**South Dakota State University**
**Department of Chemistry and Biochemistry**
**211 Shepard Hall**

# Matthew L. Miller

**Curriculum Vitae**

## I. PERSONAL INFORMATION

09/20/06

**Home information**
1004 Horner Avenue
Brookings, SD 57006
Home 605-692-5186
Cell 605-695-1371

**Work information**
211 Shepard Hall
South Dakota State University
Brookings, SD 57007
Matt.Miller@sdstate.edu
Office 605-688-6274
Fax # 605-688-6364

### Education

| | | |
|---|---|---|
| Ph.D. | Purdue University | 2001 |
| MS | Purdue University | 1998 |
| BS with honors | University of South Dakota | 1985 |

### Professional Experience

Assistant Professor of Chemistry and Biochemistry — 2001-present
South Dakota State University, Brookings, SD

Graduate work in chemistry and chemistry education, — 1994-2001
Purdue University, West Lafayette, IN

Adjunct faculty, chemistry instructor — 1998
Ivy Tech State College, Lafayette, IN

Secondary science teacher, Southwestern Wisconsin — 1985-1994
Community School District, Hazel Green, WI

### Awards and Honors

Sigma Xi, the Scientific Research Society — 2005
Alpha Lambda Delta National
2002
Academic Honor Society for freshman, honorary induction

Purdue Research Foundation Grant — 2000

Certificate of Appreciation, Purdue Excellence 21 — 1999

Phi Lambda Upsilon, honorary chemical society — 1995

Excellence in Science, Teacher Recognition — 1990, 1991
University of Wisconsin, Eau Claire

## II. PUBLICATIONS

**Refereed Publications**

1) Williams, Marla & Miller, Matthew (2006) Computers in the General Chemistry Laboratory: The Impact of Using Technology on Student Learning. Manuscript submitted for publication in the *Journal of Chemical Education*.
2) Borisch, John, Pilkenton, Sarah, Miller, Matthew L., Raftery, Daniel, & Francisco, Joseph S. (2004). $TiO_2$ Photocatalytic Degradation of Dichloromethane: An FTIR and Solid-State NMR Study. *Journal of Physical Chemistry B, 108*, 5640-5646.
3) Francisco, Joseph S., Nakhleh, Mary B., Nurrenbern, Susan C., & Miller, Matthew L. (2002). Assessing Student Understanding of General Chemistry with Concept Maps. *Journal of Chemical Education, 79,* 248.
4) Miller, Matthew L., Borisch, John, Raftery, Daniel, & Francisco, Joseph S. (1998). Changing the Product State Distribution and Kinetics in Photocatalytic Surface Reactions Using Pulsed Laser Irradiation. *Journal of the American Chemical Society, 120 (32),* 8265.

**Book Chapter**

1) Miller, M. L. (in press). Pedagogical content knowledge. In M. Orgill & G. M. Bodner (Eds.), *Theoretical frameworks for research in chemistry/science education* (pp. 83-102). Upper Saddle River, NJ: Pearson Education Publishing.

## III. GRANT PROPOSALS

**Current Grant Submissions**

1) US Dept. of Education – Fund for the Improvement of PostSecondary Education (FIPSE) Meeting the Need for Highly-Qualified Chemistry Teachers
   Status – (Pending) Principle Investigator **Requested $405,192**
2) NSF 06-534 International Polar Year (IPY). IPY: A Catalyst to Enhance Science Education in South Dakota.
   Status – (Pending) Co-Principle Investigator **Requested $387,790**
3) NSF 05-592 Research Experience for Undergraduates (REU)
   REU Site at South Dakota State University: Promoting Research to Students and Teachers
   Status – (Pending) Co-Principle Investigator **Requested $309,760**
4) Henry & Camille Dreyfus Foundation Maintaining High Quality Chemistry Teachers: Chemical Activities Workshops for Elementary and Secondary Teachers
   Status – (Pending) Principle Investigator **Requested $ 80,561**

**Funded Grant Applications**

1) SDSU Research Support Fund, 2005, Graduate School **Received $3,116.**
2) New Ideas Program, 2004, Provost & Vice-President's Office **Received $4,000.**
3) Research/Scholarship Start-up Funds, 2004, Graduate School. **Received $4,000**
   Matching funds; Department of Chemistry & Biochemistry **Received $3,000**

Matching funds; College of Arts & Sciences **Received $700.**

4) Research/Scholarship Start-up funds, 2002, Graduate School
**Received $4,000.**

# IV. TECHNICAL ADDRESSES

**Invited Address at National Meeting**

1) Theoretical Frameworks for Research in Chemistry Education. A symposium organized by MaryKay Orgill (University of Nevada-Las Vegas) and Provi Mayo (South Dakota State University) at the 19th Biennial Conference on Chemical Education in West Lafayette, IN, July 30-August 6, 2006.
2) Concept mapping in general chemistry: A tool for critical thinking. Miller, Matthew L. A symposium organized by Dave Pushkin (SUNY Maritime College) at the 18th Biennial Conference on Chemical Education, an American Chemical Society sponsored meeting at Iowa State University, Ames, IA. July, 2004.

**Workshops Conducted at National Meeting**

1) Holistic considerations of undergraduate research programs. An interactive session conducted at the 2006 National Conference, Council on Undergraduate Research (CUR) at DePauw University, Greencastle, IN, June 24-27, 2006. Session organizer: Matthew L. Miller. Speakers: David Cartrette, South Dakota State University and Dawn Del Carlo, University of Northern Iowa.

**Peer Reviewed Addresses at National Meeting**

(Name in **bold** was presenter)

1) Holistic approaches to planning undergraduate research experiences. **Miller, M.L, Cartrette, D., & Del Carlo, D.** A presentation at the 19th Biennial Conference on Chemical Education in West Lafayette, IN, July 30-August 6, 2006.
2) Outcomes of a CUR workshop: Planning for undergraduate research programs. **Miller, M.L, Cartrette, D., & Del Carlo, D.** A presentation at the 19th Biennial Conference on Chemical Education in West Lafayette, IN, July 30-August 6, 2006.
3) The Impact of Using Technology on Student Learning in the General Chemistry Laboratory. **Williams, M.** & Miller, M.L. A presentation at the 19th Biennial Conference on Chemical Education in West Lafayette, IN, July 30-August 6, 2006.
4) NSF-REU: Improving the quality of an undergraduate research experience. **Miller, M.L.,** Cartrette, D., Cole-Dai, J. A presentation at the 2006 National Association for Research in Science Teaching Annual International Conference at the Hyatt Regency in San Francisco, CA, April 2006.
5) The impact of technology on student learning in the general chemistry laboratory. **Williams, M.** & Miller, M.L. A presentation at the 2006 National Association for Research in Science Teaching Annual International Conference at the Hyatt Regency in San Francisco, CA, April 2006.

**Peer Reviewed Addresses at National Meeting (cont.)**

6) Assessing the construction of knowledge by undergraduates during the NSF REU. **Miller, M.L.,** Cartrette, D., Cole-Dai, J. A presentation at the 2005 National Association for Research in Science Teaching Annual International Conference at the Fairmont Dallas Hotel in Dallas, TX, April 2005.
7) Jihong Cole-Dai, **David P. Cartrette**, and Matthew L. Miller. "Chemistry REU Site at South Dakota State University." 229th American Chemical Society National Meeting, San Diego, CA, March 2005. (Abstract number: CHED 0212).
8) NSF REU: An assessment strategy for the undergraduate research experience. **Cartrette, D.**, Miller, M.L., Cole-Dai, J. A presentation at the 228th American Chemical Society National Meeting in Philadelphia, PA, August 2004.
9) Using Metaphors of Teaching to Monitor Pedagogical Content Knowledge. **Miller, Matthew L.** & Mary B. Nakhleh. A presentation at the 2004 National Association for Research in Science Teaching Annual International Conference at the Westin Bayshore Resort in Vancouver, CA, April 2004.
10) Concept Mapping in General Chemistry: Mapping Knowledge for Evaluation. **Miller, Matthew L.** A presentation at the 2003 National Association for Research in Science Teaching Annual International Conference at the Wyndham Franklin Plaza Hotel, Philadelphia, PA, March 2003.
11) Focusing the Pedagogical Content Knowledge Constructed by Preservice Teachers. **Miller, Matthew L.** and Nakhleh, Mary B. A presentation at the 2002 National Association for Research in Science Teaching Annual Meeting at the Hyatt Regency , New Orleans, LA, April 2002.
12) Enriching the Pedagogical Content Knowledge of Preservice Chemistry Teachers. **Miller, Matthew L.** and Nakhleh, Mary B. A presentation at the 221st American Chemical Society National Meeting at the Convention Center, San Diego, CA, April 2001.
13) Concept Maps: A Tool for Problem Solving in Chemistry. **Miller, Matthew** L.; Nakhleh, Mary B.; Francisco, Joseph S.; Nurrenbern, Susan C.; and Jardine, Rebecca M. A presentation at the 221st American Chemical Society National Meeting at the Convention Center, San Diego, CA, April 2001.
14) Enriching the Pedagogical Content Knowledge of Preservice Chemistry Teachers. **Miller, Matthew L.** and Nakhleh, Mary B. A presentation at the 2001 National Association for Research in Science Teaching Annual Meeting at the Hyatt Regency Hotel, St. Louis, MO, March 2001.
15) Enriching Pedagogical Content Knowledge of Prospective Chemistry Teachers: How Can the Science Methods Course Help? **Miller, Matthew L**. and Nakhleh, Mary B. A presentation at the 16th Biennial Conference on Chemical Education at the University of Michigan, Ann Arbor, August 2000.
16) Assessing Student Understanding of General Chemistry Using Concept Maps. **Miller, Matthew L**.; Nakhleh, Mary B.; Francisco, Joseph S.; and Nurrenbern, Susan C. A presentation at the 16th Biennial Conference on Chemical Education at the University of Michigan, Ann Arbor, August 2000.

17) Making Connections: The Use of Concept Maps in General Chemistry. Nakhleh, Mary B.; Nurrenbern, Susan C.; Francisco, Joseph S.; and **Miller, Matthew L.** A presentation at the 2000 National Association for Research in Science Teaching Annual Meeting at the Radisson Hotel, New Orleans, LA, March 2000**.**

**Poster Presentation at National Meeting**

(Name in **bold** was presenter)

1) Computers in the general chemistry laboratory: The impact of technology on laboratory learning. **Williams, Marla**; Utecht, Ronald; Miller, Matthew. A poster presented at the 2004 Biennial Conference on Chemical Education, an American Chemical Society sponsored meeting at Iowa State University, Ames, IA. July, 2004.

**Addresses at Regional Meeting**

(Name in **bold** was presenter)

1) NSF-REU: Improving the Quality of Undergraduate Research Experiences. **Miller, Matthew L., Cartrette, David P.** A presentation at the 40th Midwest Regional Meeting of the American Chemical Society, Joplin, MO, Oct. 2005.
2) Using Concept Maps in Science Classrooms to Make Connections. **Miller, Matthew L.** A presentation at the South Dakota Council of Teachers of Mathematics and the South Dakota Science Teachers Association Joint Spring Convention, Crossroads Convention Center, Huron, SD, February 2002.
3) Changing the Product State Distribution in Photocatalytic Surface Reactions Using Pulsed Laser Irradiation. **Miller, Matthew L.**; Borisch, John; Raftery, Daniel; Francisco, Joseph S. A presentation at the 20th Annual Midwest Environmental Chemistry Workshop at the University of Indiana, Bloomington, November 1997.

**Invited Addresses at Regional Institutions**

1) Concept Mapping in General Chemistry: Mapping Knowledge for Assessment. An invited address at the departmental seminar at Minnesota State University, Moorhead, April, 2006.
2) Experiences on the road to SoTL at SDSU. Member of discussion panel. Faculty Interactions and Open Discussions, South Dakota State University, March 30, 2006.
3) Integrating research in the classroom. Member of discussion panel. Faculty Interactions and Open Discussions, South Dakota State University, November 10, 2005.
4) The scholarship in teaching and learning. Member of discussion panel. Faculty Interactions and Open Discussions, South Dakota State University, April 20, 2005.
5) A lost art: Critical thinking in chemistry. Miller, Matthew L. An invited address at the departmental seminar at St. Cloud State University in October, 2004.

6) Identifying Critical Links in Chemistry Knowledge: Instructor and Student Perspectives on Using Concept Maps. Miller, Matthew L. An invited address to the faculty and students at Mount Marty College, Yankton, SD, February 2003.
7) Instructional Issues and Challenges: Student Motivation. Member of discussion panel. 2003 Spring Bush Series: Faculty Interactions and Open Discussions, South Dakota State University, January 2003.
8) Identifying Critical Links in Chemistry Knowledge: Instructor and Student Perspectives. Miller, Matthew L. An invited address to the faculty and students at the University of South Dakota, Vermillion, December 2002.

# V. PROFESSIONAL ACTIVITIES

**Reviewer for Professional Journals**

1) Reviewer for the Journal of Chemical Education 2001-2006
2) Reviewer for The Chemical Educator 2004-2006

**Society Affiliations**

American Chemical Society 1999-2006
Chair-Elect, Local Officer 2006
National Association for Research in Science Teaching 1999-2006
National Science Teachers Association 1999-2006
Sigma Xi Society 2005-2006

**Conferences**

1) 19th Biennial Conference on Chemical Education
2006
Purdue University, West Lafayette, IN.
2) 11th National Conference of the Council on Undergraduate Research 2006
DePauw University, Greencastle, IN.
3) National Association for Research in Science Teaching 2006
Annual International Meeting, San Francisco, CA.
4) 40th Midwest Regional Meeting of the American Chemical Society 2005
Joplin, MO.
5) National Association for Research in Science Teaching 2005
Annual International Meeting, Dallas, TX.
6) 18th Biennial Conference on Chemical Education 2004
Iowa State University, Ames IA
7) National Association for Research in Science Teaching 2004
Annual International Meeting, Vancouver, CA.
8) Spring Faculty Development Conference of the Collaborations 2004
For the Advancement of College Teaching and Learning, Bloomington, MN.
9) National Association for Research in Science Teaching 2003
Annual Meeting, Philadelphia, PA.
10) National Association for Research in Science Teaching
2002

Annual Meeting, New Orleans, LA.

**Conferences (cont.)**

11) South Dakota Council of Teachers of Mathematics and South Dakota Science Teachers Association Joint Spring Conference, Huron, SD. 2002

12) 221st American Chemical Society National Meeting, San Diego, CA. 2001

13) National Association for Research in Science Teaching 2001 Annual Meeting, St. Louis, MO.

14) 16th Biennial Conference on Chemical Education, University of Michigan, Ann Arbor MI. 2000

15) National Association for Research in Science Teaching Annual Meeting, Radisson Hotel, New Orleans LA. 2000

16) Science and Engineering Education Scholars Program (SEESP), University of Wisconsin, Madison WI. 1999

17) 20th Annual Midwest Environmental Chemistry Workshop, University of Indiana, Bloomington IN. 1997

**Outreach**

1) Science Fair Judge
   - Northwest South Dakota Science Fair, Timber Lake 2002-2006
   - Southeast South Dakota Science Fair, Brookings 2002-2004
   - Northeast South Dakota Science Fair, Summit 2004
   - Local Science Fair, Hayti 2002

2) Scientific Judge, South Dakota Science Bowl, Huron, SD 2002-2006

3) Chemistry Cauldron Spooky Halloween Show, Washington Pavilion, Sioux Falls, SD 2002-2006

4) Chemical Demonstration Show, Big Sioux Water Festival, SDSU 2001-2006

5) Chemical Demonstration Show, Flandreau Indian School 2002, 2004

6) Chemical Demonstration Show, South Dakota Science Bowl, Huron, SD 2002, 2004, 2006

7) Implosions, Explosions, and Kabangs, Distance Learning Demonstration Show, Washington Pavilion, Sioux Falls, SD 2003

8) Purdue University Gifted Education Resource Institute, Summer residential program teacher 1998, 1999

9) National Chemistry Week Activities, Elementary school presenter 1995-1997, 1999

10) Research Mentor, MARC/AIM Summer Research Project 1996

11) Expanding Your Horizons Project, Student guide 1996, 1997

# VI. SERVICE

**Departmental**

| | |
|---|---|
| 1) Graduate advisory committee | 2002-2006 |
| 2) Lardy Lecture committee | 2005-2006 |
| 3) Chair of faculty search committee 2003-2004 | |
| 4) Faculty search committee | 2002-2003 |

**University**

| | |
|---|---|
| 1) President's Faculty Committee, Arts & Science representative | 2006 |
| 2) Teacher education faculty committee | 2001-2006 |
| 3) Dean's advisory committee | 2003-2006 |
| Chair of committee | 2004-2006 |
| 4) Assistant Dean of Arts & Sciences search committee | 2002-2003 |
| 5) Host for Flinn Scientific Teacher Workshop | summer 2003 |
| 6) Masters of Science Teachers (MST) program committee | 2001-2004 |
| 7) Member of committee (through the MST) to develop teacher education cohort group at USDSU | summer 2002 |

# VII. TEACHING ASSIGNMENTS

**South Dakota State University**
Brookings, SD
Assistant Professor, chemistry instructor

| | |
|---|---|
| SEED 413 | 2002-2006 |
| CHEM 713 | 2004 |
| CHEM 516 | 2005-2006 |
| CHEM 715 | 2006 |
| CHEM 114 | 2002-2004 |
| CHEM 112 | 2001-2004 |
| CHEM 114 honors | 2005-2006 |
| CHEM 114L | 2006 |
| CHEM 112 honors | 2005-2006 |
| CHEM 112L honors | 2005-2006 |

| | |
|---|---|
| SEED 413 | Methods Course for Physical Science teachers |
| CHEM 713 | Qualitative Research Methods |
| CHEM 516 | Chem Communication Skills |
| CHEM 715 | Chemistry Instruction in Higher Education |
| CHEM 112 & 114 | Introductory level chemistry courses for science and engineering majors. |
| CHEM 112 & 114 honors | Introductory level chemistry courses for chemistry majors and university honors students |
| CHEM 112L & 114L | Laboratory course taught concurrently with 112/114 intended for chemistry majors and university honors students |

**Purdue University**
West Lafayette, IN

| | | |
|---|---|---|
| University supervisor of student teacher | Fall | 2000 |
| Chemistry course supervisor | | |
| CHM 112 | Summer | 1996 |
| CHM 112 | Summer | 1995 |
| Chemistry teaching assistant | | |
| CHM 126 | Spring | 2001 |
| CHM 115 | Spring | 2001 |
| CHM 100 | Fall | 2000 |
| CHM 115 | Fall | 2000 |
| CHM 115 | Spring | 2000 |
| CHM 115 | Fall | 1999 |
| CHM 116 | Spring | 1999 |
| CHM 502/EDCI 424 | Fall | 1998 |
| Undergraduate Resource Room | Summer | 1998 |
| CHM 112 | Spring | 1998 |
| CHM 116 | Fall | 1997 |
| CHM 115 | Fall | 1996 |
| CHM 224 | Spring | 1996 |
| CHM 116 | Spring | 1995 |
| Undergraduate Resource Room | Fall | 1994 |
| Chemistry laboratory development | | |
| CHM 224 | Fall | 1995 |

| | |
|---|---|
| CHM 100 | Remedial chemistry course for beginning chemistry students. |
| CHM 112 | Introductory level chemistry course for non-majors. |
| CHM 115, 116 | Introductory level chemistry course for science and engineering majors. |
| CHM 126 | Introductory level chemistry course for chemistry majors. |
| CHM 224 | Analytical chemistry for non-majors. |
| CHM 502/EDCI 424 | Secondary physical science teacher methods course. |
| Undergraduate resource room | Help room for all chemistry students. |

**Ivy Tech State College**
Lafayette, IN
Adjunct faculty, chemistry instructor
CHM 100 Spring 1998

CHM 100 Introductory level class for students with no previous chemistry experience.

**Southwestern Wisconsin Community School District**
Hazel Green, WI
Secondary science instructor 1985-1994
chemistry, physics, physical science
advanced science, AP chemistry

# VIII. RESEARCH ACTIVITIES

## Current Projects

### South Dakota State University

1) Preparing a science-oriented labor force for the 2010 initiative: Assessing the knowledge base of South Dakota chemistry instructors. The purpose of this work is to identify the needs that exist for instructional personnel so that intervention methods can be developed to improve science instruction, specifically in chemistry.
   Principle investigators: Dr. Matthew Miller
   Dr. Sara Madsen
2) Chemical Education: Critical links in learning chemical concepts: The use of concept maps to identify important chemical concepts.
   Principle investigator: Dr. Matthew Miller
   Undergraduate researcher: Sharon Klein
3) Computers in the general chemistry laboratory: The impact of technology on laboratory learning. The purpose of this work is to identify the impact of technology on the construction of knowledge by first-year undergraduates in the general chemistry laboratory.
   Principle investigator: Dr. Matthew Miller
   Graduate researcher: Marla Williams
4) NSF-Research Experience for Undergraduates. The purpose of this research is to investigate how undergraduates construct knowledge during authentic research experiences.
   Principle investigator: Dr. Jihong Cole-Dai
   Assessment personnel: Dr. David Cartrette
   Dr. Matthew Miller
   Bethany Melroe
   Sharon Klein

**Past Projects**

**Research in Teacher Preparation**

1) Ph.D. project, chemical education

Ph.D. dissertation advisor: Dr. Mary B. Nakhleh

Ph.D. dissertation topic: "Enriching Pedagogical Content Knowledge of Prospective Chemistry Teachers: How Can the Science Methods Course Help?"

Funding granted through the Purdue Research Foundation and the Purdue Chemistry Department

Past Projects (cont.)

**Research in Assessment**

2) "Collaborative for Excellence in Teacher Preparation"

This program originally was designed to develop a model to systematically revise undergraduate science courses at Purdue University. Currently, work on this project has investigated the use of concept maps as alternative study tools for students as well as assessment tools for professors and teaching assistants

Principle Investigator: Dr. Mary B. Nakhleh

Associate Investigators: Dr. Joseph S. Francisco
Dr. Susan C. Nurrenbern

Funding granted through NSF-DUE

Principle investigators: Dr. Gerald H. Krockover
Dr. Louis A. Sherman
Dr. Kenneth D. Ridgway

**Masters Project**

MS project, analytical chemistry

MS Thesis advisor: Dr. M. Daniel Raftery

MS Thesis topic: "Semiconductor Photocatalytic Degradation of Volatile Organic Compounds Using Titanium Dioxide"

Funding granted through Lucent Technologies

Principle investigators: Dr. M. Daniel Raftery