

## Albert E. Parker

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### Education

- Ph.D., Mathematics, Montana State University, Bozeman, 2003  
Thesis: *Symmetry Breaking Bifurcations of the Information Distortion*  
Advisor: Tomáš Gedeon
- M.S., Statistics, Montana State University, Bozeman, 2004  
Research Topic: *A Bayesian Approach to Hierarchical Model Building*  
Advisor: Jim Robison-Cox
- M.S., Mathematics, University of Vermont, 1997
- B.S., Summa Cum Laude, Mathematics, Computer Science minor, Bridgewater State College, 1994

### Professional Experience

2008-present	Biostatistician	Center for Biofilm Engineering, MSU
2007-2010	Postdoctoral Fellow	New Zealand Institute of Mathematics, University of Auckland and University of Otago
2004-2006	Postdoctoral Fellow	Center for Adaptive Optics, UC Berkeley and MSU
1999-2003	Research/Teaching Assistant	Center for Computational Biology, Department of Mathematical Sciences, MSU
1997-2000	Senior Software Engineer	IDX Systems Corporation, Burlington, VT
1999	Lecturer	Mathematics, University of Vermont
1998	Lecturer	Mathematics, Saint Michael's College, Winooski, VT
1995-1997	Graduate Teaching Fellow	Mathematics, University of Vermont

### Research Interests

Modeling complex biological systems, iterative sampling from high dimensional densities, Bayesian inverse problems, bifurcation theory with symmetry, clustering

### Teaching Experience

Numerical Linear Algebra and Optimization MATH441  
Ordinary Differential Equations MATH224  
Matrix Theory MATH221  
Probability Theory and Mathematical Statistics STAT421 & 422  
Statistics for Researchers STAT401, Statistics for Scientists and Engineers STAT332  
Elementary and Intermediate Statistical Concepts STAT216 & 217  
College Algebra, Precalculus, Calculus I and II, Applications of Finite Math  
College of Letters and Science University Freshman Seminar

### Technical Experience

Numeric and symbolic computer packages: Matlab, Minitab, R, Splus, SAS, Maple, Mathematica  
Programming languages: C, Pascal, COBOL, MUMPS

## Publications

- J. L. Faulwetter, M. D. Burr, A. E. Parker, O. R. Stein, A. K. Camper. The influence of sulfate reducing bacteria and ammonia oxidizing bacteria on nutrient cycling in constructed wetland microcosms. *Microbial Ecology*. (submitted)
- J. M. Bardsley, A. Soloneny, A. Parker, H. Haario, and M. Howard. An ensemble Kalman filter using the conjugate gradient sampler. *J. of Uncertainty Quantification* (submitted).
- A. Parker and C. Fox. Sampling Gaussian Distributions in Krylov Spaces with Conjugate Directions. *SIAM Journal on Scientific Computing* (in review).
- J. Bardsley, A. Parker and M. Wilde. Krylov Space Methods for Kalman Filtering. *Numerical Linear Algebra with Applications* (to appear).
- A. Agostinho, A. Hartman, C. Lipp, A. Parker, P. Stewart, G. James. An in vitro model for the growth and analysis of chronic wound MRSA biofilms. *J. Applied Microbiology*, September, 2011.
- S. Behnke, A. Parker, D. Woodall, and A. Camper. Comparing the chlorine disinfection of detached biofilm clusters with sessile biofilms and planktonic cells in single and dual species cultures. *Applied and Environmental Microbiology*, 77(20): 7176-7184, 2011.
- A. Corbin, B. Pitts, A. Parker and P. Stewart. Antimicrobial Penetration and Efficacy in an In-Vitro Oral Biofilm Model. *Antimicrobial Agents and Chemotherapy*, 55: 3338 - 3344, July 2011.
- D. L. Williams, K. L. Woodbury, A. E. Parker, R. D. Bloebaum. A Modified CDC Biofilm Reactor to Produce Mature Biofilms on the Surface of PEEK Membranes for an In Vivo Animal Model Application. *Current Microbiology*, 62(6): 1657-1663, 2011.
- J. P. Folsom, L. Richards, B. Pitts, F. Roe, G. D. Ehrlich, A. Mazurie, A. Parker, and P. S. Stewart. Physiology of *Pseudomonas aeruginosa* in Biofilms as Revealed by Transcriptional Profiling. *BMC Microbiology*, 10:294, 2010.
- A. Parker, A. Dimitrov and T. Gedeon. Symmetry breaking clusters in soft clustering decoding of neural codes. *IEEE Special Issue on Molecular Biology and Neuroscience*, 56(2): 901-927. February 2010.
- T. Gedeon, C. Campion, A. Parker, and Z. Aldworth. Annealing and the normalized  $N$ -cut. *Pattern Recognition*, 41(2):592-606, February 2008.
- C. Vogel, D. Arathorn, A. Roorda, and A. Parker. Retinal motion estimation and image dewarping in adaptive optics scanning laser ophthalmoscopy. *Optics Express*, 14: 487-497, January, 2006.
- A. Parker and T. Gedeon. Bifurcations of a class of  $S_n$ -invariant constrained optimization problems. *Journal of Dynamics and Differential Equations*, 16(3):629-678, July, 2004.
- A. Parker, T. Gedeon, and A. Dimitrov. Annealing and the rate distortion problem. In S. Thrun, S. Becker, and K. Obermayer, editors, *Advances in Neural Information Processing Systems 15*, pages 969-976. MIT Press, 2003.
- A. Dimitrov, T. Gedeon, B. Mumey, R. Snider, A. Parker, and J. Miller. Derivation of a natural stimulus feature set using a data-driven model. In P. Soot, D. Abramson, A. V. Bogdanov, J. Dongarra, A. Y. Zomaya, and Y. E. Gorbachev, editors, *International Conference on Computational Science*, volume 2660 of *Lecture Notes in Computer Science*, pages 337-345. Springer, August 2003.

- T. Gedeon, A. Parker, and A. G. Dimitrov. Information distortion and neural coding. *Canadian Applied Mathematics Quarterly*, 10(1):33-70, Spring 2003.
- A. Dimitrov, J. Miller, Z. Aldworth, T. Gedeon, and A. Parker. Analysis of neural coding through quantization with an information-based distortion measure. *Network: Computation in Neural Systems*, 14:151-176, February, 2003.
- A. Dimitrov, J. Miller, Z. Aldworth, and A. Parker. Spike pattern-based coding schemes in the cricket cercal sensory system. *Neurocomputing*, pages 44–46, 373-379, 2002.

### Technical Reports

- A. E. Parker and M. A. Hamilton. Resemblance, Repeatability, and Reproducibility for quantitative methods. Center for Biofilm Engineering, KSA-SM-10, 2011.
- M. A. Hamilton and A. E. Parker. Enumerating viable cells by pooling counts for several dilutions. Center for Biofilm Engineering, KSA-SM-06. October 2010.
- C. Vogel, D. Arathorn, A. Parker, and A. Roorda. Retinal motion tracking in adaptive optics scanning laser ophthalmoscopy. *Adaptive Optics: Analysis and Methods/Computational Optical Sensing and Imaging/Information Photonics/Signal Recovery and Synthesis Topical Meetings on CD-ROM*, Technical Digest, paper JTuc2. Optical Society of America, June, 2005.
- S. Kubiak, H. Lehr, R. Levy, T. Moeller, A. Parker, and E. Swim. Modeling control of HIV infection through structured treatment interruptions with recommendations for experimental protocol. Report 5 in Pierre A. Gremaud, Zhilin Li, Ralph C. Smith, and Hien T. Tran, editors, Center for Research in Scientific Computation at North Carolina State University Technical Report, CRSC-TR01-27, November, 2001.

### Selected Presentations

- Polynomial Accelerated Iterative Sampling of Normal Distributions*. SIAM's 7th International Congress on Industrial and Applied Mathematics, Statistics, Computations, and Inverse Problems Symposium. Vancouver, BC, Canada, July 19, 2011.
- Differences in Bacterial Transfer and Fluid Path Colonization through Needle-free Connector-Catheter Systems In Vitro*. Ryder, M., James, G., Pulcini, E. Bickle, L., Pesch, M., Parker, A. The Society for Healthcare and Epidemiology of America, Poster Session at the Annual Scientific Meeting. Dallas. April 1-4, 2011.
- A Modified CDC Biofilm Reactor to Produce Mature Biofilms on the Surface of PEEK Membranes for an In Vivo Animal Model Application*. Williams, D.L., Woodbury, K.L., Parker, A.E., and Bloebaum, R.D. Poster Session at the 110th Am. Soc. Microbiol. Gen. Meet. 2820. San Diego. May, 2010.
- Accelerating Gibbs sampling using matrix decompositions*. Workshop on Statistical Inference and Partial Differential Equations (SIPE). New Zealand Institute of Mathematics. University of Otago, Dunedin, New Zealand. January 18, 2010.
- Ruggedness Assessment and Experimental Design in the Biofilm Laboratory*. 5<sup>th</sup> American Society for Microbiology Conference on Biofilms. Standardized Biofilm Methods Workshop. Cancun, Mexico. November 15, 2009.

*Accelerated Gibbs sampling from multivariate normal distributions.* Department of Mathematical Sciences Colloquium at the University of Montana, Missoula. October 19, 2009.

*Some Statistical considerations for molecular methods.* Biofilm Science and Technology Meeting. MSU-Bozeman, July 9, 2009.

*Eye Motion Estimation and Image Dewarping using a Map Seeking Circuit.* Center for Adaptive Optics Spring Retreat, Image Processing Workshop. University of California, Santa Cruz. March 30, 2006.

*Retinal motion tracking in adaptive optics scanning laser ophthalmoscopy.* Optical Society of America Conference 2005: Signal Recovering in Adaptive Optics. Charlotte, NC, June, 2005.

*Dewarping Images from a Scanning Laser Ophthalmoscope.* Center for Adaptive Optics, SLO image processing meeting. University of California, Berkeley, April 19, 2005.

*Tracking Eye Motion from Retinal Scan Data with a Map Seeking Circuit.* Center for Adaptive Optics Fall Retreat, Controlling Eye Movements Session. UCLA Conference Center, Lake Arrowhead, CA, November 13, 2004.

*Phase Transitions in the Information Distortion.* Neural Information Processing Systems 2003 Workshop on Information Theory and Learning: The Bottleneck and Distortion Approach. Whistler, BC, Canada, December 13, 2003.

*A Bifurcation Theoretical Approach to Solving the Neural Coding Problem.* Integrated Graduate Education and Research Traineeship Symposium. Carnegie Mellon University, Pittsburgh, PA, June 28, 2003.

*Annealing and the Rate Distortion Problem.* Neural Information Processing Systems Conference, Poster Session. Vancouver, Canada, December 11, 2002.

*Continuation and Bifurcations of the Distortion Problem.* American Mathematical Society Sectional Meeting. University of Wisconsin, Madison, WI, October 13, 2002.

*Information Distortion and Neural Coding.* First SIAM Conference on the Life Sciences, Poster Session. Boston, MA, March 7, 2002.

*A Probability Model for Neural Coding.* Meeting of the Montana Chapter of the American Statistical Association. Montana Tech, Butte, MT, October 23, 2001.

*Modeling Control of HIV Infection through Structured Treatment Interruptions.* S. Kubiak, H. Lehr, R. Levy, T. Moeller, A. Parker, and E. Swim. Industrial Mathematical Modeling Workshop. North Carolina State University, Raleigh, NC, August, 2001.

## **Professional Activities**

Biostatistics, ASTM International.

Inter-laboratory study for ASTM method E2799-11 *Standard Test Method for Testing Disinfectant Efficacy against Pseudomonas aeruginosa Biofilm using the MBEC Assay.*

Inter-laboratory study for ASTM method E2149-10 *Standard Test Method for Determining the Antimicrobial Activity of Immobilized Antimicrobial Agents Under Dynamic Contact Conditions.*

Biostatistics, Garcia and Associates, Bozeman, MT.

Island Fox Monitoring and Research on Naval Auxiliary Landing Field, San Clemente Island, California, 2008-2010.

North Fork Feather River Macroinvertebrate Benthic (bottom dwelling) Study, 2003-2004.

Frog Movement and Breeding Study on the North Fork Feather River, 2005.

Insect Drift Study on the North Fork Feather River, 2002, 2008.

Department of Education, MSU

Project Evaluator, National Science Foundation Mathematics and Science Partnership: Gallatin to Glacier Middle Grades Mathematics Project, a collaboration between Bozeman, Browning and Gallatin County School Districts, 2006-2007.

Curriculum advisor, *Brain Science, Educational Research, and Teaching*, a graduate course in the Northern Plains Transition-to-Teaching Program, 2004.

Other Projects:

Business intelligence, eBags, 2010-2011.

Monforton School District impact fee initiative, 2008.

*Estimating Biomass Using Synthetic Aperture Radar (SAR) Measurements* with the Yellowstone Ecological Research Center, 2005-2006.

Industrial Mathematical Modelling Workshop, North Carolina State University, 2001.

Undergraduate Research Assistant, Department of Mathematics, Dartmouth College, 1994 – 1995.

Reviewed papers for:

*Biofouling*, The Journal of Bioadhesion and Biofilm Research

CRC Press

*Entropy*

*IET Systems Biology*

Administrative Committees:

Executive Committee, Adjunct Faculty Representative, Department of Mathematical Sciences, MSU, September 2008 - May 2009.

Graduate Program Committee, Graduate Student Representative, Department of Mathematical Sciences, MSU, September 2001 – May 2003.

PhD Committees:

James Moberly, *Microbial Communities: the effect of environmental variables and operationally dened toxic heavy metal phases*. Department of Chemical and Biological Engineering, MSU. February, 2010.

Markus Dieser, *Ecosystem Dynamics And Temporal Variations In A Microbially Dominated, Coastal Antarctic Lake*. Department of Ecology and Environmental Sciences, MSU. 2007-2008, graduated December, 2009.

Rachael Welder, *Preservice Elementary Teachers' Mathematical Content Knowledge of Prerequisite Algebra Concepts*. Department of Mathematical Sciences, MSU. March, 2007.

Theses consulted on:

*Disinfection susceptibilities of detached biofilm clusters compared to planktonic cells and biofilms in single species and dual species cultures*, Sabrina Behnke's PhD thesis, Microbiology, Montana State University, June 2011.

*Analysis of microbial biofilm community composition within constructed wetlands*, Jennifer Faulwetter's PhD thesis, Microbiology, Montana State University, November 2010.

*The detection, characterization and cultivation of nonculturable Helicobacter pylori*, Crystal Richard's PhD thesis, Microbiology, Montana State University, October 2010.

*Robust parameter estimation in Electrical Capacitance Tomography using Markov Chain Monte Carlo sampling*, Christian Schwarzl's M.S. thesis, Institute of Electrical Measurement and Measurement Signal Processing, Graz University of Technology, 2007.

*Cliff and Alpine Ecology in the Greater Yellowstone Ecosystem*, Ken Aho's Ph.D. thesis, LRES, MSU, 2006.

*Arbuscular mycorrhizae in Yellowstone National Park thermal soils: host plant, fungal inoculum, soil pH, and elevated temperature effects on symbiosis function*, Rebecca Bunn's Ph.D. thesis, LRES, MSU, 2004.

*Constructing wetlands as a mitigation tool for saline-sodic product water disposal in semi-arid environments*, Megan Bourbeau's M.S. thesis, LRES, MSU, 2004.

*Wet avalanche meteorology at Bridger Bowl*, Jeanette Romig's M.S. thesis, LRES, MSU, 2003.

Participant, Integrated Graduate Education and Research Trainee-ship Program, National Science Foundation, 1999-2003.

### Community Activities

Sensei, Ash's Okinawan Karate, 2010-2011.

Volunteer, Gallatin Valley Bike Club, 2009-2011.

Volunteer, Montana Wilderness Association, 2009-2011.

Volunteer, Gallatin Valley Land Trust, 2010-2011.

Into the Streets, MSU Volunteer Fair, 2008-2010.

Gallatin County Search and Rescue, 2008-2009.

Judge, Original Oratory at the Montana District National Forensic Tournament, February 11-12, 2011; Policy Debate, Jan 14-17, 2009.

Gallatin County Election Judge, Bozeman Precinct 35, 2006.

Mentor, Student-Athlete Mentoring Program, Department of Athletics, MSU, 2004-2006.

*Your Brain, Crickets, and Math*. An invited talk for 4<sup>th</sup> and 5<sup>th</sup> graders at Longfellow Elementary School, Bozeman, MT, May, 2004.

*Gottfried Leibniz, Carl Gauss and Neural Coding.* An invited talk for German students at Bozeman High School, Bozeman, MT, May 9, 2002.

Event Judge, Montana Science Olympiad for middle schoolers, Bozeman Public Schools, 2000–2002.

Shadowee, Job Shadow Program, Turner Youth Development Initiative in cooperation with Bozeman Public Schools, March, 2001.