

BRUCE KENT GALE

Assistant Professor of Mechanical Engineering, University of Utah
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Education

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| September, 1995 to August, 1999 | PH.D. IN BIOENGINEERING University of Utah Major Subjects: Microelectromechanical Systems (BioMEMS), Analytical Biosensors, VLSI Fabrication, Microfluidics, Cell and Tissue Engineering Dissertation Chair: A. Bruno Frazier | SEPTEMBER 1999 Salt Lake City, UT |
| September, 1990 to June, 1991 and January, 1994 to August, 1995 | B.S. IN MECHANICAL ENGINEERING Brigham Young University Major Subjects: Control Systems, Robotics, Compliant Mechanisms | AUGUST 1995 Provo, UT |

Academic Appointments

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| July 2004 to present | Director , Utah State Center of Excellence for Biomedical Microfluidics. Supervise, direct, and perform research on biomedical microdevices important to the economy of the state of Utah. |
| October 2003, - present | Adjunct Assistant Professor , Materials Science, University of Utah |
| September 2003 – present | Adjunct Assistant Professor , Electrical and Computer Engineering, University of Utah |
| February 2002 – present | Adjunct Assistant Professor , Bioengineering, University of Utah |
| December 2001 to present | Assistant Professor , Mechanical Engineering, University of Utah. Teach classes in Mechanical Engineering, advise students, and perform research involving MEMS devices and their applications to in microfluidics and sensing. |
| August, 1999 to December 2001 | Assistant Professor , Biomedical Engineering, Louisiana Tech University. Teach classes in Biomedical Engineering, advise students, and perform research involving MEMS devices and their applications to biology and medicine. |
| September, 1995 to August, 1999 | Graduate Research Assistant , Micro Instrumentation Research Laboratory and Center for Biopolymers at Interfaces, University of Utah. |

Teaching Experience

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| Fall 2002, 2003, 2004 | <u>Instructor</u> , ME EN 2400 & 2410 Dynamics, University of Utah (4 h) |
| Spring 2002 and 2003 | <u>Instructor</u> , ME EN 5960 & 6960, EL EN 5221 and 6221, BIOEN 6421 Introduction to Micromachining, University of Utah (3 h) |
| Fall 2001 | <u>Instructor</u> , MSE 501 Microsystems Principles, Louisiana Tech (3 h) (67 students) |
| Winter 2000-2001 | <u>Instructor</u> , BIEN 550C Biomedical Microsystems, Louisiana Tech (3 h) |
| Spring 2000 and 2001 | <u>Instructor</u> , BIEN 420 Biomaterials and Biomechanics, Louisiana Tech (3 h) |
| Winter 1999-2000 | <u>Instructor</u> , BIEN 515 Biosensors and Their Applications, Louisiana Tech (3 h) |
| Fall 1999 and 2000 | <u>Instructor</u> , BIEN 500 Physiology for Engineers, Louisiana Tech, (4 h) |
| Fall 1998 | <u>Co-Instructor</u> , BE 6900 & EE 6960: Micromachined Instrumentation Systems University of Utah. (3 h) |

Honors and Awards

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| April, 2004 | Nominated for Student Choice Teaching Award |
| September 2001 | Louisiana Tech College of Engineering Outstanding Researcher Award |
| 1996-1999 | NSF Graduate Research Fellowship |
| March 1996 | Awarded Whitaker Foundation Graduate Research Fellowship |
| 1995-1996 | Whitaker Foundation Biobased Engineering Internship |

Proposal and Research Activities

Currently Funded Research

Utah State Center of Excellence for Biomedical Microfluidics, DCED, PI, \$750,000, July 1, 2004 – June 30, 2009.

High Resolution Laser Micromachining System, U of U RIF, PI, \$35,000, July 1, 2004 – June 30, 2005.

Pressure Compensation in Micropumps, Ceramtec, co-PI, \$5,000, June 1, 2004 – May 31, 2005.

Viscous Microscale Pump, University of Utah TTO – TCP Program, co-PI, \$70,000, July 1, 2003 – June 30, 2005.

A Graduate Training Program in Micro Thermal Fluids, NSF-IGERT, Investigator, \$3,500,000, August 1, 2000 – July 30, 2005.

Completed Projects

Planning Grant for Center of Excellence in Biomedical Microfluidics, State COEP, \$5,000, November, 2003 – February, 2004, PI.

University TA, U of U, \$11,000, August, 2003 – May, 2004, co-PI.

High Throughput Nanoparticle Separations Using Highly Parallel Electrical SPLITT Technology, University of Utah TTO – TCP Program, PI, \$70,000, July 1, 2002 – June 30, 2004.

Microstructures for Directed Smooth Muscle Cell Growth, Louisiana Board of Regents RCS Program, PI, \$130,500, July 1, 2001- June 30, 2004.

One-Two Three Go: A Strategic Initiative for Rapid Research Competitiveness in Microsystems Development (Salary and Research Enhancements), Louisiana BoR DEFE Program, co-PI, \$910,000, Jun 2000 - May 2005.

Louisiana EPSCoR Research Infrastructure Improvement Award, NSF EPSCoR and Louisiana BoR, \$13,500,000 (\$2,850,000 under my direction), co-PI (coordinate activities of 12 investigators at seven research institutions and interface with other PIs), June 1, 2001- May 31, 2004.

Microfabricated Electrical Field Flow Fractionation Systems for Detection of Biowarfare Agents, United Engineering Foundation, PI, \$25,000, January 2001 – December 2001.

Microstructures for Directed Cardiac Muscle Cell Growth, Rockefeller Brothers Foundation, PI, \$25,000, January 1, 2001-December 31, 2001.

Biosensor Array, Los Alamos National Lab, PI, \$16,053, May 1, 2001- July 15, 2001.

Optical Devices using X-ray Lithography, 3M Corporation, \$70,000, co-PI, Sep 2000 - Mar 2001

Scholarly Activities and Publications

Submitted Journal Articles

1. Danny Blanchard, Phil Ligrani, and Bruce Gale, "Single-Disk and Double-Disk Viscous Micropumps," *Sensors and Actuators*, submitted. (Likely publication date June 2005)
2. Danny Blanchard, Phil Ligrani, Bruce Gale, and Ian Harvey, "Micro-Structure Mechanical Failure Characterization Using Rotating Couette Flow in a Small Gap," *Journal of Micromechanics and Microengineering*, submitted. (Likely publication date May, 2005)
3. Andrew M. Christensen, David A. Chang-Yen, and Bruce K. Gale, "Characterization Of Interconnects Used In PDMS Micro Fluidic Systems," *Journal of Micromechanics and Microengineering*, submitted. (Likely publication date April 2005)
4. Himanshu J. Sant and Bruce K. Gale, "Improved Models of Geometric Scaling Effects in Field Flow Fractionation," *Journal of Separation Science*, submitted. (Likely publication date Feb 2005)
5. Merugu Srinivas and Bruce K. Gale, "Cyclical Electrical Field Flow Fractionation", *Electrophoresis*, submitted. (Likely publication date Feb 2005)
6. Danny Blanchard, Phil Ligrani, and Bruce Gale, "Performance and Development of a Miniature Rotary Shaft Pump (RSP)," *Journal of Fluids Engineering*, submitted. (Likely publication date January, 2005)
7. D. A. Chang-Yen, R. Eich, Member, and B. K. Gale, "A Monolithic PDMS Waveguide System Fabricated Using Soft-Lithography Techniques," *IEEE Journal of Lightwave Technology*, submitted. (Likely publication date January, 2005).

Published Journal Articles

1. David A. Chang-Yen and Bruce K. Gale, "An Integrated Optical Oxygen Sensor Fabricated Using Rapid-Prototyping Techniques," *Lab on a Chip*, Vol. 3, pp. 297-301, 2003.
2. Ameya S. Katak, Bruce K. Gale, Yuri Lvov, Steven A. Jones, "Shear Activation of Platelets in Microchannels," *Biomedical Microdevices*, Vol. 5, pp. 207-215, September, 2003.
3. David A. Chang-yen, Yuri Lvov, Michael McShane, and Bruce K. Gale, "Electrostatic Self-Assembly Of A Ruthenium-Based Oxygen Sensitive Dye Using Polyion-Dye Interpolyelectrolyte Formation", *Sensors and Actuators, B: Chemical*, Vol. 87, No. 2, pp. 346-355, December 10, 2002.
4. Bruce K. Gale, "BioMEMS Education at Louisiana Tech University," *Journal of Biomedical Microdevices*, Vol. 4, pp. 223-230, July, 2002.
5. Bruce K. Gale, Karin D. Caldwell, and A. Bruno Frazier, "Geometric Scaling Effects in Electrical Field-Flow Fractionation. 2. Experimental Verification," *Analytical Chemistry*, Vol. 74, No. 5, pp. 1024-1030, March 1, 2002.
6. Thayne Edwards, Bruce K. Gale, and A. Bruno Frazier, "A Microfabricated Thermal Field Flow Fractionation System", *Anal. Chem.*, Vol. 74, No 6, pp. 1211-1216, March 15, 2002.
7. Thayne Edwards, Bruce K. Gale, and A. Bruno Frazier, "Micro Scale Sample Preparation Systems for Biological Analysis", *Journal of Biomedical MicroDevices*, Vol. 3, No. 3, pp. 211-218, 2001.

8. Bruce K. Gale, Karin D. Caldwell, and A. Bruno Frazier, "Geometric Scaling Effects in Electrical Field-Flow Fractionation. 1. Theoretical Analysis," *Analytical Chemistry*, Vol. 73, No. 10, pp.2345-2352, May 15, 2001.
9. Bruno Frazier, Karin D. Caldwell, Bruce K. Gale, and Ian Papautsky, "Integrated micromachined components for biological analysis systems," *Journal of Micromechatronics*, Vol. 1, No. 1, pp. 67-84, 2000
10. Bruce K. Gale, Karin D. Caldwell, and A. Bruno Frazier, "A Micromachined Electrical Field- Flow Fractionation System," *IEEE Tran. on Biomedical Engineering*, Vol. 45, No. 12, pp. 1459-1469, December 1998.

Invited Conference Papers

1. Bruce K. Gale, "Nanoscale Field Flow Fractionation," in Proc. 226th ACS National Meeting, Anaheim, CA, March 27-April 1, 2004.
2. Bruce K. Gale, "Novel Techniques and Instruments for Field Flow Fractionation of Biological Materials ," in Proc. 225th ACS National Meeting, New Orleans, LA, March 23-27, 2003.
3. Bruce K. Gale, David Chang-yen, Yuri Lvov, and Michael J. McShane, "Novel Optically-based Oxygen Sensor Fabricated Using a Combination of Microfabrication and Nanotechnology Techniques", in *Proc. Second Annual BioMEMS and Biomedical Nanotechnology World 2001 conference*, Columbus, OH, September 22-25, 2001.
4. Bruce K Gale, Himanshu J Sant, Avinsh Saldanha, Meregu Srinivas, Mahesh Thoppil, "Microfabricated Field Flow Fractionation Systems," in *Proc. of the Second Annual Louisiana Microsystems and Materials Conference*, Baton Rouge, LA, August 20-22, 2001.
5. Mengyan Li, John D. Glawe, Heather Green, David K. Mills, Michael J. McShane, Bruce K. Gale. "Microfabricated Substrates for Tissue Engineering," in *Proc. of the Nineteenth Annual Houston Conference on Biomedical Engineering Research*, Houston, TX, February 8-9, 2001.
6. Bruce K. Gale, "Scaling Effects in Microchromatography Systems", in *Proc. Southeast/Southwest Regional ACS Conference*, New Orleans, LA, December 6-8, 2000.
7. Bruce K. Gale, Ian Papautsky, John Brazzle, Ronald S. Besser, and A. Bruno Frazier, "Packaging for Biomedical Analysis Systems," in *Proc. Advanced Technology Workshop (ATW) for MEMS and Microsystem Packaging and Integration*, Orlando, FL, November 10-12, 2000.
11. Bruno Frazier, Thayne L. Edwards, and Bruce K. Gale, "Micro Scale Purification Systems for Biological Sample Preparation", in *Proc. of 198th Meeting of the Electrochemical Society: Microfabricated Systems and MEMS V*, Phoenix, AZ, October 22-27, 2000.
12. Charles J. Robinson, Stan A. Napper, Bruce K. Gale, Michael J. McShane, "Rehabilitative Biomicrosystems", in *Proc. 1st Annual International IEEE-EMBS Special Topic Conference on Microtechnologies in Medicine and Biology*, Lyon, France, October 12-14, 2000, pp. 547-551.
13. Bruce K. Gale, Karin Caldwell, and A. Bruno Frazier, "Blood and Protein Separations Using a Micromachined Electrical Field-flow Fractionation System," in *Proc. of the First Annual Louisiana Microsystems Conference*, Ruston, LA, April 5, 2000.

14. Bruno Frazier, John Brazzle, Bruce K. Gale, and Ian Papautsky, "Miniaturized Devices for Bio/Chemical Sample Preparation," in *Proc. International Device Research Symposium 1999*, Charlottesville, VA, Dec. 1-2, 1999.
15. Bruno Frazier, Ian Papautsky, Thayne Edwards, and Bruce K. Gale, "Integrated Sample Preparation Systems for Miniaturized Biochemical Analysis," in *Proc. International Symposium on Mechatronics and Human Science (MHS '99)*, Nagoya, Japan, Nov. 23-26, 1999.
16. Bruno Frazier, John D. Brazzle, Bruce K. Gale, and Ian Papautsky, "Packaging for Microfluidic Systems," in *Proc. of Interpack '99*, Lahaina, Hawaii, June 13-18, 1999.
17. Bruno Frazier, Bruce K. Gale, and Ian Papautsky, "Micromachined metallic pipettes and bioanalysis systems," in *Proc. International Symposium on Mechatronics and Human Science (MHS '97)*, Nagoya, Japan, Oct. 5-8, pp. 5-12, 1997.

Reviewed Conference Papers

1. David A. Chang-yen and Bruce K. Gale, "PDMS microfluidic spotter for fabrication of protein chips and micro-arrays," to be published in *Proc. Of SPIE: Microfluidics, BioMEMS, and Medical Microsystems III*, San Jose, CA, January 22-27, 2005
2. Laurian Escalanti, James E. Metherall, and Bruce K. Gale, "Colorimetric Assay In a Miniature Device With Application To Screening for Smith-Lemli-Optiz Syndrome," to be published in *Proc. Of SPIE: Microfluidics, BioMEMS, and Medical Microsystems III*, San Jose, CA, January 22-27, 2005
3. Danny Blanchard, Phil Ligrani, and Bruce Gale, "Single-Disk and Double-Disk Viscous Micropumps," to be published in *Proceedings of IMECE2004, November 13-19, 2004, Anaheim, California USA*.
4. Danny Blanchard, Phil Ligrani, and Bruce Gale, "Performance and Development of a Miniature Rotary Shaft Pump (RSP)," to be published in *Proceedings of IMECE2004, November 13-19, 2004, Anaheim, California USA*.
5. Tim Ameel, Bruce Gale, and Ian Harvey, "A Three-semester Interdisciplinary Educational Program in Microsystems Engineering," in *Proc. Of 2004 ASEE International Conference and Exposition*, Salt Lake City, Utah, June 20-24, 2004.
6. David A. Chang-yen and Bruce K. Gale, "Integrated optical glucose sensor fabricated using PDMS waveguides on a PDMS substrate," *Proc. Of SPIE: Microfluidics, BioMEMS, and Medical Microsystems II*, San Jose, CA, Vol. 5345, January 25-27, 2004, pp. 98-107.
7. Himanshu J. Sant and Bruce K. Gale, "Flexible coupling of a waveguide detector with a microscale field flow fractionation device," *Proc. Of SPIE: Microfluidics, BioMEMS, and Medical Microsystems II*, San Jose, CA, Vol. 5345, January 25-27, 2004, pp. 250-257.
8. Himanshu J. Sant, Bruce K. Gale, "An Integrated Optical Detector For Microfabricated Electrical Field Flow Fractionation System," in *Proc. of MicroTAS 2003*, Squaw Valley, California, October 5-9, 2003.
9. Ameya S Kantak, Srinivas Merugu, Bruce K Gale, "Microfabricated Cyclical Electrical Field Flow Fractionation," in *Proc. of MicroTAS 2003*, Squaw Valley, California, October 5-9, 2003.
10. Srinivas Merugu, Nithin Narayanan and Bruce K. Gale, "High Throughput Separations Using A Microfabricated Serial Electric SPLITT System," in *Proc. of MicroTAS 2003*, Squaw Valley, California, October 5-9, 2003.

11. Jung Woo Kim, Himanshu J Sant and Bruce K Gale, "Reduction of Microfluidic End Effects In Micro-Field Flow Fractionation Channels," in Proc. of MicroTAS 2003, Squaw Valley, California, October 5-9, 2003.
12. David A. Chang-yen and Bruce K. Gale, "An Integrated Optical Biochemical Sensor Fabricated Using Rapid-Prototyping Techniques," in Proc. of SPIE: Microfluidics, BioMEMS, and Medical Microsystems, San Jose, CA, Vol. 4982, January 27-29, 2003, pp. 185-195.
13. Avinash Saldanha and Bruce K. Gale, "Viral Separations Using a Microfabricated Electrical Field Flow Fractionation System," *Proc. Of Micro Total Analysis Systems 2002*, Nara, Japan, Nov. 3-7, 2002.
14. Ameya Kantak, Bruce Gale, Yuri Lvov, Steven Jones, "Microfluidic Platelet Function Analyzer For Shear-induced Platelet Activation Studies," in *Proc. Of IEEE-MMB 2002*, Madison, WI, May 2-4, 2002, pp. 169-173.
15. Mengyan Li, Hua Ai, David K. Mills, Yuri M. Lvov, Michael J. McShane, Bruce K Gale, "Using Microfabrication and Electrostatic Layer-by-layer (LbL) Self-Assembly Technologies to Improve the Growth and Alignment of Smooth Muscle Cells," in *Proc. of IEEE-MMB 2002*, Madison, WI, May 2-4, 2002, pp. 109-114.
16. David A. Chang-Yen and Bruce K. Gale, "A Novel Integrated Optical Dissolved Oxygen Sensor For Cell Culture And Micro Total Analysis Systems," in *Proc. MEMS 2002*, Las Vegas, Nevada, January 20-24, 2002, pp. 574-577.
17. Himanshu J. Sant and Bruce K. Gale, "A Microfabricated Thermal Electric Field Flow Fractionation System," in *Proc. of MicroTAS 2001*, Monterrey, California, October 21-25, 2001.
18. Mengyan Li, John D. Glawe, David K. Mills, Michael J. McShane, Bruce K. Gale. "Effect of High Aspect Ratio Microstructures on Cell Growth and Attachment, to be presented at *IEEE Special Topics Conference on Microtechnology in Medicine*, Lyon, France, October 12-14, 2000.
19. Bruce K. Gale, Karin D. Caldwell, and A. Bruno Frazier, "Blood and Protein Separations Using a Micromachined Electrical Field- Flow Fractionation System," in *Proc. of MicroTAS 2000*, Enschede, Netherlands, May 14-18, 2000, pp. 399-402.
20. Bruce K. Gale, Karin D. Caldwell, and A. Bruno Frazier, "Scaling Effects in a Micromachined Electrical Field - Flow Fractionation System," in *Proc. of 1999 First Joint BMES/EMBS Conference*, Atlanta, GA, October 13-16, 1999, pp.842.
21. Thayne L. Edwards, Bruce K. Gale, and A. Bruno Frazier, "Miniaturized Thermal Field-Flow Fractionation System" in *Proc. of 1999 First Joint BMES/EMBS Conference*, Atlanta, GA, October 13-16, 1999, pp. 848.
22. Bruce K. Gale and A. Bruno Frazier, "Electrical Impedance Spectroscopy Particle Detector for Use in Microanalysis Systems," in *Proc. SPIE Symposium on Micromachining and Microfabrication: Micro Fluidic Devices and Systems*, Santa Clara, CA, Sep. 20-21, 1999, 190-201.
23. Ian Papautsky, Bruce K. Gale, Swomitra Mohanty, Tim A. Ameel, and A. Bruno Frazier, "Effects of rectangular microchannel aspect ratio on laminar friction constant," in *Proc. SPIE Symposium on Micromachining and Microfabrication: MicroFluidic Devices and Systems*, Santa Clara, CA, Sep. 20-21, 1999, pp. 147-158.

24. Thayne L. Edwards, Bruce K. Gale, and A. Bruno Frazier, "A Micromachined Thermal Field- Flow Fractionation System, in *Proc. of Transducers '99*, 1999 International Conference on Solid-State Sensors and Actuators, Sendai, Japan, June 7-11, 1999.
25. Bruce K. Gale, Karin D. Caldwell, and A. Bruno Frazier, "Electrical Conductivity Particle Detector for Use in Biological and Chemical Micro-analysis Systems," in *Proc. SPIE Symposium on Micromachining and Microfabrication: Micro Fluidic Devices and Systems*, Santa Clara, CA, Sep. 21-24, pp. 230-242, 1998.
26. Bruce K. Gale, Karin D. Caldwell, and A. Bruno Frazier, "Characterization of a Micromachined Electrical Field- Flow Fractionation System," in *Proc. of the Solid-State Sensor and Actuator Workshop*, Hilton Head, SC, June 8-11, pp. 342-345, 1998.
27. Bruce K. Gale, A. Bruno Frazier, and Karin D. Caldwell, "A Micromachined Electrical Field- Flow Fractionation System," in *Proc. 10th IEEE International Workshop on Micro Electro Mechanical Systems (MEMS '97)*, Nagoya, Japan, Jan. 26-30, pp. 317-322, 1997. (14.5% acceptance rate for oral)

Conference Papers and Abstracts

1. Ameya Kantak and Bruce K. Gale, "Microscale Cyclical Electrical Field Flow Fractionation," in Proc. Of the 11th International Symposium on Field Flow Fractionation, Cleveland, OH, October 7-10, 2003.
2. Himanshu Sant and Bruce K. Gale, "Optical Detectors for Miniaturized FFF Systems," in Proc. Of the 11th International Symposium on Field Flow Fractionation, Cleveland, OH, October 7-10, 2003.
3. Srinivas Merugu, Nithin Narayanan, and Bruce K. Gale, "Microscale Serial SPLITT Systems," in Proc. Of the 11th International Symposium on Field Flow Fractionation, Cleveland, OH, October 7-10, 2003.
4. Siddharth Chakravarthy and Bruce K. Gale, "PolyPIPosome Characterization using a Combination of Normal and Cyclical Electrical Field Flow Fractionation," in Proc. Of the 11th International Symposium on Field Flow Fractionation, Cleveland, OH, October 7-10, 2003.
5. Meregu Srinivas and Bruce K. Gale, "Cyclical Electrical Field Flow Fractionation," in Proc. Of the 10th International Symposium on Field Flow Fractionation, Amsterdam, Netherlands, July 2-5, 2002.
6. Himanshu J. Sant and Bruce K. Gale, "A Microfabricated Thermal Electric Field Flow Fractionation System," in Proc. Of the 10th International Symposium on Field Flow Fractionation, Amsterdam, Netherlands, July 2-5, 2002.
7. Avinash Saldanha and Bruce K. Gale, "Microfabricated Electrical SPLITT System," in Proc. of the 10th International Symposium on Field Flow Fractionation, Amsterdam, Netherlands, July 2-5, 2002.
8. Sreenivas Rao, Himanshu Sant, and Bruce K. Gale, "Minimization of End Effects in Field Flow Fractionation," in Proc. Of the 10th International Symposium on Field Flow Fractionation, Amsterdam, Netherlands, July 2-5, 2002.
9. Charles J Robinson, K Briski, B Choi, PD Coppola, T-H Cui, A Dunn, T Ehsan, Bruce K Gale, W Green, AM Hollister, A Jawahar, HF Ji, S Jones, Y Lvov, M McShane, D Mills, J Patterson, S Patton, H Price, S Roerig, M Sahin, R Schubert, W Simms, K Varahramyan, "The Newlane Consortium (Neural Engineering With Louisiana North Excellence) Building Newlanes To Record And Restore Neural Function," in Proc. of Third Rehabilitation Research and Development Conference: Rehabilitation Research for the Twenty-First Century: The New Challenges, Arlington, VA, February 10-12, 2002.

10. Mengyan Li, Hua Ai, David K. Mills, Yuri M. Lvov, Bruce K. Gale, "Increasing the Alignment of Smooth Muscle Cells by 100 mm Channels with Micro- and Nano- Technology," in *Proc. of IBE 2002 International Meeting: Interfacing Biology and Engineering*, Baton Rouge, LA, January 18-20, 2002
11. John Glawe, David Mills, and Bruce K. Gale, "Analysis of Cell Organization in a Smooth Muscle Culture Grown On High Aspect Ratio Microstructures," in *Proc. of IUVSTA 15th International Vacuum Congress (IVC-15), AVS 48th International Symposium (AVS-48), 11th International Conference on Solid Surfaces (ICSS-11)*, San Francisco, CA, October 28 - November 2, 2001.
12. Ameya Kantak, Himanshu Sant, Bruce K. Gale, David K. Mills, Yuri Lvov, and Steve Jones, "A Microfabricated Platelet Analyzer," in *Proc. Smalltalk 2001*, San Diego, CA, August 27-31, 2001.
13. Himanshu J. Sant and Bruce K. Gale, "Improved Scaling Models for Electrical and General Field Flow Fractionation Systems," in *Proc. 9th International Symposium on Field- Flow Fractionation*, Boulder, CO, June 26-29, 2001.
14. Avinash Saldanha and Bruce K. Gale, "A Microfabricated Electrical SPLITT System," in *Proc. 9th International Symposium on Field- Flow Fractionation*, Boulder, CO, June 26-29, 2001.
15. Bruce K. Gale and Mahesh Thoppil, "A Microfabricated Cyclical Electrical Field Flow Fractionation System," in *Proc. 9th International Symposium on Field- Flow Fractionation*, Boulder, CO, June 26-29, 2001.
16. Bruce K. Gale, "Microfabricated FFF and SPLITT Systems," in *Proc. Tex MEMS III*, Dallas, TX, June 7, 2001.
17. Himanshu J. Sant and Bruce K. Gale, "Improved Models for Geometric Scaling in Field- Flow Fractionation," in *Proc. of the Nineteenth Annual Houston Conference on Biomedical Engineering Research*, Houston, TX, February 8-9, 2001.
18. Bruce K. Gale, Karin D. Caldwell, and A. Bruno Frazier, "Blood and Protein Separations Using a Micromachined Electrical Field- Flow Fractionation System," in *Proc. of the Eighteenth Annual Houston Conference on Biomedical Engineering Research*, Houston, TX, Feb 10-11, 2000.
19. Bruce K. Gale, Karin D. Caldwell, and A. Bruno Frazier, "Scaling Effects in a Micromachined Electrical Field Flow Fractionation System," in *Proc. 8th International Symposium on Field- Flow Fractionation*, Paris, France, Sep. 6-8, 1999.
20. Bruce K. Gale, Karin D. Caldwell, and A. Bruno Frazier, "Characterization of a Micromachined Electrical Field- Flow Fractionation System," in *Proc. 7th International Symposium on Field-flow Fractionation*, Salt Lake City, UT, Feb. 8-11, 1998.
21. Bruno Frazier, Karin Caldwell, Tim Ameel, Bruce K. Gale, and Ian Papautsky, "Micro scale fluid analysis systems: applications and engineering issues," in *Proc. 7th International Symposium on Field-flow Fractionation*, Salt Lake City, UT, Feb. 8-11, 1998.

Invited Workshop Presentations

1. Bruce K. Gale, Ian Harvey, and Tim Ameel, "MEMS Workshop" sponsored by Korean Government, January 12-16, 2004. Full week course involving lectures and labs for 8 Professors from Korea on MEMS and MEMS education.

2. Bruce K. Gale and Michael J. McShane, "BioMEMS and Biomedical Optics," Shortcourse Sponsored by Government of Taiwan (ROC), March 6-8, 2001 (Full three days of presentations: Over 100 paid attendees).
3. Bruce K. Gale, "Advanced Bio-MEMS Techniques and Research Applications" BioMEMS workshop at Chicago 2000, the World Congress on Medical Physics and Biomedical Engineering, Chicago, IL, July 22, 2000.
4. Bruce K. Gale, "Introduction to BioMEMS," Microfabrication Short Course held with the First Annual Louisiana Microsystems Conference, Ruston, LA, April 4, 2000.
5. Bruce K. Gale, Laboratory Instruction in Microfabrication, MEMS Bootcamp, University of Utah, May 1999.

Invited Lectures

I have presented a wide variety of invited lectures at several institutions including: Arizona State University, University of Arkansas, Louisiana State University, Tulane University, New Jersey Institute of Technology, University of Missouri- Rolla, and others.

Patents

1. Patent No. 6,136,171, Micromachined Electrical Field- Flow Fractionation System, Inventors: Bruce K. Gale, A. Bruno Frazier, and Karin D. Caldwell

Provisional Patents and Patent Applications

1. Protein Spotting System
2. Rotary Shaft Pump
3. Rotary Disk Pump
4. Monolithic PDMS Waveguides in PDMS

Invention Disclosures

1. SPLITT systems in serial and parallel
2. Cyclical Thermal FFF
3. Design of Thermal FFF System
4. End Effects Reduction in FFF
5. Evanescent Waveguide Detector for Microchromatography
6. Microfabricated SPLITT Systems
7. Optical and Fluidic Integration Using PDMS
8. SPLITT systems with no splitter
9. Syringe Interface for PDMS microfluidic systems
10. Process for fabricating microneedle arrays

Service to the Department and University

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| August 2004 – present | ME Seminar Coordinator |
| January 2004 – May 2004 | URT Selection Committee |
| August 2003- August 2004 | Member of ME External Relations Committee |
| August 2003- May 2004 | Member of Design Faculty Search Committee |
| August 2003 – May 2004 | IGERT Seminar Coordinator |
| August 2002- present | Member of ME Curriculum Committee |
| February 2002- present | Member of HEDCO Microfabrication Lab Executive Committee |
| January 2002- August 2003 | Member of ME Public Relations Committee |
| 1999- 2001 | Internal advisory committee for the Institute for Micromanufacturing (La Tech) |
| 1999- 2001 | Biomedical Engineering program Webmaster (La Tech) |

Service to the Academic Community

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| March 2007 | Scheduled to organize International FFF Symposium |
| January 2005 | Program committee for Microfluidics, BioMEMS, and Medical Microsystems III |
| March 2004 | Organizer of Nanoscale Separations Track at ACS National Meeting |
| April 2003 to present | NSF SBIR Panel Reviewer (4 separate panels, over 30 proposals reviewed) |
| January 2003 | Chair of BioMEMS and Nanofabrication Session at SPIE 2003 |
| May 2001 | Reviewer of research proposals for DOE |
| February 2001 | Chair of BioMEMS session at HSEMB Conference |
| November 2000 | Chair at two sessions of Advanced Technology Workshop on MEMS Packaging |
| October 1999 | Chair at several sessions of Joint BMES/EMBS Conference |
| 1997-1999 | Co-President, IEEE Engineering in Medicine and Biology Chapter, Univ. of Utah |
| October 2002-present | Reviewer for Journal of Micromechanics and Microengineering |
| | Reviewer for Journal of Measurement Science and Technology |
| | Reviewer for Electrophoresis |
| | Reviewer for Analytical Chemistry |
| | Reviewer for IEEE- Transactions on Biomedical Engineering |

Professional Affiliations

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|---------------|--|
| 2001-present | Member, American Chemical Society (ACS) |
| 2001- present | Member American Society for Engineering Education (ASEE) |
| 2000-present | Member, Institute for Microelectronics and Packaging Systems (IMAPS) |
| 1997-present | Member, Institute for Electrical and Electronics Engineers (IEEE) |
| 1997-present | Member, IEEE Engineering in Medicine and Biology Society (EMBS) |