

DAVID W. MURHAMMER

Dept. of Chemical and
Biochemical Engineering
4132 Seamans Center
The University of Iowa
Iowa City, IA 52242-1527
Phone: (319) 335-1228
FAX: (319) 335-1415
murham@engineering.uiowa.edu

Education

- 1975-79 B. S., Chemistry, Oregon State University, Corvallis, OR
- 1980-82 M. S., Chemical Engineering, Oregon State University
Project: *The Determination of the Concentration
Dependence of the Diffusion Coefficient in the Chloroform-
Nitrogen System by Gas Chromatography*
Advisor: Robert V. Mrazek
- 1984-89 Ph. D., Chemical Engineering, University of Houston
Thesis: *The Scaleup of Insect Cell Culture: Protective
Effects of Pluronic F-68*
Advisor: Charles F. Goochee

Professional Experience

- 1981-82 Teaching Assistant, Oregon State University, Department
of Chemical Engineering
- 1982-84 Research Engineer, Teledyne Wah Chang Albany, Albany, OR
- 1984-89 Research and Teaching Assistant, University of Houston,
Department of Chemical Engineering
- 1989-98 Assistant Professor, The University of Iowa, Department of
Chemical and Biochemical Engineering, Iowa City, IA
- 1998-2003 Associate Professor, The University of Iowa, Department of
Chemical and Biochemical Engineering, Iowa City, IA
- 2003-present Professor, The University of Iowa, Department of
Chemical and Biochemical Engineering, Iowa City, IA

Honors and Awards

- 1984-89 Fellowship, University of Houston
- 1990 Old Gold Summer Fellowship, The University of Iowa
- 1992-2003, 2005-present AIChE Outstanding Student Chapter Award
- 1996 AIChE Outstanding Student Chapter Advisor Award
- 1994-98 Patents and Literature Review Editor, *Applied
Biochemistry and Biotechnology*

2001	Collegiate Outstanding Teaching Award
2003-present	Associate Editor, <i>Applied Biochemistry and Biotechnology</i>
2003-2007	Editor, <i>Baculovirus and Insect Cell Expression Protocols (Methods in Molecular Biology series)</i> – April 2007 projected publication date

Professional Affiliations

1989-Present	Member, American Chemical Society
1989-Present	Member, American Institute of Chemical Engineers
1989-Present	Member, American Association for the Advancement of Science
1989-94	Member, Sigma Xi Scientific Research Honorary Society
1990-Present	Member, American Society for Engineering Education
1991-Present	Associate Member, Omega Xi Epsilon, Chemical Engineering Honor Society
1992-2001	Registered Professional Engineer in Iowa
2001-Present	Member, Society for Free Radical Biology and Medicine

RESEARCH ACTIVITIES

Research Interests

- Continuous baculovirus bioinsecticide production
- Oxidative stress in baculovirus infected insect cell culture
- Carbon dioxide inhibition of insect cell cultures
- Development of cell culture systems with improved representation of *in vivo* characteristics

Publications

Decius, J.C.; Murhammer, D.W. (1980). Absolute i.r. intensities, dipole derivatives and vibrational charge parameters in the perchlorate anion. *Spectrochimica Acta*, **36A**: 965-969.

Murhammer, D.; Davis, D.; Levenspiel, O. (1986). Shrinking core model/reaction control for a wide size distribution of solids. *Chemical Engineering Journal*, **32**: 87-91.

Murhammer, D.W.; Goochee, C.F. (1988). Scaleup of insect cell cultures: protective effects of Pluronic F-68. *Bio/Technology*, **6**: 1411-1418.

Murhammer, D.W.; Goochee, C.F. (1990). Structural features of nonionic polyglycol polymers responsible for the protective effect in sparged animal cell bioreactors. *Biotechnology Progress*, **6**: 142-148.

Murhammer, D.W.; Goochee, C.F. (1990). Sparged animal cell bioreactors: mechanism of cell damage and Pluronic F-68 protection. *Biotechnology Progress*, **6**: 391-397.

Murhammer, D.W. (1991). The use of insect cell cultures for recombinant protein synthesis: engineering aspects. *Applied Biochemistry and Biotechnology*, **31**: 283-310.

Murhammer, D.W.; Pfalzgraf, E.C. (1992). Effects of Pluronic F-68 on oxygen transport in an agitated, sparged bioreactor. *Biotechnology Techniques*, **6**: 199-202.

Pasumarthy, M.K.; Murhammer, D.W. (1994). Clonal variation in the *Spodoptera frugiperda* IPLB-SF21-AE insect cell population. *Biotechnology Progress*, **10**: 314-319.

Pasumarthy, M.K.; Murhammer, D.W. (1995). Variation in recombinant protein expression levels among clones of lepidopteran cell populations. *Enzyme and Microbial Technology*, **17**: 168-174.

Chung, H.; Arnold, M.A.; Rhiel, M.; Murhammer, D.W. (1995). Simultaneous measurement of glucose and glutamine in aqueous solutions by near infrared spectroscopy. *Applied Biochemistry and Biotechnology*, **50**: 109-125.

Rhiel, M.; Murhammer, D.W. (1995). The effect of oscillating dissolved oxygen concentrations on the metabolism of a *Spodoptera frugiperda* IPLB-Sf21-AE Clonal Isolate. *Biotechnology and Bioengineering*, **47**: 640-650.

Zhou, X.; Chung, H.; Arnold, M.A.; Rhiel, M.; Murhammer, D.W. (1995). Selective measurement of glutamine and asparagine in aqueous media by near-infrared spectroscopy. *ACS Symposium Series*, **613**: 116-132.

Matschiner, A.; Dordick, J.S.; Murhammer, D.W. (1995). Isolation of virally-infected insect cells from a population containing infected and uninfected cells. *Biotechnology Techniques*, **9**: 897-900.

Murhammer, D.W. (1996). Use of viral insecticides for pest control and production in cell culture. *Applied Biochemistry and Biotechnology*, **59**: 199-220.

Chung, H.; Arnold, M.A.; Rhiel, M.; Murhammer, D.W. (1996). Simultaneous measurements of glucose, glutamine, ammonia, lactate, and glutamate in aqueous solutions by near-infrared spectroscopy. *Applied Spectroscopy*, **50**: 270-276.

Riley, M.R.; Rhiel, M.; Zhou, X.; Arnold, M.A.; Murhammer, D.W. (1997). Simultaneous measurement of glucose and glutamine in insect cell culture media by near infrared spectroscopy. *Biotechnology and Bioengineering*, **55**: 11-15.

Rhiel, M.; Mitchell-Logean, C.M.; Murhammer, D.W. (1997). Comparison of *Trichoplusia ni* BTI-Tn-5B1-4 (High Five™) and *Spodoptera frugiperda* Sf-9 insect cell line metabolism in suspension cultures. *Biotechnology and Bioengineering*, **55**: 909-920.

Mitchell-Logean, C.M.; Murhammer, D.W. (1997). Bcl-2 expression in Sf-9 and BTI-Tn-5B1-4 insect cells: effect on recombinant protein expression and cell viability. *Biotechnology and Bioengineering*, **56**: 380-390.

Mitchell-Logean, C.M.; Murhammer, D.W. (1997). Bioreactor headspace purging reduces dissolved carbon dioxide accumulation in insect cell cultures and enhances cell growth. *Biotechnology Progress*, **13**: 875-877.

Riley, M.R.; Arnold, M.A.; Murhammer, D.W.; Walls, E.L.; DelaCruz, N. (1998). Adaptive calibration scheme for quantification of nutrients and byproducts in insect cell bioreactors by near infrared spectroscopy. *Biotechnology Progress*, **14**: 527-533.

Spear, S.K.; Rhiel, M.R.; Murhammer, D.W.; Arnold, M.A. (1998) Ammonia measurements in mammalian cell bioreactors with a diffuse reflectance-based fiberoptic ammonia sensor. *Applied Biochemistry and Biotechnology*, **75**: 175-186.

Riley, M.R.; Arnold, M.A.; Murhammer, D.W. (1998). Matrix enhanced buffer calibration procedure for multivariate calibration models with near infrared spectra. *Applied Spectroscopy*, **52**: 1339-1347.

Wolff, M.W.; Linhardt, R.J.; Murhammer, D.W. (1999). Release and preparation of intact and unreduced N-linked oligosaccharides from *Spodoptera frugiperda* Sf-9 insect cells. *Preparative Biochemistry and Biotechnology*, **29**: 1-21.

Saarinen, M.A.; Troutner, K.A.; Gladden, S.G.; Mitchell-Logean, C.M.; Murhammer, D.W. (1999). Recombinant protein synthesis in *Trichoplusia ni* BTI-Tn-5B1-4 insect cell aggregates. *Biotechnology and Bioengineering*, **63**: 612-617.

Murhammer, D.W. (1999). Pluronic Polyols, Cell Protection. Chapter in *The Encyclopedia of Bioprocess Technology: Fermentation, Biocatalysis and Bioseparation*. John Wiley & Sons, Inc., pp. 2019-2023.

Wolff, M.W.; Murhammer, D.W.; Jarvis, D.L.; Linhardt, R.J. (1999). Electrophoretic analysis of glycoprotein glycans produced by lepidopteran insect cells infected with an immediate early recombinant baculovirus encoding mammalian β 1,4-galactosyltransferase. *Glycoconjugate Journal*, **16**: 753-756.

Riley, M.R.; Arnold, M.A.; Murhammer, D.W. (2000). Effect of sample complexity on quantification of analytes in aqueous samples by near infrared spectroscopy. *Applied Spectroscopy*, **54**: 255-261.

Saarinen, M.A.; Murhammer, D.W. (2000). Culture in the rotating-wall vessel affects recombinant protein production capabilities of two insect cell lines in different manners. *In Vitro Cellular & Developmental Biology – Animal*, **36**: 362-366.

Choe, J.; Zhang, F.; Wolff, M.W.; Murhammer, D.W.; Linhardt, R.J.; Dordick, J.S. (2000). Separation of α -acid glycoprotein glycoforms using affinity-based reverse micellar extraction and separation. *Biotechnology & Bioengineering*, **70**: 484-490.

Dorathy, B. D.; Mooers, J. A.; Warren, M. M.; Mich, J. L.; Murhammer, D. W. (2001). Experiments to Demonstrate Chemical Process Safety Principles. *Chemical Engineering Education*, **35**: 36-44.

Zhang, F.; Wolff, M. W.; Williams, D.; Busch, K.; Lang, S. C.; Murhammer, D. W.; Linhardt, R. J. (2001). Affinity purification of secreted alkaline phosphatase produced by the baculovirus expression vector system. *Applied Biochemistry and Biotechnology*, **90**: 125-136.

Wang, Y.; Oberley, L. W.; Murhammer, D. W. (2001). Antioxidant defense systems of two lepidopteran insect cell lines. *Free Radical Biology & Medicine*, **30**: 1254-1262.

Wolff, M. W.; Zhang, F.; Roberg, J. J.; Caldwell, E. E. O.; Kaul, P. R.; Serrahn, J. N.; Murhammer, D. W.; Linhardt, R. J.; Weiler, J. M. (2001). Expression of C1 esterase inhibitor by the baculovirus expression vector system: preparation, purification, and characterization. *Protein Expression and Purification*, **30**: 414-421.

Wang, Y.; Oberley, L.W.; Murhammer, D.W. (2001). Evidence of oxidative stress following the viral infection of two lepidopteran insect cell lines. *Free Radical Biology & Medicine*, **31**: 1448-1455.

Rhiel, M.; Cohen, M. B.; Murhammer, D. W.; Arnold, M. A. (2002). Nondestructive near-infrared spectroscopic measurement of multiple analytes in undiluted samples of serum-based cell culture media. *Biotechnology & Bioengineering*, **77**: 73-82.

Zhang, F.; Saarinen, M.A.; Itle, L.J.; Lang, S.C.; Murhammer, D.W.; Linhardt, R.J. (2002). The effect of dissolved oxygen (DO) concentration on the glycosylation of recombinant protein produced by the insect cell-baculovirus expression system. *Biotechnology & Bioengineering*, **77**: 219-224.

Zhang, F.; Murhammer, D. W.; Linhardt, R. J. (2002). Enzyme kinetics and glycan structural characterization of secreted alkaline phosphatase prepared using the baculovirus expression vector system. *Applied Biochemistry and Biotechnology*, **101**: 197-210.

Saarinen, M.A.; Murhammer, D.W. (2003). The response of virally infected insect cells to dissolved oxygen concentration: recombinant protein production and oxidative damage. *Biotechnology & Bioengineering*, **81**: 106-114.

Winkenwerder, J.J.; Murhammer, D.W.; Reece, J.S.; Palechek, P.L.; Saarinen, M.A.; Arnold, M.A.; Cohen, M.B. (2003). Evaluating prostate cancer cell culturing methods: a comparison of cell morphologies and metabolic activity. *Oncology Reports*, **10**: 783-789.

Saarinen, M.A.; Reece, J.S.; Arnold, M.A.; Murhammer, D.W. (2003). Monitoring and controlling the dissolved oxygen (DO) concentration within the high aspect ratio vessel (HARV). *Biotechnology Progress*, **19**: 1335-1341.

Rhiel, M.H.; Cohen, M.B.; Arnold, M.A.; Murhammer, D.W. (2004). On-line monitoring of human prostate cancer cells in a perfusion rotating wall vessel by near-infrared spectroscopy. *Biotechnology and Bioengineering*, **86**: 852-861.

Arnold, M.A.; Small, G.W.; Xiang, D.; Qui, J.; Murhammer, D.W. (2004). Pure component selectivity analysis of multivariate calibration models from near infrared spectra. *Analytical Chemistry*, **76**: 2583-2590.

Wang, Y.; Oberley, L.W.; Howe, D.; Jarvis, D.L.; Chauhan, G.; Murhammer, D.W. (2004). The effect of manganese superoxide dismutase expression in baculovirus infected insect cells. *Applied Biochemistry and Biotechnology*, **119**: 181-193.

Zhang, F.; Bries, A.D.; Lang, S.C.; Wang, Q.; Murhammer, D.W.; Weiler, J.M.; Linhardt, R.J. (2004). Metabolic alteration of the N-glycan structure of a protein from patients with a heterozygous protein deficiency. *Biochimica et Biophysica Acta*, **1739**: 43-49.

Invited Presentations

Murhammer, D.W. Scale-up of insect cell cultures. *Monsanto Company*, St. Louis, MO, 1990.

Murhammer, D.W. Improved protein synthesis using insect cell culture. *Midwest Biotechnology Symposium*, Saint Paul, MN, 1990.

Murhammer, D.W. The Use of insect cell cultures for recombinant protein synthesis: engineering aspects. *Department of Chemical Engineering Seminar Series, Iowa State University*, 1992.

Murhammer, D.W. Engineering aspects of insect cell culture. *ASM Meeting*, Atlanta, GA, 1993.

Murhammer, D.W. Engineering aspects of insect cell cultures. *Fort Dodge Laboratories*, Fort Dodge, IA, 1995.

Murhammer, D.W. Applications of the baculovirus expression vector system. *Biochemistry Seminar, Northern Illinois University*, De Kalb, Illinois, 1996.

Murhammer, D.W. Developing an undergraduate chemical process safety laboratory. *ASEE Summer School For Chemical Engineering Faculty*, Snowbird, UT, 1997.

Murhammer, D.W. Effect of bcl-2 expression on the viral infection process in insect cells. *Iowa Microscopy Society Meeting*, Iowa City, IA, 1997.

Murhammer, D.W. Evaluating and counteracting oxidative stresses in virally-infected insect cells. *Chemical Engineering Seminar, Notre Dame University*, South Bend, IN, 2000.

Murhammer, D.W. Baculovirus based recombinant protein expression system. *15th Annual Conference of the Center For Biocatalysis and Bioprocessing*, Iowa City, IA, 2006.

Conference Presentation Abstracts

Murhammer, D.W. Critical literature review of the kinetics of zircon-sand chlorination and related reactions. *Pacific Northwest Metals and Minerals Conference*, 1984, Portland, OR.

Murhammer, D.W.; Goochee, C.F. The scaleup of insect cell cultures. *ACS National Meeting*, 1987, New Orleans, LA.

Murhammer, D.W.; Goochee, C.F. The protective effect of nonionic polyglycol polymers in sparged animal cell bioreactors. *AIChE Annual Meeting*, 1988, Washington, D.C.

Murhammer, D.W.; Goochee, C.F. Cell growth and product formation of an insect cell/virus expression system in sparged environments. *ACS National Meeting*, 1988, Los Angeles, CA.

Murhammer, D.W.; Passini, C.A.; Goochee, C.F. Bubble damage in sparged bioreactors: the protective effect of Pluronic polyols. *Engineering Foundation Conference: Cell Culture Engineering II*, 1989, Santa Barbara, CA.

Murhammer, D.W.; Goochee, C.F. Mechanism of the protective effect of nonionic polyglycol polymers in sparged animal cell bioreactors: chemical and physical considerations. *AICHE Annual Meeting*, 1989, San Francisco, CA.

Murhammer, D.W.; Goochee, C.F. The protection of animal cells from the adverse effects of bubble incorporation via either cavitation or vortexing. *Fall National AIChE Meeting*, 1990, Chicago, IL.

Murhammer, D.W. Improved protein synthesis using insect cell culture. *Midwest Biotechnology Symposium*, 1990, Saint Paul, MN.

Murhammer, D.W.; Pasumarthy, M.K.; Mitchell-Logean, C.M. The use of insect cell cultures for recombinant protein synthesis: engineering aspects. *Second Pan American Chemical Congress*, 1991, San Juan, Puerto Rico.

Pasumarthy, M.K.; Murhammer, D.W. Selection of cell lines for producing recombinant glycoproteins in insect cells. *ACS National Meeting*, 1992, San Francisco, CA.

Mitchell-Logean, C.M.; Murhammer, D.W. Production of fibronectin and actin by insect cells under shear stress and the effect of different media on their attachment. *ACS National Meeting*, 1992, San Francisco, CA.

Pasumarthy, M.K.; Murhammer, D.W. Clonal variations of cellular properties within the *Spodoptera frugiperda* IPLB-Sf-21AE insect cell population. *ACS National Meeting*, 1993, Denver, CO.

Murhammer, D.W. Engineering aspects of insect cell culture. *ASM meeting*, 1993, Atlanta, GA.

Pasumarthy, M.K.; Murhammer, D.W. Clonal variations of cellular properties within the *Spodoptera frugiperda* SF-21AE insect cell population. *AICHE Annual Meeting*, 1993, St. Louis, MO.

Mitchell-Logean, C.M.; Murhammer, D.W. Development of an inducible baculovirus expression system for the study of transient protein glycosylation phenomena in insect cell cultures. *AICHE Annual Meeting*, 1993, St. Louis, MO.

Mitchell-Logean, C.M.; Murhammer, D.W. Investigation of virally-infected insect cell death. *AICHE Annual Meeting*, 1994, San Francisco, CA.

Chung, H.; Rhiel, M.; Murhammer, D.W.; Arnold, M.A. Simultaneous measurement of important cell culture nutrients and waste products by NIR spectroscopy. *The Pittsburgh Conference*, 1995, New Orleans, LA.

Mitchell-Logean, C.M.; Murhammer, D.W. Cell breakdown and death of virally-infected insect cells. *Baculovirus and Insect Cell Gene Expression Conference*, 1995, Pinehurst, NC.

Rhiel, M.; Chung, H.; Zhou, X.; Arnold, M.A.; Murhammer, D.W. Determination of 18 amino acids in aqueous solution by near infrared spectroscopy. *Annual Meeting of the Iowa Academy of Sciences*, 1995, Waverly, IA.

Zhou, X.; Arnold, M.A.; Rhiel, M.; Murhammer, D.W. Simultaneous measurement of asparagine and glutamine in aqueous solutions by near infrared spectroscopy. *ACS National Meeting*, 1995, Anaheim, CA.

Rhiel, M.; Mitchell-Logean, C.M.; Murhammer, D.W. Productivity of the *Trichoplusia ni* BTI Tn-5B1-4 (High Five™) insect cell line in suspension cultures. *AIChE Annual Meeting*, 1995, Miami, FL.

Zhou, X.; Chung, H.; Arnold, M.A.; Rhiel, M.; Murhammer, D.W. Feasibility of on-line bioreactor monitoring by near infrared spectroscopy. *Federation of Analytical Chemistry and Spectroscopy Societies*, 1995, Cincinnati, OH.

Rhiel, M.; Murhammer, D.W.; Zhou, X.; Arnold, M.A. Cell culture process monitoring by NIR spectroscopy. *The Pittsburgh Conference*, 1996, Chicago, IL.

Wolff, M.W.; Park, Y.; Finn, E.F.; Linhardt, R.J.; Murhammer, D.W.; Jarvis, D.L. Determining glycan structures produced in insect cells. *AIChE Annual Meeting*, 1996, Chicago, IL.

Rhiel, M.; Riley, M.R.; Zhou, X.; Arnold, M.A.; Murhammer, D.W. Sensitivity and selectivity of near-infrared spectroscopy methods for process monitoring. *AIChE Annual Meeting*, 1996, Chicago, IL.

Rhiel, M.; Palechek, P.; Chuang, H.; Spear, S.; Arnold, M.A.; Cohen, M.B.; Murhammer, D.W. Comparison of metabolism and morphology of prostate cancer cells cultivated in tissue culture flasks and rotating wall vessel bioreactors. *AIChE Annual Meeting*, 1996, Chicago, IL.

Riley, M.R.; Rhiel, M.; Zhou, Z.; Arnold, M.A.; Murhammer, D.W. NIR spectroscopy for monitoring metabolite concentrations in insect cell bioreactors. *AIChE Annual Meeting*, 1996, Chicago, IL.

Weiler, J.M.; Roberg, J.J.; Clarke, J.M.; Mitchell-Logean, C.; Murhammer, D.W.; Serrahn, J.N.; Hanson, G.R.; Caldwell, E.E.O. Characterization of C1 inhibitor expressed by the baculovirus expression vector system. *American Association of Immunologists*, 1997, San Francisco, CA.

Murhammer, D.W.; Riley, M.R.; Rhiel, M.; Arnold, M.R.; Walls, E.L.; DelaCruz, N. Simultaneous monitoring of multiple cellular metabolites in bioreactors by near infrared spectroscopy. *ACS National Meeting*, 1997, San Francisco, CA.

Rhiel, M.; Riley, M.R.; Arnold, M.A.; Murhammer, D.W. Evaluation of near-infrared spectroscopy for bioreactor monitoring. *ACS National Meeting*, 1997, San Francisco, CA.

M. Rhiel, M. R. Riley, H. Chuang, S. Spear, P. Palechek, M. Cohen, M. Arnold, and D. Murhammer. Continuous, noninvasive monitoring of bioreactors. *ACHEMA 97*, 1997, Frankfurt, Germany

M. R. Riley, D. W. Murhammer, M. A. Arnold, E. Walls, and N. DelaCruz. An adaptive calibration scheme for NIR measurements of metabolites in insect cell bioreactor. *AIChE Annual Meeting*, 1997, Los Angeles, CA.

M. Rhiel, M. A. Arnold, and D. W. Murhammer. On-line monitoring of mammalian cell cultures with near-infrared spectroscopy. *AIChE Annual Meeting*, 1997, Los Angeles, CA.

M. Rhiel, M. A. Arnold, and D. W. Murhammer. Simultaneous monitoring of glucose, glutamine, lactate, and ammonia in prostate cancer cell cultures with near-infrared spectroscopy. *ANALYTICA 98*, 1998, Munich, Germany.

Wolff, M.W.; Linhardt, R.J.; Murhammer, D.W. Preparation and characterization of N-linked glycans with the baculovirus expression vector system. *Midwestern Medicinal Chemistry Meeting*, 1998, Chicago, IL.

Caldwell, E.E.O.; Wolff, M.W.; Kaul, P.; Serrahn, J.N.; Murhammer, D.W.; Weiler, J.M. Baculovirus expression of human complement C1 esterase inhibitor, *XVIIth International Complement Workshop*, 1998, Rhodes, Greece.

Saarinen, M.A.; Murhammer, D.W. Insect Cell Metabolism in Rotating Wall Vessels and Shaker Flasks -- a Comparison, *Institute of Biological Engineering Annual Meeting*, 1998, Orlando, FL.

Murhammer, D.W.; Oberley, L.W.; Darby, C.J.; Schlawin, K.L.; Mooers, J.A. Evaluating and counteracting oxidative stresses in virally-infected insect cells. *AICHE Annual Meeting*, 1998, Miami, FL.

Wolff, M.W.; Linhardt, R.J.; Murhammer, D.W.; Jarvis, J.L. Addition of galactosyltransferase to the insect cell N-glycosylation pathway. *AICHE Annual Meeting*, 1998, Miami, FL.

Oberley, L.W.; Saarinen, M.A.; Wang, Y.; Murhammer, D.W. Oxidative stress in virally infected insect cells. *AICHE Annual Meeting*, 1999, Dallas, TX.

Linhardt, R.J.; Wolff, M.W.; Zhang, F.; Murhammer, D.W. Modifying N-linked protein glycosylation in the *Spodoptera frugiperda* Sf-9 insect cell line. *AICHE Annual Meeting*, 1999, Dallas, TX.

Murhammer, D.W.; Wang, Y.; Oberley, L.W.; Jarvis, D.L. Evaluating and counteracting oxidative stresses in virally infected insect cells. *ACS National Meeting*, 2000, San Francisco, CA.

Saarinen, M.A.; Wang, Y.; Jarvis, D.L.; Oberley, L.W.; Murhammer, D.W. Evaluating the role of oxidative stresses in virally infected insect cells. *AICHE Annual Meeting*, 2000, Los Angeles, CA.

Linhardt, R.J.; Zhang, F.; Lang, S.C; Wang, Q.; Murhammer, D.W.; Weiler, J.M. Metabolic alteration of the N-glycan structure of C1 esterase inhibitor in patients with hereditary angioedema. *ACS National Meeting*, 2001, Chicago, IL.

Qiu, J.; Arnold, M.; Murhammer, D. Using near-infrared spectroscopy for monitoring insect cell cultures in various bioreactors. *AICHE Annual Meeting*, 2001, Reno, NV.

Zhang, F.; Murhammer, D.; Linhardt, R. Effect of dissolved oxygen concentration on protein glycosylation in insect cells. *AICHE Annual Meeting*, 2001, Reno, NV.

Rose, P.; Feiss, M.; Murhammer, D. Expression of the baculovirus 25 kD protein in infected *Spodoptera frugiperda* to overcome the few polyhedra phenotype. *AICHE Annual Meeting*, 2001, Reno, NV.

Wang, Y.; Saarinen, M.; Murhammer, D. Evaluating and counteracting oxidative stress in virally-infected insect cells. *AIChE Annual Meeting*, 2001, Reno, NV.

Murhammer, D.W.; Wang, Y. Counteracting the adverse effects of oxidative stress in baculovirus infected insect cells. *AIChE Annual Meeting*, 2002, Indianapolis, IN.

Rose, P.A.; Murhammer, D.W. Determining the role of viral FP25kD protein in the production of occluded baculovirus. *AIChE Annual Meeting*, 2002, Indianapolis, IN.

Ng, C.F.; Chen, L.D.; Murhammer, D.W.; Rodgers, V.G.J. Three dimensional mass transport modeling of dissolved gases in NASA high aspect ratio rotating wall vessel. *AIChE Annual Meeting*, 2002, Indianapolis, IN.

Rose, P.A.; Murhammer, D.W. Expression of baculovirus FP25K protein at different times during viral infection impacts polyhedra production. *AIChE Annual Meeting*, 2003, San Francisco, CA.

Chauhan, G.; Murhammer, D.W. Determining the intracellular location of reactive oxygen species in baculovirus infected insect cells. *AIChE Annual Meeting*, 2003, San Francisco, CA.

Rose, P.; Feiss, M.; Murhammer, D. Baculovirus FP25K protein expression at different times during viral infection impacts polyhedra production. *ACS National Meeting*, 2004, Anaheim, CA.

Bond, E.; Chauhan, G.; Thumser, A.; Doherty, K.; Murhammer, D. The role of oxidative stress in the baculovirus cytotoxicity of insect cells. *Society for Free Radical Biology and Medicine Meeting*, 2004, St. Thomas, Virgin Islands.

Qiu, J.; Arnold, M.; Murhammer, D. On-line simultaneous cell density, glucose and lactate monitoring of *Trichoplusia ni* BTI-Tn-5B1-4 insect cell cultures with near-infrared spectroscopy. *American Association of Pharmaceutical Scientists Annual Meeting*, 2005, Nashville, Tn.

Bond, E.; Chauhan, G.; Turner, R.; Doherty, K.; Murhammer, D. Understanding oxidative stress in baculovirus-infected insect cells. *Society for Free Radical Biology and Medicine Meeting*, 2005, Austin, TX.

Bond, Elena L.; Chauhan, Gaurav; Doherty, Kathleen; Turner, Rebecca; Murhammer, David W. Investigating the Mitochondria's Role in the Oxidative Stress of Baculovirus-Infected Cells. *AIChE Annual Meeting*, 2006, San Francisco, CA.

Giri, Lopamudra; Murhammer, David W.; Bonning, Bryony; Feiss, Mike. Towards Continuous Biopesticide Production in Insect Cell Culture: Overcoming Mutations in Fp25k Baculovirus Gene. *AIChE Annual Meeting*, 2006, San Francisco, CA.

Bond, Elena; Doherty, Kathleen; Murhammer, David. Oxidative stress in baculovirus-infected insect cells with inactive mitochondria. *Society for Free Radical Biology and Medicine Meeting*, 2006, Denver, CO.

Funded Research Grants (Federal)

Research experiences for undergraduates (REU) site, National Science Foundation, David W. Murhammer (PI) and Victor G. J. Rodgers (Co-PI), \$76,000, 6/92 - 11/94.

Adaptation of insect cells to suspension growth, National Science Foundation, David W. Murhammer (PI), \$166,254, 8/94 - 8/97 (no cost extension to 8/98).

Research experiences for undergraduates (REU) supplement for adaptation of insect cells to suspension growth, National Science Foundation, David W. Murhammer (PI), \$20,000, 2/95-8/97.

Research experiences for undergraduates (REU) site, National Science Foundation, David W. Murhammer (PI) and Victor G. J. Rodgers (Co-PI), \$163,763, 6/95 - 5/98.

Continuous, noninvasive monitoring of rotating wall vessels and application to the study of prostate cancer, NASA, David W. Murhammer (PI), Mark A. Arnold (Co-PI), and Michael B. Cohen (Co-PI), \$905,000, 8/95-8/99.

Development of an undergraduate process safety laboratory, National Science Foundation Instrumentation and Laboratory Improvement Program, David W. Murhammer (PI), \$37,427, 5/96 - 4/98 (no cost extension to 4/99).

Genetic modifications and environmental factors influencing glycoprotein processing in the baculovirus-insect cell system, National Science Foundation, David W. Murhammer (PI), Robert J. Linhardt (Co-PI), Donald L. Jarvis (Co-PI), and John Weiler (Co-PI), \$406,610, 8/98-8/00.

Evaluating oxidative stress in virally-infected cells in simulated microgravity, NASA, Victor G. J. Rodgers (PI), David W. Murhammer (Co-PI), and Larry W. Oberley (Co-PI), \$533,000, 3/1/99 – 11/31/02 (no cost extension to 11/31/03).

Monitoring and control of rotating wall vessels and application to the study of prostate cancer [renewal], NASA, David W. Murhammer (PI), Mark A. Arnold (Co-PI), and Michael B. Cohen (Co-PI), \$964,460, 8/1/99 – 11/31/02 (no cost extension to 11/31/03).

Research experiences for undergraduates (REU) supplement for Genetic modifications and environmental factors influencing glycoprotein processing in the baculovirus-insect cell system, National Science Foundation, David W. Murhammer (PI), \$10,000, 11/98-8/00.

Metabolic engineering: extending the lifespan of baculovirus infected insect cells, NIH (1 RO1 GM067932), David W. Murhammer (PI), Donald L. Jarvis (Univ. of Wyoming, Co-PI), \$620,081 (includes UW funds), 5/1/2003 – 4/30/2006 (no-cost extension to 4/30/2007).

Cost-effective production of baculovirus insecticides, EPA, David W. Murhammer (PI), Michael Feiss (Co-PI), Bryony Bonning (Iowa State Univ., Co-PI), \$320,000 (does not include ISU funds), 12/1/2003 – 11/31/2006. (no-cost extension to 11/31/2007).

Mechanism of carbon dioxide inhibition in insect cell culture, NSF, David W. Murhammer (PI), \$340,004, 7/15/2006 – 6/30/2009.

Pending Proposals (Federal)

None

Funded Research Grants (Industrial)

Production of viral insecticides in plug flow bioreactors, American Cyanamid, David W. Murhammer (PI), \$8,000, 11/94 - 11/95.

Monitoring insect cell bioreactors with near-infrared spectroscopy, American Cyanamid, David W. Murhammer (PI) and Mark A. Arnold (Co-PI), \$19,500, 8/95 - 8/96.

Developing near-infrared spectroscopy for monitoring glucose, glutamine, and other components in insect cell bioreactors, American Cyanamid, David W. Murhammer (PI) and Mark A. Arnold (Co-PI), \$19,500, 1/96-12/97.

Funded Research Grants (Internal at University of Iowa)

Hybridoma protein synthesis, including monoclonal antibody, under anoxic conditions, NIH Through Biomedical Research Support Grant Funds, David W. Murhammer (PI), \$10,000, 11/89 - 11/90.

Hybridoma protein synthesis, including monoclonal antibody, under anoxic conditions, Old Gold Summer Fellowship, David W. Murhammer (PI), \$3,500, 5/90 - 8/90.

Improving the fidelity of protein glycosylation in a baculovirus/insect cell expression system, NIH Through Biomedical Research Support Grant Funds, David W. Murhammer (PI), \$10,000, 12/90 - 12/91.

Use of cell fusion techniques to improve the protein processing capabilities of insect cells, Carver Scientific Research Initiative Grant Program, David W. Murhammer (PI), \$7,525, 1/92 - 1/93.

Expression of viral surface proteins for cancer diagnosis and therapy, American Cancer Society Institutional Research Seed Grant, David W. Murhammer (PI), \$15,000, 10/92 - 10/93.

Use of perfusion cultures to study the effect of dissolved oxygen concentration on the baculovirus/insect cell expression system, Central Investment Fund For Research Development, David W. Murhammer (PI), \$8,175, 2/93 - 7/93.

Altering protein glycosylation in insect cells, Carver Scientific Research Initiative Grant Program, David W. Murhammer (PI), \$13,000, 5/95 - 12/96.

Overcoming few polyhedra mutant accumulation in baculovirus production, Carver Scientific Research Initiative Grant Program, David W. Murhammer (PI), \$15,000, 6/2001-6/2002.

Developing cell cultures from Drosophila similans tissue, IREU, David W. Murhammer (PI), \$2,892, 3/2005-7/2006.

TEACHING ACTIVITIES

Courses Taught (Undergraduate)

1990-1996, 1998-present	Professional Seminar
1990, 1991, 1993, 1997,	
2004-present♣	*Introduction to Biochemical Engineering
1991, 1992, 1995, 1996,	
2004-2006	Process Calculations
1992, 1994, 1998	Engineering I (Discussion Sections)
1992, 1993	*Unit Operations Laboratory I

1992, 1993 *Unit Operations Laboratory II
 1993, 1994 #Freshmen Seminar
 1994-95, 1998-99, 2001-03 *Momentum Transport
 1996-2004, 2006-present #Chemical Process Safety
 2004, 2005 #Engineering Flow and Heat Exchange
 2006 (Sp & Fa); 2007 (Sp) #First-Year Seminar (Energy Future)
 *Significantly changed existing course; #New course introduced; ♣Taught as self-study course
 Fall 2006 (3 students)

Courses Taught (Graduate)

1990, 1991 *Advanced Biochemical Engineering
 1990 #Bioseparations (with Profs. Carmichael, Dordick, and Rodgers)
 1991, 1992, 1995 #Advanced Thermodynamics (with Prof. Rodgers in 1991)
 1992, 1996, 2000, 2006 #Engineering Aspects of Animal Cell Culture
 2001-03 Intermediate Chemical Reaction Kinetics
 *Significantly changed existing course; #New course introduced

Student Rating of Teaching Effectiveness (6.0 Maximum)

Spring 1990	Advanced Biochemical Engineering	5.29
Fall 1990	Introduction to Biochemical Engineering	4.61
Spring 1991	Process Calculations	5.75
Spring 1991	Advanced Biochemical Engineering	5.46
Fall 1991	Introduction to Biochemical Engineering	4.64
Spring 1992	Engineering Aspects of Animal Cell Culture	5.88
Spring 1992	Process Calculations	4.81
Fall 1992	Unit Operations Laboratory I	4.00
Spring 1993	Unit Operations Laboratory II	4.73
Fall 1993	Introduction to Biochemical Engineering	5.04
Fall 1993	Unit Operations Laboratory I	5.64
Spring 1994	Unit Operations Laboratory II	5.47
Fall 1994	Momentum Transport	4.32
Spring 1995	Momentum Transport	5.04
Fall 1995	Process Calculations	5.13
Fall 1995	Advanced Thermodynamics	5.00
Spring 1996	Chemical Process Safety	5.47
Fall 1996	Process Calculations	5.63
Spring 1997	Chemical Process Safety	4.58
Spring 1997	Engineering Aspects of Animal Cell Culture	6.00
Fall 1997	Introduction to Biochemical Engineering	4.64
Spring 1998	Momentum Transport	5.27
Spring 1998	Chemical Process Safety	5.17
Fall 1998	Engineering I Discussion	5.06/4.90
Spring 1999	Momentum Transport	5.30
Spring 1999	Chemical Process Safety	5.50
Spring 2000	Chemical Process Safety	4.90
Fall 2000	Engineering Aspects of Animal Cell Culture	5.94

Spring 2001	Momentum Transport	5.06
Spring 2001	Chemical Process Safety	5.03
Fall 2001	Intermediate Chemical Reaction Kinetics	5.50
Spring 2002	Momentum Transport	5.50
Spring 2002	Chemical Process Safety	5.58
Fall 2002	Intermediate Chemical Reaction Kinetics	5.83
Spring 2003	Momentum Transport	5.39
Spring 2003	Chemical Process Safety	5.24
Fall 2003	Intermediate Chemical Reaction Kinetics	5.82
Spring 2004	Engineering Flow and Heat Exchange	5.53
Spring 2004	Chemical Process Safety	5.42
Fall 2004	Process Calculations	5.27
Fall 2004	Introduction to Biochemical Engineering	5.63
Spring 2005	Engineering Flow and Heat Exchange	5.43
Fall 2005	Process Calculations	5.00
Fall 2005	Introduction to Biochemical Engineering	5.45
Spring 2006	Chemical Process Safety	5.57
Fall 2006	Process Calculations	5.33
Spring 2007	Chemical Process Safety	

Post Doctoral Fellows Supervised

Mark Riley	<i>Monitoring insect cell bioreactors with near-infrared spectroscopy, 1995-97.</i> Current Position: Assistant Professor, Agricultural and Biological Engineering Department, University of Arizona.
Fuming Zhang	<i>Extending the glycosylation capabilities of the Spodoptera frugiperda Sf-9 insect cell line, 1999-2001</i> Current Position: Post-Doctoral Researcher for Robert Linhardt
Jiang Qiu	<i>Monitoring insect cell bioreactors with near-infrared spectroscopy, 2000-2002.</i>

Theses and Dissertations Completed

Murali Krishna Pasumarthy	<i>Selection and development of insect cell lines for recombinant protein synthesis, Ph. D., 1994.</i> Latest Position: Principal Engineer, Baxter Biosciences.
Alexander Matschiner	<i>Development of a method for screening randomly mutated peroxidases using the baculovirus expression system, M. S., 1994.</i> Latest Position: Research Associate, Human Genome Sciences, Inc., Rockville, MD.
Christine Mitchell-Logean	<i>Effects of bcl-2 expression on insect cell viability, productivity and morphology and characterization of Sf-9 and High Five™ cell suspension cultures, Ph. D., 1997.</i> First Position: Research Scientist, Bristol-Myer Squibb, Syracuse, New York. Latest Position: Cell Culture Process Development,

Serono, Switzerland

- Martin Rhiel *Application of near-infrared spectroscopy to bioreactor monitoring*, Ph. D., 1998.
Latest Position: Process Development, Cytos Biotechnology AG, Switzerland.
- Michael Wolff *Extension of the glycoprotein processing capabilities of the lepidopteran insect cell line Spodoptera frugiperda by metabolic engineering*, Ph. D., 1999.
Latest Position: Cell Culture Process Development, Sympore, Germany
- Mark Saarinen *Effects of the culture environment of the high-aspect ratio vessel on recombinant protein production in insect cell lines*, M. S., 1999.
Latest Position: Post-Doctoral Associate at University of Colorado, Boulder
- Mark Saarinen *Effects of dissolved oxygen concentration on oxidative stress and recombinant protein production in insect cell cultures*, Ph. D., 2001.
Latest Position: Post-Doctoral Associate at University of Colorado, Boulder
- Gaurav Chauhan *Countering the adverse effect of oxidative stress in virally infected insect cells*, M.S., 2004.
Latest Position: JRH Biosciences (Lenexa, KS)
- Chin Ng *Prelude to modeling multiscale three-dimensional cell metabolic process in bioreactors*, Ph. D., 2004 (co-advised by Rodgers).
Latest Position:
- Patricia Rose *Timing and concentration of the baculovirus FP25K: effects of production of polyhedra in insect cell culture*, Ph. D., 2005.
Latest Position: Engineering at Schering Plough, New Jersey
- Sybil Hrstka *Engineering therapeutic proteins*, Ph. D., 2005 (co-advised by Linhardt).
Latest Position:

Theses and Dissertations in Progress

- Elena Bond *Overcoming oxidative stress in baculovirus infected insect cells*, Ph.D., 2009.
- Lopamudra Giri *Continuous, cost-effective baculovirus biopesticide production*, Ph.D., 2009.

Undergraduate Student Research Projects Supervised

1990-91 Jennifer Doran; Gary Machetta; Erich Pflazgraf; Denise

Munoz (4)

1991-92 Marty Moats; Shahrul Zainol; Ritu Bhatnager (3)

1992-93 Steve Ernst; Julie Muenchow; Luke Stevens; LaShawn Freeman; David Beuther (summer REU) (5)

1993-94 Joe Jacobson; Kevin Dibel; Jennifer Mayer; Karla Khuel; Barbara Griffith (summer REU); Heather Marie Carlson (summer REU) (6)

1994-95 Deborah Prendergast; Elisabeth Gustavsen; Jennifer Monroe; Claudia Melara; Ryan Taber; Joe Ehle; Robby Tanjung; Matthew Peterson; Rebekah Sawaya (summer REU); Stephanie Isaacson (summer REU) (10)

1995-96 Kimberly Troutner; Stacy Cooke; Michelle Hilary; Jason Clarke; Elisabeth Gustavsen; Robby Tanjung; Doug Carmichael; Melanie Seader (summer REU); Jamie Huynh (summer REU) (9)

1996-97 Steve Gladden; Allison Miller; Stacy Cooke; Michelle Hillary; Joshua Dorfmueller; Elisabeth Gustavsen; Jason Clarke; Jennifer Mich; John Andrew McKay (summer REU); Ana Catalina Flores (summer REU) (10)

1997-98 Kurt Schlawin; Jamisue Mooers; Jennifer Mich (3)

1998-99 Jamisue Mooers; Katie Busch; Laura Itle; Jennifer Mich; Gerald Phipps (5)

1999-2000 Laura Itle, Katie Busch, Jennifer Lahr, David Williams (4)

2000-01 Laura Itle (1)

2001-02 None

2002-03 Afton Thumser, Rebecca Turner (2)

2003-04 Afton Thumser, Ryan Daly, Rebecca Turner (3)

2004-05 Afton Thumser, Rebecca Turner, Katie Doherty, Ryan Daly, Tyler Kleene (5)

2005-06 Afton Thumser, Katie Doherty, Ryan Daly, Tyler Kleene (4)

2006-07 Katie Doherty

Pre-Teaching Internships Supervised

Spring 1991	Process Calculations	Jennifer Doran
Spring 1992	Process Calculations	Gloria Jennings
Spring 1995	Momentum Transport	Ken Kauffman
Fall 1995	Process Calculations	Jonathan Carter
Spring 1998	Momentum Transport	James Davoux
Spring 1998	Chemical Process Safety	Jennifer Foelske, Stacy Cooke
Fall and Spring 1999	Chemical Process Safety	Brian Dorathy, Jamisue Mooers
Spring 1999	Momentum Transport	Rebecca Rose
Spring 2000	Chemical Process Safety	Jennifer Mich, Matt Warren
Spring 2001	Chemical Process Safety	Laura Itle, Abby Anderegg
Spring 2001	Momentum Transport	Danielle Hillary
Spring 2002	Chemical Process Safety	Bryce Nielsen, Melissa Nippert
Spring 2003	Chemical Process Safety	John Elliff, Theresa Heckenlively
Spring 2004	Chemical Process Safety	Tracey Irwin, Erica Scheckel
Fall 2004	Process Calculations	Valerie Perrin
Spring 2006	Chemical Process Safety	Alexandra Olson, Tyler Kleene
Fall 2006	Process Calculations	William Liechty
Spring 2007	Chemical Process Safety	William Liechty, William Wortman

Advisor to Students Winning Awards

1991-92	National AIChE Scholarship	Gloria Jennings
1991-92	Design project for SWE technical writing competition, regional winner and second in national competition	Lara Thorius
1992-93	National AIChE Scholarship	Julie Muenchow
1992-93	Mid-America Regional AIChE	Steve Ernst

	Paper Contest, second place	
1993-94	National AIChE Scholarship	Lisa Hoil
1995-96	National AIChE Scholarship	William AuYeung
1995-96	Safety and Chemical Engineering Education (SACHE) essay contest, first place	Greg Levi
1995-96	Mid-America Regional AIChE Paper Contest, third place	Kimberly Troutner
1996-97	National AIChE Scholarship	Greg Levi
1996-97	SACHE Essay Contest, honorable mention	Angelica Williams
1999-00	National AIChE Scholarship	Joseph Mohr
1999-00	SACHE Essay Contest, first place	Corey Kriegermeier
2000-01	National AIChE Scholarship	Laura Itle
2000-01	SACHE Essay Contest, first place	Brad Peyton
2001-02	National AIChE Scholarship	Bryce Nielsen
2003-04	National AIChE Scholarship	Tracey Irwin
2004-05	National AIChE Scholarship	Afton Thumser
2004-05	Mid-America Regional AIChE Paper Contest, second place	Afton Thumser
2005-06	National AIChE Scholarship	Alexandra Olson
2005-06	North-Central Regional AIChE Paper Contest, second place	Kathleen Doherty
2005-06	North-Central Regional AIChE Paper Contest, third place	Tyler Kleene
2006-07	National AIChE Scholarship	Alexander Conway

Funded Teaching-Related Grants

Research experiences for undergraduates (REU) site, National Science Foundation, David W. Murhammer (PI) and Victor G. J. Rodgers (Co-PI), \$76,000, 6/92 - 11/94.

Research experiences for undergraduates (REU) supplement for adaptation of insect cells to suspension growth, National Science Foundation, David W. Murhammer (PI), \$20,000, 2/95-8/97.

Research experiences for undergraduates (REU) site, National Science Foundation, David W. Murhammer (PI) and Victor G. J. Rodgers (Co-PI), \$163,763, 6/95 - 5/98.

Development of an undergraduate chemical process safety laboratory, National Science Foundation Instrumentation and Laboratory Improvement Program, David W. Murhammer (PI), \$37,427, 5/96 - 4/98 (no cost extension to 4/99).

Research experiences for undergraduates (REU) supplement for Genetic modifications and environmental factors influencing glycoprotein processing in the baculovirus-insect cell system, National Science Foundation, David W. Murhammer (PI), \$10,000, 11/98-8/00.

Teaching-Related Meetings Attended

American Society for Engineering Education (ASEE) summer school for chemical engineering faculty (Bozeman, MT), August 1992.

Safety and Chemical Engineering Education (SACHE) Faculty Workshop regarding the characterization and control of chemical process hazards (Wyandotte, MI), May 1997.

ASEE summer school for chemical engineering faculty (Snowbird, UT), August 1997.

ABET faculty workshop for program improvement (Baltimore, MD), January 2002.

Teaching-Related Presentations

Murhammer, D.W. Development of an undergraduate chemical process safety laboratory, ASEE summer school for chemical engineering faculty (Snowbird, UT), 1997.

Teaching-Related Publications

Dorathy, B. D.; Mooers, J. A.; Warren, M. M.; Mich, J. L.; Murhammer, D. W. (2001). Experiments to Demonstrate Chemical Process Safety Principles. *Chemical Engineering Education*, **35**: 36-44.

SERVICE ACTIVITIES

Service-Related Positions Held

1990-96 and

1998-Present Advisor, Undergraduate AIChE Student Chapter, University of Iowa

1992-98

Membership Committee Chair for the Biochemical Technology Division of the American Chemical Society

1994-98

Chemical and Biochemical Engineering Representative on the executive committee of the Biocatalysis and Bioprocessing Center at the University of Iowa

1994-96	Recruitment committee chair for the Biocatalysis and Bioprocessing Center at the University of Iowa
1994-98	Patents and Literature Review Editor, <i>Applied Biochemistry and Biotechnology</i>
1996-98	Chairman of the subcommittee to formulate the 1999 AIChE National Student Chapter Competition
1998-2001	Engineering Faculty Council (Univ. of Iowa)
1998-Present	Liaison for the Mid-America Region on the Regional Conference Subcommittee of AIChE
1998-99	Second Vice-Chair, Student Chapters Committee, AIChE
1999-2000	First Vice-Chair, Student Chapters Committee, AIChE
2000-2001	Chair, Student Chapters Committee, AIChE
2000-2002	Chair, Chemical and Biochemical Engineering Department ABET Committee
2003-Present	Associate Editor, <i>Applied Biochemistry and Biotechnology</i>
2003-Present	Editor, <i>Baculovirus and Insect Cell Expression Protocols (Methods in Molecular Biology series)</i> ; target publication date: April 2007
2004-present	Member, Awards Subcommittee of AIChE Student Chapters Committee

Sessions Chaired at National Meetings

General Papers session (Biochemical Technology Division) at the ACS National Meeting, Washington, D.C., 1990.

Poster session (Biochemical Technology Division) at the ACS National Meeting, Washington, D.C., 1990.

Biochemical Engineering session at the Second Pan American Chemical Congress, San Juan, Puerto Rico, 1991.

Poster session (Biochemical Technology Division) at the Spring National ACS Meeting, San Francisco, CA, 1992.

Environmental Effects on Metabolism and Product Expression Kinetics session at the AIChE National Meeting, Miami, FL, 1992.

General Papers Session (Biochemical Technology Division) at the Spring National ACS Meeting, Denver, CO, 1993.

Prokaryotic and Eucaryotic Systems for Protein Production session at the AIChE National Meeting, Miami, FL, 1995.

Advances in Animal and Insect Cell Culture session at the AIChE National Meeting, Dallas, TX, 1999.

Advances in Animal and Insect Cell Culture session at the AIChE National Meeting, Los Angeles, CA, 2000.

Advances in Animal and Insect Cell Culture session at the AIChE National Meeting, Reno, NV, 2001.

Reviewer For Journals and Research Funding Agencies

- *ACS Symposium Series*
- *Biotechnology Progress*
- *Biotechnology and Bioengineering*
- *Cytotechnology*
- *BioTechniques*
- *Journal of Biotechnology*
- *Biocatalysis and Biotransformations*
- *Applied Biochemistry and Biotechnology*
- *Journal of Engineering Education*
- *Protein Expression and Purification*
- Chapter from "Bioreactor Design Fundamentals" (Butterworth)
- Two chapters in "Baculovirus Expression Vectors"(W. H.Freeman)
- "Insect Cell Culture Engineering" (entire book) (Marcel Dekker, Inc.)
- Proposal regarding the publication of "Modeling Reaction and Mass Transfer in Immobilised Living Cell"
- National Science Foundation, Biotechnology Program
- National Science Foundation, Instrumentation and Laboratory Improvement
- Louisiana Education Quality Support Fund, Research and Development Program
- Iowa State University Competitive Grants Program for agricultural biotechnology
- National Institutes of Health, Training Grants
- National Aeronautics and Space Administration, Cell Science Program
- Binational (United States-Israel) Agricultural Research and Development Fund