwood, *International Journal of Wildland Fire, 22* (4), p. 537-548, (2013).

HIGGS, M.

"Implementing and Interpreting Population Scale Invasive Species Distribution Models," T. Brummer, B. Maxwell, M. Higgs, and L. Rew, *Diversity and Distributions, 19*(8), p. 919-932 (2013).

"Inferential Consequences of Modeling Rather than Measuring Snow Accumulation in Studies of Animal Ecology," B. Angela, P. Cross, M. Higgs, J. Beckman, R. Klaver, B. Scurlock, and S. Creel, *Ecological Applications,* 23(3), p. 643-653, (2013).

"Insights into the Latent Multinomial Model through Mark-resight Data on Female Grizzly Bears with Cubs-of-the-year," M. Higgs, W. Link, C. White, M. Haroldson, and D. Bjornlie, *The International Journal of Agricultural and Biological Statistics,* 18(4), p. 556-577, (2013). dx.doi.org/10.1007/s13253-013-0148-8

"Fishway Passage Bottleneck Identification and Prioritization: a Case Study of Pacific Lamprey at Bonneville Dam," M. Keefer, C. Caudill, T. Clabough, M. Jepson, E. Johnson, C. Peery, M. Higgs, and M. Moser, *Canadian Journal of Fisheries and Aquatic Sciences, 70* (10), p.1551-1565, (2013).

"Individual Heterogeneity in Reproductive Rates and Cost of Reproductionin a Long-lived Vertebrate," T. Chambert, J. Rotella, M. Higgs, and R. Garrott, *Ecology and Evolution, 3*(7), p. 2047-2060, (2013).

"Microsatellites Indicate Minimal Barriers to Mule Deer Odocoileushemionus Dispersal across Montana, USA," J. Powell, S. Kalinowski, M. Higgs, M. Ebinger, N. Vu, and P. Cross, *Wildlife Biology,* 19(1), p. 102-110, (2013).

"Do We Really Need the S-word?," M. Higgs, *American Scientist,* 1st ed., vol. 101, p. 6-9, (2013).

HILDRETH, L.

"A Permutation Test for Correlated Errors in Adjacent Questionnaire Items," L. Hildreth, U. Genschel, F. Lorenz, and V. Lesser, *Structural Equation Modeling: A Multidisciplinary Journal,* 20(2), p. 226-240, (2013).

KWAPISZ, J.

"Cocyclic Subshifts from Diophantine Equations," J. Kwapisz, D. Buhanan, *Dynamical Systems,* 29(1), p. 56-66, (2013). http://www.tandfonline.com/doi/abs/10.1080/14689367.2013.844225#.UvVZjzddXZg

"Expository Article: Young Person's Guide to Translation Surfaces of Genus Two: McMullen's Connected Sum Theorem," A. Bouwman, J. Kwapisz, *Rocky Mountain Journal of Mathematics, 43*(1), p. 37–53, (2013). http://dx.doi.org/10.1216/RMJ-2013-43-1-37

LAURISKI-KARRIKER, T.

"Linking Engagement and Student Retention," C. Beck, E. McCormick, T. Lauriski-Karriker, S. Kuala, J. Jenks, *National Symposium on Student Retention,* (2013).

SPENDLOVE, K.

"Predicting Critical Transitions in Dynamical Systems Using Active Learning," K. Spendlove, J. Berwald, T. Gedeon, *Mathematical and Computer Modeling of Dynamical Systems,* 19(6), 557-574, (2013). DOI:10.1080/13873954.2013.801866

PARKER, A.

"An Ensemble Kalman Filter using the Conjugate Gradient Sampler," J. Bardsley, A. Parker, *International Journal of Uncertainty Quantification, 3*(4), p. 357-370, (2013).

Krylov Space Methods for Kalman Filtering," J. Bardsley, A. Parker, *Numerical Linear Algebra with Applications, 20*(2), p. 171-184, (2013).

"Procedural Revision to the Germicidal Spray Products as Disinfectants Test Method: Establishment of Minimum and Maximum Log Density Values for Test Microbes on Inoculated Carriers," R. Pines and A. Parker, *JAOAC International, 96*(3), p. 567-572, (2013).

"Temperature, Plant Species and Residence Time Effects on Nitrogen Removal in Model Treatment Wetlands," C. Allen and A. Parker, *Water Science and Technology, 68*(11), p. 2337-2343, (2013).

"The Influence of Sulfate Reducing Bacteria and Ammonia Oxidizing Bacteria on Nutrient Cycling in Constructed Wetland Microcosms," J. Faulwetter and A. Parker, *Microbial Ecology, 65*(1), p. 111-127, (2013).

"Influence of Season and Plant Species on the Abundance and Diversity of Sulfate Reducing Bacteria and Ammonia Oxidizing Bacteria in Constructed Wetland Microcosms," J. Faulwetter, M. Burr, A. Parker, O. Stein, and A. Camper, *Microbial Ecology, 65*(1), p. 111–127, (2013).

"Guidelines for the Statistical Analysis of a Collaborative Study of a Laboratory Disinfectant Product Performance Test Method ," M. Hamilton, Parker, A.. *JAOAC International, 96*(5), p. 1138-1151, (2013).

ZHANG, T.

"General Theory for Integrated Analysis of Growth, Gene, and Protein Expression in Biofilms," T. Zhang, B. Pabst, I. Klapper and P. Stewart, *PLoS ONE, 8*, e83626, (2013).

Presentations

PRESENTATIONS

AKAPAME, S.

"Prior-Robust Designs for Nonlinear Models," with J. Borkowski, Joint Statistical Meetings, Montreal, Canada, August, 2013.

BORKOWSKI, J,

"Prior-Robust Designs for Nonlinear Models," with S. Akapame, Joint Statistical Meetings, Montreal, Canada, August, 2013.

"Adaptive Cluster Sampling: An Introduction," with P. Turk, Statistics and Its Interactions with Other Disciplines (SIOD) 2013, Ho Chi Minh City, Vietnam, June, 2013.

"Using a Genetic Algorithm to Generate Weighted D-Optimal Designs for Mixture Experiments," with W. Limmun and B. Chomtee, Statistics and Its Interactions with Other Disciplines (SIOD) 2013, Ho Chi Minh City, Vietnam. June, 2013.

"Teaching Statistics to Graduate Students in Other Disciplines," with M. Higgs, The International Conference on Statistics and its Applications with Other Disciplines (SIOD 2013), Ton Due Thang University, Ho Chi Minh City, VN, Thailand, June 2013.

"Adaptive Cluster Sampling: An Introduction," with P. Turk, International Conference on Applied Statistics 2013, Thailand Statistical Association, Maha Sarakham University, Thailand, May 2013.

"Using a Genetic Algorithm to Generate Ds-Optimal Designs for Mixture Experiments," with S. Thongsook, International Conference on Applied Statistics 2013, Thailand Statistical Association, Maha Sarakham University, Thailand, May, 2013.

"Random Effects One-Way ANOVA Model when Sampling from a Finite Population of Treatment Groups," with T. Simmachang and K. Budsaba, International Workshop on Applied Mathematics and Statistics, Northwest A&F University, China, May, 2013.

"Factorwise Variance Dispersion Graphs," Asian Simulation and Modeling 2103 Conference, Bangkok, Thailand, January, 2013.

BROWN, J.

"Structure of Afferent Terminals in Terminal Ganglion of a Cricket and Persistent Homology," with T. Gedeon, Topological Structures in Computational Biology, IMA, Minneapolis, December, 2013.

BURROUGHS, E.

"Model with Mathematics, using Tools Strategically," MEA-MFT Annual Meeting, MCTM, Belgrade, Montana, October, 2013.

"Three New Findings about Mathematics Classroom Coaching in Elementary Schools," Randomized Controlled Trials in the Social Sciences, Durham University, Durham, United Kingdom, September 2013.

"The Teacher in Residence Program at MSU," with J. Luebeck and L. Yenny, Conference of the APLU Science & Mathematics Teacher Imperative, Association of Public and Land-Grant Universities, St. Louis, Missouri, June, 2013.

"Promoting Gender Equity (and Reasoning) in the Mathematics Classroom," with J. Deshler, NCTM Annual Meeting, NCTM, Denver, Colorado, April 2013.

"Coaches Need Professional Development, Too," with C. Heidema, and A. Mitchell, NCTM Annual Meeting, NCTM, Denver, Colorado, April, 2013.

"Engaging Students, Engaging as Professionals, and Promoting Equity," MCTM Leadership Conference, MCTM, Bozeman, Montana, January, 2013.

"Mathematics Classroom Coaching in Grades K-8," Joint Mathematics Meetings, AMS/MAA, San Diego, California, January, 2013.

DAVIS, L.

"Traffic Flow Model for Biopolymerization Processes," with T. Gedeon, J. Gedeon, and J. Thorenson, Molecular Biosciences Graduate Student Seminar, Montana State University, Bozeman, Montana, October, 2013.

"A Discontinuous Method for Analyzing and Modeling Delay Due to Pauses During Transcription," with T. Gedeon, and J. Thorenson, SIAM Annual Meeting, Society for Industrial and Applied Mathematics, San Diego, California, July, 2013.

"Introducing Stochasticity into a Continuum Model for

Tanscription," with T. Gedeon, and J. Thorenson, SIAM Annual Meeting, Society for Industrial and Applied Mathematics, San Diego, California, July, 2013.

"Traffic Flow Model for Biopolymerization Processes," with T. Gedeon, J. Gedeon, and J. Thorenson, Mathematical Biology Seminar, University of Alberta, Edmonton, Canada, February, 2013.

"Traffic Flow Model for Biopolymerization Processes," with T. Gedeon, J. Gedeon and J. Thorenson, Snowbird Conference on Applied Dynamical Systems, Snowbird, Utah, June, 2013.

DOCKERY, J.

"Quorum Sensing in Biofilms," Applied Math Seminar, Montana State University, Bozeman, Montana, month, 2013.

"Quorum Sensing and Bioflm Modeling," Mathematical Tools for Multi-Scale Biological Processes, Bozeman, Montana, month, 2013.

"Senescence and Microbial Persistence," Pattern Formation and Development in Colonial Organisms, Columbus, Ohio, month, 2013.

"Quorum Sensing - Microbial Speciation," Applied Math Seminar, Montana State University, Bozeman, Montana, October, 2013.

"Quorum Sensing and Short-circuiting in Pseudomonas Aeruginosa," Society for Mathematical Biology Annual Meeting, Tempe, Arizona, June, 2013.

GEDEON, T.

"Structure of Afferent Terminals in Terminal Ganglion of a Cricket and Persistent Homology," with J. Brown, Topological Structures in Computational Biology, IMA, Minneapolis, December, 2013.

"Traffic Flow Model for Biopolymerization Processes," with L. Davis, J. Gedeon, and J. Thorenson, Molecular Biosciences graduate student seminar, Montana State University, Bozeman, Montana, October, 2013.

"A Discontinuous Method for Analyzing and Modeling Delay Due to Pauses During Transcription," with T. Gedeon, and J. Thorenson, SIAM Annual Meeting, Society for Industrial and Applied Mathematics, San Diego, California, July, 2013.

"Introducing Stochasticity into a Continuum Model for Tanscription," with L. Davis, and J. Thorenson, SIAM Annual Meeting, Society for Industrial and Applied Mathematics, San Diego, California, July, 2013.

"Traffic Flow Model for Biopolymerization Processes," with L. Davis, J. Gedeon, and J. Thorenson, Mathematical Biology Seminar, University of Alberta, Edmonton, Canada, February, 2013.

"Model Selection in Gene Regulation and Prediction of Oscilations," CAIMS, Canadian Applied Mathematics, Quebec City, June, 2013.

"Stochastic Simulation of RNAP Simulation," with J. Gedeon, Snowbird Conference on Applied Dynamical Systems, Snowbird, Utah, June, 2013.

"Traffic Flow Model for Biopolymerization Processes," with L. Davis, J. Gedeon, and J. Thorenson, Snowbird Conference on Applied Dynamical Systems, Snowbird, Utah, June, 2013.

"Multi-valued Characteristics, Morse Decompositions and Periodic Orbits," Dynamical Systems Conference, Atlanta, Georgia, March, 2013.

"Delayed Protein Synthesis Reduces the Correlation between mRNA and Protein Fluctuations," Gordon Conference Stochastic Physics in Biology, Ventura, California, January, 2013.

GEYER, L.

"Transversality and Rigidity in Complex Dynamics I," Graduate Student Seminar, Montana State University, Bozeman, Montana, October, 2013.

"Transversality and Rigidity in Complex Dynamics II," Graduate Student Seminar, Montana State University, Bozeman, Montana, October, 2013.

GREEN, J.

"Statistics Education Research: Future Directions and Perspectives," Joint Statistical Meetings, American Statistical Association, Montreal, Quebec, Canada, August, 2013.

"The New Face of Statistics Education," Joint Statistical Meetings, American Statistical Association, Montreal, Quebec, Canada, August, 2013.

"Making Change Happen in Mathematical Statistics," with E. Blankenship, United States Conference on Teaching Statistics, Consortium for the Advancement of Undergraduate Statistics Education, Raleigh, North Carolina, May, 2013.

"Connections Between Teachers' Mathematical Knowledge for Teaching and School-level Poverty," with T. Kutaka, H. Fleharty and W. Smith, Annual Meeting of the American Educational Association, " American Educational Association, San Francisco, California, 2013.

"Developing Teachers of Statistics: Graduate Teaching Assistant Preparation," Montana State University Department of Mathematical Sciences, Bozeman, Montana, April, 2013.

"Primary Teachers' Mathematical Knowledge and Student Achievement Gains: A Longitudinal Study," with H. Fleharty, T. Kutaka, W. Smith and C. Edwards, Society for Research in Child Development Biennial Meeting, Seattle, Washington, April, 2013.

"An Investigation of the Behavior of Value-added Models for Estimating MSP Impact," with P. Fellers, W. Stroup, L. Lukin, W. Smith and J. Sutton, Math Science Partnerships Learning Network Conference, National Science Foundation, Washington, D.C., January, 2013.

GREENWOOD, M.

"Relationship Between the Hypertriglyceridemic Waist Phenotype and Levels of Inflammatory Biomarkers and Plasma Insulin," with G. Ruegsegger, C. Miller, K. McNulty and M. Miles, 27th National Council on Undergraduate Research, National Council on Undergraduate Research, LaCrosse, Wisconsin, April, 2013.

"A Ultivariate Approach for Assessing the Spatial Relationship Between Regional Climates over Time," with L. Hawkins, Fall Meeting, American Geophysical Union, San Francisco, California, December, 2013.

"Monothetic Clustering of Hydrologic Catchment Characteristics," with L. Marshall, K. Weber and T. Smith, Fall Meeting, American Geophysical Union, San Francisco, California, December, 2013.

"Functional Analysis of Variance for Sequence-based Association Studies," with O. Vsevolozhskaya, D. Zaykin and Q. Luy, Impact of Large-Scale Genomic Data on Statistical and Quantitative Genetics Conference, University of Washington, Seattle, Washington, November, 2013.

"Functional Analysis of Variance with Application to Genetic Association Study," with Vsevolozhskaya, O, Joint Statistical Meetings, American Statistical Association, Montreal, Canada, August, 2013.

Weeding, J (Author & Presenter), Greenwood, Mark (Author), Fall Meeting, "Approaches to Modeling Variables with Correlated Measurement Errors,"

Montana Chapter of the American Statistical Association, Bozeman, MT. (September 2013 need date).

Weeding, J (Author & Presenter), Greenwood, Mark (Author), Joint Statistical Meetings, "An Exploration of the GSIMEX Approach to Modeling Variables with Correlated Measurement Errors in R," American Statistical Association, Montreal, CA. (August 2013).

"Functional Analysis of Variance with Application to Genetic Association Study," with Vsevolozhskaya, O, Joint Statistical Meetings, American Statistical Association, Montreal, Canada, August, 2013.

"A Multivariate Approach for Assessing the Spatial Relationship Between Regional Climates over Time," with L. Hawkins, Next Generation Climate Data Products Workshop, National Center for Atmospheric Research, Boulder, Colorado, July, 2013.

"Comparison Of Mindfulness-based Stress Reduction And Nutritional Enhancement Interventions to Reduce Metabolic Syndrome," with G. Ruegsegger, C. Miller, K. McNulty, J. Smith, J. Christopher and M. Miles, American College of Sports Medicine Annual Meeting and 3rd World Congress on Exercise is Medicine, Indianapolis, Indiana. June, 2013.

"Comparison Of Mindfulness-based Stress Reduction And Nutritional Enhancement Interventions to Reduce Metabolic Syndrome," with G. Ruegsegger, C. Miller, K. McNulty, J. Smith, J. Christopher and M. Miles, 60th Annual Meeting, American College of Sports Medicine, Indianapolis, Indiana, May, 2013.

HAYES, C.

"Lunch with Leaders in Teaching," Faculty Workshop, Center For Faculty Excellence, Montana State University, Montana State University, Bozeman, Montana, October, 2013.

HIGGS, M.

"Effects of Nonnative Brome Grasses: Moving toward a Mechanistic Understanding of Small Mammal Declines," with D. Bachen, A. Litt and C. Gower, Annual Meeting of the Wildlife Society, Milwaukee, Wisconsin, October, 2013.

"Impacts of Nonnative Brome Grasses: Moving toward a Mechanistic Understanding of Small Mammal Declines," with D. Bachen, A. Litt and C.Gower, the National Meeting of the Wildlife Society, Milwaukee, Wisconsin, October, 2013.

"Teaching Statistics to Graduate Students in Other Disciplines," with J. Borkowski, The International Conference on Statistics and its Applications with Other Disciplines (SIOD 2013), Ton Due Thang University, Ho Chi Minh City, VN, Thailand, June 2013.

"Do we really need the s-word?," The International Environmetrics Society's Annual Meeting: Quantitative Methods, Applications, and Issues in Natural Resources: Assessment, Regulation, Development, Use and Conservation, The International Environmetrics Society (TIES), Anchorage, Alaska, June, 2013.

"Estimation of the Abundance and Survival Rates of Spawning Grayling in Red Rock Creek, Red Rock Lakes National Wildlife Refuge," with J. Paterson and J. Warren, Meeting of the USGS, FWP-Montana, Federal Wildlife Service and Conservation Groups, Red Rock Lakes National Wildlife Refuge, Dillon, Montana, May, 2013.

"Use of Posterior Predictive Checks for Choosing Whether or Not to Include Individual Random Effects in Mark Recapture Models," with T. Chambert, J. Rotella, and J. Nichols, EURING Analytical Meeting and Workshop, Athens, Georgia, April, 2013.

"Understanding Trends in Snow Accumulation, Water

Availability and Climate Change Using Snow Telemetry and Streamflow Observations in the Missouri River Headwaters," with T. Matthews, J. Hendrikx and G. Pederson, Western Snow Conference, Jackson Hole, Wyoming, April, 2013.

"Understanding Trends in Snow Accumulation, Water Availability and Climate Change Using Snow Telemetry and Streamflow Observations in the Missouri River Headwaters," with T. Matthews, J. Hendrikx and G. Pederson, Western Snow Conference, Jackson Hole, Wyoming, April, 2013.

"How Rare is Life in the Universe? A Bayesian Contribution to Space Exploration," with P. Bandyopadhyay and S. Mahajan, ISBA Regional Meeting & International Workshop/Conference on Bayesian Theory and Applications, DST Centre for Interdisciplinary Mathematical Sciences and Department of Statistics, Banaras Hindu University, Varansasi, India, January, 2013.

HILDRETH, L.

"Correlated Residuals in General-specific Survey Questions," with F. Lorenz, V. Lesser and U. Genschel, International Total Survey Error Workshop, National Institute of Statistical Sciences, Ames, Iowa, June, 2013.

JACKSON, B.

"Image-Based Modeling of Biofilm-Induced Calcium Carbonate Precipitation," with A. Cunningham, J. Connolly, I. Klapper, R. Gerlach and A. Rothman, Interpore 5th International Conference on Porous Media & Annual Meeting, Prague, Czech Republic. September 2013.

"Biomineralization Using Biofilms: Estimating Kinetic Parameters Using a Simple Flow Channel Model," with A. Cunningham, I. Klapper, R. Gerlach, J. Connolly and A. Rothman, Society for Mathematical Biology Annual Meeting and Conference, Phoenix, Arizona, June, 2013.

KLAPPER, I.

"Image-based Modeling of Biofilm-induced Calcium Carbonate Precipitation," with A. Cunningham, J. Connolly, R. Gerlach, American Geophysical Union 2013 Fall Meeting, American Geophysical Union, San Francisco, California, December, 2013.

"Image-Based Modeling of Biofilm-Induced Calcium Carbonate Precipitation," with A. Cunningham, J. Connolly, B. Jackson, R. Gerlach and A. Rothman, Interpore 5th International Conference on Porous Media & Annual Meeting, Prague, Czech Republic. September 2013.

"Biomineralization Using Biofilms: Estimating Kinetic Parameters Using a Simple Flow Channel Model," with A. Cunningham, B. Jackson, R. Gerlach, J. Connolly and A. Rothman, Society for Mathematical Biology Annual Meeting and Conference, Phoenix, Arizona, June, 2013.

KWAPISZ, J.

"Mapping Class Group, Rigidity, and Abstract Tiling Spaces," Subtile 2013, Tilings: Dynamical Systems, Combinatorics, Number Theory, Decidability, Discrete Geometry, Non-commutative Geometry, EU, CIRM Marseille, France, January, 2013.

"Expansion Factors for Self-affine Tilings," Subtile 2013, Tilings: Dynamical Systems, Combinatorics, Number Theory, Decidability, Discrete Geometry, Non-commutative Geometry, EU, CIRM Marseille, France, January, 2013.

LAURISKI-KARRIKER, T.

"Linking Engagement and Student Retention," with C. Beck, E. McCormick, S. Kujala and J. Jenks, National Symposium on Student Retention, November, 2013.

LUEBECK, J.

"Two Models to Roll Out CCSS and NGSS Statewide," with G. Cobbs, School Science and Mathematics Association Annual Conference, School Science and Mathematics Association, San Antonio, Texas, November, 2013.

"Growing the Common Core in a Rural State," National Council of Teachers of Mathematics Regional Meeting, National Council of Teachers of Mathematics, Las Vegas, Nevada, October, 2013.

"Common Core Capsules: Packaging Standards-Based Change for Teachers," with G. Cobbs, Conference of the APLU Science & Mathematics Teacher Imperative, Association of Public and Land-Grant Universities, St. Louis, Missouri, June, 2013.

"The Teacher in Residence Program at Montana State University," E. Burroughs and L. Yenny, Conference of the APLU Science & Mathematics Teacher Imperative, Association of Public and Land-Grant Universities, St. Louis, Missouri, June, 2013.

"Bar Modeling, Percent Decrease, and the Common Cold," with K. Hill, National Council of Teachers of Mathematics Regional Meeting, National Council of Teachers of Mathematics, Denver, Colorado, April, 2013.

"STEM is Hot in Hot Springs!," National Council of Teachers of Mathematics Regional Meeting, National Council of Teachers of Mathematics, Denver, Colorado, April, 2013.

"Growing STEM: Act Locally to Reach Globally," with G. Cobbs, Association of Mathematics Teacher Educators Annual Conference, Association of Mathematics Teacher Educators, Orlando, Florida, February, 2013.

"What's All the Fuss about STEM?," with G. Cobbs, Association of Mathematics Teacher Educators Annual Conference, Association of Mathematics Teacher Educators, Orlando, Florida, February, 2013.

PARKER, A.

"Using Plynomials and Matrix Splittings to Sample from LARGE Gaussians," Statistical and Computational methods for inverse problems arising in differential equations, CIMAT, Guanajuato, Mexico, August, 2013.

"An in vitro Comparison of Intraluminal Biofilm Bacteria Transfer of Three Peripheral Intravenous Valved Blood Control Catheters," with Ryder, G. James and E. Pulcini, 40th annual APIC conference, Association for Professionals in Infection Control and Epidemiology, Ft. Lauderdale, Florida, June, 2013.

"Using polynomials and Matrix Splittings to Sample from LARGE Gaussians," Aerospace Computational Design Laboratory Seminar, Department of Aeronautics & Astronautics at MIT, Cambridge, Massachusetts, 2013.

"Novel Micro-Patterned Surfaces Reduce Biofilm Formation of Staphylococcus aureus and Pseudomonas aeruginosa," with May, Hoffman, Sogo, Initial? O'Toole, Reddy, American Society for Microbiology General Meeting, ASM, Denver. (2013).

"Assessing the Statistical Properties of Laboratory Methods," Sherwin Williams, Cleveland, Ohio, April, 2013.

"Comparison of Bacterial Transfer and Biofilm Formation on Intraluminal Catheter Catheter Surfaces Among Eight Connectors in a Clinically Simulated in vitro Model," with Initial? Ryder, E. Pulcini and G. James, Clinical Nutrition Week 2013, American Society for Parenteral and Enteral Nutrition, Phoenix, Arizona, February, 2013.

"Some Implementation Issues with Gaussian Iterative Samplers in Finite Precision," Southern Uncertainty

Quantification Conference, University of Otago, Dunedin, New Zealand, January, 2013.

ROBISON-COX, J.

"Reproducible Research," Annual Meeting, Montana Chapter of ASA, Bozeman, Montana, September, 2013.

"Symposium on Gender Bias," Academy of Management Conference 2013, Academy of Management, Orlando, Florida, August, 2013.

THORENSON, J.

"Traffic Flow Model for Biopolymerization Processes,"with L. Davis, T. Gedeon, and J. Gedeon, Molecular Biosciences Graduate Student Seminar, Montana State University, Bozeman, Montana, October, 2013.

"A Discontinuous Method for Analyzing and Modeling Delay Due to Pauses During Transcription," with L. Davis and T. Gedeon, SIAM Annual Meeting, Society for Industrial and Applied Mathematics, San Diego, California, July, 2013.

"Introducing Stochasticity into a Continuum Model for Tanscription," with L. Davis and T. Gedeon, SIAM Annual Meeting, Society for Industrial and Applied Mathematics, San Diego, California, July, 2013.

"Traffic Flow Model for Biopolymerization Processes," with T. Gedeon, L. Davis, and J. Gedeon, Mathematical Biology Seminar, University of Alberta, Edmonton, Canada, February, 2013.

"Traffic Flow Model for Biopolymerization Processes," with T. Gedeon, L. Davis, and J. Gedeon, Snowbird Conference on Applied Dynamical Systems, Snowbird, Utah, June, 2013.

VSEVOLOZHSKAYA, O.

"Functional Analysis of Variance with Application to Genetic Association Study," with M. Greenwood, Joint Statistical Meetings, American Statistical Association, Montreal, Canada, August, 2013.

"Functional Analysis of Variance for Sequence-based Association Studies," with M. Greenwood, D. Zaykin and Q. Luy, Impact of Large-Scale Genomic Data on Statistical and Quantitative Genetics Conference, University of Washington, Seattle, Washington, November, 2013.

YENNY, L.

"Delving into Common Core Practice #3," Math Science Leadership Conference, Bozeman, Montana, 2013.

"The Teacher in Residence Program at Montana State University," E. Burroughs and J. Luebeck, Conference of the APLU Science & Mathematics Teacher Imperative, Association of Public and Land-Grant Universities, St. Louis, Missouri, June, 2013.

ZHANG, T.

"General Theory for Integrated Analysis of Growth, Gene, and Protein Expression in Biofilms," AMS Eastern Sectional Meeting, Temple University, Philadelphia, Pennsylvania, October, 2013.

"Critical Occlusion via Biofilm Induced Calcite Precipitation in Porous Media," Temple University, Applied Math Seminar, Temple University, Philadelphia, Pennsylvania, October, 2013.

"Critical Occlusion via Biofilm Induced Calcite Precipitation in Porous Media," Montana Biofilm Meeting, Bozeman, Montana, July, 2013.

"Modeling and Analysis of Growth, Gene, and Protein Expression in Biofilms," Xi'an University of Architecture and Technology, Xi'an, China, June, 2013.

Grants

EXTERNALLY FUNDED GRANTS

BURROUGHS, E.

"EMC: Examining Coaching in Elementary (K-8) Classrooms," National Science Foundation (NSF), PI: E. Burroughs, $3,500,000, (2009-2015).

DAVIS, L.

"Mathematical Models for Pause-induced Delays in Bioprocesses," PI: L. Davis, Co-PI: T. Gedeon, National Science Foundation (NSF), $269,648, (2012-2015).

DOCKERY, J.

"Collaborative Research: Short-Circuiting in Bacterial Quorum Sensing," PI: J. Dockery, National Science Foundation (NSF), $52,776, (2012-2015).

GEDEON, T.

"Mathematical Models for Pause-induced Delays in Bioprocesses," PI: L. Davis, Co-PI: T. Gedeon, National Science Foundation (NSF), $269,648, (2012-2015).

"Impact of Hepatocyte Lineage Life History...," PI: E. Schmidt, Co-PI: T. Gedeon, National Institute of Health (NIH), $1,526,626, (2011-2014).

"Biochronicity: Time, Networks, Evolution and Function," PI: T. Gedeon, Duke University (DUKUNI), $273,798, (2012-2014).

GREEN, J.

"Collaborative Research: RealVAMS-Getting Real-World Value from Value Added Models," University of Nebraska Lincoln (UNINEB), PI: J. Green, $35,239.00, (2013-2015).

HIGGS, M.

"Conduct an Integrated Analysis of Red Rock Creek and Upper Red Rock Lake Historical Arctic Grayling Data," US Geological Survey (USGS), PI: M. Higgs, Co-PI: A. Zale, $17,248, (2013-2014).

KLAPPER, I.

"Microbial Biofilm Communities: Theory and Practice," PI: Klapper, Co-Pi's: R. Carlson and D. Ward, National Science Foundation (NSF), $250,000, (2010-2014).

"CMG Research Impact of Biofilms on the Physical and Chemical Characteristics of Porous Media," PI: I. Klapper, Co-PI's: A. Cunningham and R. Gerlach, National Science Foundation (NSF), $750,002, (2009-2014).

LUEBECK, J.

"STREAM: Standards-Based Teaching Renewing Educators Across Montana," PI: J. Luebeck, Bozeman School District 7 (BOZSCH), $68,920, (2012-2014).

YENNY, L.

"Math to Create, Play, and Work: Creating a Culture of Mathematics Thinkers among Young Women," PI: L. Yenny, The Mathematical Association of America (MAA), $6,731, (2013-2014).