

Benjamin L. Miller

Assistant Professor
Department of Chemistry
University of Rochester
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1996- **Assistant Professor of Chemistry**
University of Rochester, Rochester, New York

EDUCATION

1988-1994 **Ph. D., Organic Chemistry**
Stanford University, Stanford, California
Research Advisor: Professor Paul A. Wender
Dissertation Title: "The Interaction of Natural Products with Natural and Synthetic Receptors: Molecular Modeling of Dynemicin A with DNA, and the Determination of the Tertiary Solution Structure of the Phorbol-Protein Kinase C Complex by NMR"

1984-1988 **B. S., Chemistry**
 B. A., Mathematics
 B. A., German
Miami University, Oxford, Ohio

RESEARCH AND TEACHING EXPERIENCE

1994-1996 **NIH Postdoctoral Fellow**, Department of Chemistry, Harvard University: Professor Stuart L. Schreiber, advisor. Design, synthesis, and evaluation of structure-based, nonpeptide combinatorial libraries for binding to Src homology 3 (SH3) domains.

1988-1994 **Research Assistant**, Department of Chemistry, Stanford University: Professor Paul A. Wender, advisor. Synthesis of calphostin C and related perylenequinone natural products; molecular modeling of the interactions of dynemicin A with DNA; identification, synthesis, overexpression, analysis, and tertiary structure determination of phorbol ester-binding polypeptides related to protein kinase C.

3/90-3/93 **Head Teaching Assistant**, Advanced Organic Chemistry, Paul A. Wender, Professor.

3/93, 3/94 **Guest Lecturer**, Advanced Quantum Mechanics, Richard N. Zare, Professor.

9/88-5/89 **Teaching Assistant**, Department of Chemistry, Stanford University. Undergraduate Organic Synthesis laboratory and lecture.

6/87-9/87 **Research Intern**, Department of Chemistry, The Ohio State University: Professor Leo A. Paquette, advisor. Synthesis of transition metal coordination complexes of spirocyclic isodicyclopentadienes.

6/86-5/88 **Research Assistant**, Department of Chemistry, Miami University: Professor James Hershberger, advisor. Synthesis, analysis, and applications of polystyrene-bound trialkyltin hydrides.

FELLOWSHIPS

1994-1996 **NIH Postdoctoral Fellow**, Harvard University

1991-1993 **W. R. Grace Graduate Fellow**, Stanford University

PUBLICATIONS

(Items indicated by a * are from the University of Rochester)

*Chan, S.; Horner, S. R.; Miller, B. L.; Fauchet, P. M. "Identification of Gram Negative Bacteria using Nanoscale Silicon Microcavities" *J. Am. Chem. Soc.*, submitted.

*Karan, C.; Miller, B. L. "RNA-Selective Coordination Complexes Identified via Dynamic Combinatorial Chemistry" *J. Am. Chem. Soc.*, in press.

*Hari, A.; Rodrigues, W. C.; Karan, C.; Miller, B. L. "Extending the Scope of Chromium-Manganese Redox-Coupled Reactions: A One-Pot Synthesis of Benzoxazoles" *J. Org. Chem.*, **2001**, *66*, 991-996.

*Hubbard, R. D.; Horner, S. R.; Miller, B. L. "Highly Substituted *ter*-Cyclopentanes as Receptors for Lipid A and Simple Carbohydrates in Aqueous Solution" *J. Am. Chem. Soc.*, **2001**, *123*, 5810-5811.

*Hari, A.; Miller, B. L. "Rapid and Efficient Synthesis of 2-Amino-4*H*-benzothiazines" *Org. Lett.*, **2000**, *2*, 3667-3670.

*Chan, S.; Fauchet, P. M.; Li, Y.; Rothberg, L. J.; Miller, B. L. "Porous Silicon Microcavities for Biosensing Applications" *Physica Status Solidi A*, **2000**, *182*, 541-546.

*Hari, A.; Miller, B. L. "Segregation of Separate Steps in Chromium-Catalyzed Reactions for Convenience and Mechanistic Analysis" *Org. Lett.*, **2000**, *2*, 691-693.

*Karan, C.; Miller, B. L. "Dynamic Diversity in Drug Discovery: Putting Small-Molecule Evolution to Work" *Drug Discovery Today*, **2000**, *5*, 67-75.

*Hari, A.; Miller, B. L. "Exploiting Differences in Solution vs. Solid-Supported Reactivity for the Synthesis of Sulfonic Acid Derivatives" *Org. Lett.*, **1999**, *1*, 2109-2111.

*Hari, A.; Miller, B. L. "Transfer Catalysis Between Two Solids: Application to the Reduction of Nitroarenes" *Angew. Chem. Int. Ed. Engl.* **1999**, *38*, 2777-2779.

*Hari, A.; Miller, B. L. "A New Method for the Mild and Selective Reduction of Aryl Nitro Groups on Solid Support" *Tetrahedron Lett.*, **1999**, *40*, 245-248.

*Klekota, B.; Miller, B. L. "Selection of DNA-Binding Compounds *via* Multistage Molecular Evolution" *Tetrahedron* (Combinatorial Chemistry Symposium in Print), **1999**, *55*, 11687.

*Klekota, B.; Miller, B. L. "Dynamic Diversity and Small-Molecule Evolution: a New Paradigm for Ligand Identification" *Trends in Biotechnology*, **1999**, *17*, 205-209.

*Pickert, J. D.; Miller, B. L. "Cloning as a Tool for Chemists" in *Comprehensive Natural Products Chemistry*, Kool, E. T., Ed., Elsevier Press, 1998 v. 7, pp. 643-674.

*Hubbard, R. D.; Miller, B. L. "Lewis Acid Catalyzed Diels-Alder Reactions of Highly Hindered Dienophiles" *J. Org. Chem.* **1998**, *63*, 4143.

*Klekota, B.; Hammond, M. H.; Miller, B. L. "Self-Assembled Combinatorial Libraries Capable of Self-Selection and Amplification: Generation of Novel DNA-Binding Compounds" *Tetrahedron Lett.*, **1997**, *38*, 8639-8643.

Irie, K.; Ishii, T.; Ohigashi, H.; Wender, P. A.; Miller, B. L.; Takeda, N. "Synthesis and Characterization of New Photolabile Phorbol Esters for Affinity Labeling of Protein Kinase C" *J. Org. Chem.*, **1996**, *61*, 2164.

Irie, K.; Yanai, Y.; Ohigashi, H.; Wender, P. A.; Miller, B. L. "Synthesis and Characterization of the Second Cysteine-Rich Region of Mouse Skin PKC η " *Bioorg. Med. Chem. Lett.* **1996**, *6*, 353.

Miller, B. L.; Bonner, W. A. "Enantioselective Autocatalysis. III. Configurational and Conformational Studies on a 1,4-Benzodiazepinooxazole Derivative" *Origins of Life and Evolution of the Biosphere*, **1995**, *25*, 539.

Wender, P. A.; Irie, K.; Miller, B. L. "Identification, Activity, and Structural Studies of Model Peptides Incorporating the Phorbol Ester Binding Site of Protein Kinase C" *Proc. Natl. Acad. Sci. USA* **1995**, *92*, 239.

Irie, K.; Koizumi, F.; Iwata, Y.; Ishii, T.; Yanai, Y.; Nakamura, Y.; Ohigashi, H.; Wender, P. A.; Miller, B. L. "Active Conformation of Tumor-Promoting (-)-Indolactam-V" *Tennen Yuki Kagobutsu Toronkai Koen Yoshishu* **1995**, *37*, 25-30.

Wender, P. A.; Irie, K.; Miller, B. L. "Synthesis and Binding of Photoaffinity Ligand Candidates for Protein Kinase C" *J. Org. Chem.* **1993**, *58*, 4179.

Wender, P. A.; Miller, B. L. "Toward the Ideal Synthesis: Connectivity Analysis and Multibond-Forming Processes" in *Organic Synthesis: Theory and Applications*, Hudlicky, Ed., **1993**, p. 27.

Wender, P. A.; Miller, B. L. "Chiroptical Molecular Switch" *Chemtracts*, **1991**, *4*, 358.

Wender, P. A.; Kelly, R.; Beckham, S.; Miller, B. L. "Studies on DNA-cleaving agents: Computer modeling analysis of the mechanism of activation and cleavage of dynemicin-oligonucleotide complexes" *Proc. Natl. Acad. Sci. USA* **1991**, *88*, 8839.

Paquette, L. A.; O'Doherty, G. A.; Miller, B. L.; Rogers, R. D.; Rheingold, A. L.; Geib, S. L. "Stereochemically Uniform Mode of Iron Carbonyl Complexation to Spirocyclic Isodicyclopentadienes" *Organometallics* **1989**, *8*, 2167.

Miller, B. L.; Hershberger, J. W. "Preparation of a Highly Functionalized Polystyrene-bound Tin Hydride" *J. Poly. Sci. Poly. Lett.* **1987**, *25*, 219.

PATENTS PENDING:

Miller, B. L.; Klekota, B. "Combinatorial Libraries"

Miller, B. L.; Hubbard, R. D. "Oligocycloalkanoid Peptidomimetic Compounds and Method of Making the Same"

Miller, B. L.; Klekota, B. "Biphasic Combinatorial Chemistry"

Miller, B. L.; Horner, S. R.; Fauchet, P.; Chan, S. "Porous Silicon Biosensors"

Miller, B. L.; Krauss, T. D. "Nanocrystal-Based Colorimetric Sensors"

INVITED LECTURES

1) Miller, B. L. "Design, Self-Assembly, and Combinatorial Synthesis of Small Molecule Ligands for Biological Macromolecules"; Rochester Institute of Technology, February 11, 1997.

2) Miller, B. L. "Design, Self-Assembly, and Combinatorial Synthesis of Small Molecule Ligands for Biological Macromolecules"; Eastman Kodak Corporation, February 27, 1997.

3) Miller, B. L. "Design, Self-Assembly, and Combinatorial Synthesis of Small Molecule Ligands for Biological Macromolecules"; Procter and Gamble Corporation, May 7, 1997

4) Miller, B. L. "Design, Self-Assembly, and Combinatorial Synthesis of Small Molecule Ligands for Biological Macromolecules"; University of Cincinnati, May 8, 1997.

5) Miller, B. L. "Self-Assembled, Self-Amplified Combinatorial Libraries as a New Method for Ligand Synthesis"; Bioorganic Gordon Research Conference, June 21, 1997.

6) Miller, B. L. "Design, Self-Assembly, and Combinatorial Synthesis of Small Molecule Ligands for Biological Macromolecules" Kodak Organic Chemistry Technical Council, Rochester, New York, September 26, 1997.

7) Miller, B. L. "Design, Self-Assembly, and Combinatorial Synthesis of Small Molecule Ligands for Biological Macromolecules" SmithKline-Beecham Corporation, February 20, 1998.

8) Miller, B. L. "Design, Self-Assembly, and Combinatorial Synthesis of Small Molecule Ligands for Biological Macromolecules" Keynote presentation, ACS Northeast Regional Undergraduate Research Symposium, Nazareth College, April 25, 1998.

9) Miller, B. L. "Dynamic Diversity and Molecular Evolution in Ligand Identification" SRI 2nd International Solid and Solution Phase Combinatorial Synthesis Conferencr, Philadelphia, PA, October 6, 1998.

10) Miller, B. L. "Dynamic Diversity and Molecular Evolution in Ligand Identification" (San Diego), January , 1999

11) Miller, B. L., "Dynamic Diversity and Molecular Evolution in Ligand Identification" University of Toledo, February, 1999

- 12) Miller, B. L., "Dynamic Diversity and Molecular Evolution in Ligand Identification" Bloomsburg University, Bloomsburg, PA, 1999
- 13) Miller, B. L. "The Identification of Novel Ligands for Receptors Using New Synthetic Methods and Dynamic Combinatorial Chemistry", Bristol-Myers Squibb, Wallingford, CT, March 15 1999
- 14) Miller, B. L. "The Identification of Novel Ligands for Receptors Using New Synthetic Methods and Dynamic Combinatorial Chemistry" Rhone-Poulenc Rorer, King of Prussia, PA, April 12, 1999
- 15) Miller, B. L. "Small Molecule Evolution", St. Cloud State University, St. Cloud, MN, October 13, 1999.
- 16) Miller, B. L. "New Techniques for Chemical Synthesis: Small-Molecule Evolution and Multiphase Catalysis", State University of New York at Binghamton, Binghamton, NY, October 29, 1999.
- 17) Miller, B. L. "Dynamic Diversity and Multiphase Catalysis: New Strategies for Synthesis and Combinatorial Chemistry", University of Notre Dame, South Bend, IN, November 3, 1999.
- 18) Miller, B. L. "Dynamic Diversity and Multiphase Catalysis: New Strategies for Synthesis and Combinatorial Chemistry", University of North Carolina, Chapel Hill, NC, February 18, 2000.
- 19) Miller, B. L. "High Affinity Carbohydrate Recognition in Water" University of Rochester Molecular Biophysics and Structural Biochemistry Cluster Retreat, February 25, 2000.
- 20) Miller, B. L. "Compartmentalization and Evolution in Synthesis and Combinatorial Chemistry", SUNY Buffalo, Buffalo, NY, April 12, 2000.
- 21) Miller, B. L. "Dynamic Diversity and Multiphase Catalysis: New Strategies for Synthesis and Combinatorial Chemistry" Symposium on Recent Advances in Combinatorial Chemistry, The University of North Carolina at Greensboro, Greensboro, North Carolina, April 28, 2000.
- 22) Miller, B. L. "Molecular Recognition of Lipid A and Simple Carbohydrates in Aqueous Solution" Yale Chemical Biology Symposium, Yale University, May 6, 2000.
- 23) Miller, B. L. "New Strategies in Solid-Phase Synthesis and Dynamic Combinatorial Chemistry", Central Regional Meeting of the American Chemical Society, Covington, Kentucky, May 17, 2000.
- 24) Miller, B. L. "Molecular Recognition of Lipid A and Simple Carbohydrates in Aqueous Solution", University of Pittsburgh, Pittsburgh, Pennsylvania, September 7, 2000.
- 25) Miller, B. L. "Molecular Recognition of Lipid A and Simple Carbohydrates in Aqueous Solution", University of Pennsylvania, State College, Pennsylvania, September 18, 2000.
- 26) Miller, B. L. "Towards the Smart Bandage: New Technologies for Proteomics and Molecular Recognition" Department of Biology, University of Rochester, Rochester, New York, September 25, 2000.
- 27) Miller, B. L. "Molecular Recognition of Lipid A and Simple Carbohydrates in Aqueous Solution", Miami University, Oxford, Ohio, October 5, 2000.

28) Miller, B. L. "Smart Bandages and Fast Proteomics: New Opportunities for Molecular Design and Organic Synthesis in a Post-Genome World" State University of New York - Brockport, Brockport, New York, October 10, 2000.

29) Miller, B. L. "Molecular Recognition of Lipid A and Simple Carbohydrates in Aqueous Solution", University of Utah, Salt Lake City, Utah, October 19, 2000.

30) Miller, B. L. "Molecular Recognition of Lipid A and Simple Carbohydrates in Aqueous Solution", College of St. Benedict's/St. John's University, St. Joseph's, Minnesota, October 25, 2000.

31) Miller, B. L. "Molecular Recognition of Lipid A and Simple Carbohydrates in Aqueous Solution", University of Minnesota, Minneapolis, Minnesota, October 26, 2000.

32) Miller, B. L. "Smart Bandages and Fast Proteomics: New Opportunities for Molecular Design and Organic Synthesis in a Post-Genome World", University of Guelph, Guelph, Ontario, October 31, 2000.

33) Miller, B. L. "Smart Bandages and Fast Proteomics: New Opportunities for Molecular Design and Organic Synthesis in a Post-Genome World" Manhattan College, New York, New York, November 8, 2000.

34) Miller, B. L. "Molecular Recognition of Lipid A and Simple Carbohydrates in Aqueous Solution", Colorado State University, Ft. Collins, Colorado, November 27, 2000.

35) Miller, B. L. "Toward the Smart Bandage: Molecular Recognition of Lipid A and Simple Carbohydrates in Aqueous Solution", Stanford University, Stanford, California, March 7, 2001.

36) Miller, B. L. "Multistage Catalysis and Dynamic Combinatorial Chemistry: New Methods for the Identification and Synthesis of Biologically Relevant Compounds", Roche Biosciences, Palo Alto, California, March 8, 2001.

37) Miller, B. L. "Towards the Smart Bandage: Molecular Recognition of Lipid A and Simple Carbohydrates in Aqueous Solution", Microcide Pharmaceuticals, Mountain View, California, March 9, 2001.

38) Miller, B. L. "Fabrication and Screening of Molecular Biosensor Arrays: Development of a 'Smart Band-Aid'"; Convergence:2001, Innovation at the Intersection of Biotechnology and Photonics, University of Rochester Medical Center; Rochester, New York; June 27, 2001

INVITED SHORT COURSE

Miller, B. L. "Concepts and Techniques in Combinatorial Chemistry", Eastman Kodak Company, June 22-23, 1999.

CONTRIBUTED LECTURES

Miller, B. L.; Karan, C. "Discovery of Novel RNA-Binding Small Molecules by Dynamic Combinatorial Chemistry" 221st National Meeting, American Chemical Society, San Diego, California, April, 2001.

Hubbard, R. D.; Miller, B. L. "The design and synthesis of novel, rigid, non-hydrogen-bonding mimetics of polypeptide beta-strands" 217th National Meeting, American Chemical Society, Anaheim, CA, March 1999.

Miller, B. L.; Wender, P. A.; Irie, K. "The Phorbol Ester Binding Domain of Protein Kinase C: Synthesis, Activity, NMR Spectroscopic, and Computational Studies"; 207th National Meeting, American Chemical Society, San Diego, 1994.

Miller, B. L.; Pike, P. W.; Hershberger, J. W. "The Utilization of a Highly Functionalized Polystyrene-bound Triorganotin Hydride"; 20th Central Regional Meeting, American Chemical Society, 1988.

Miller, B. L.; Hershberger, J. "The Preparation and Utilization of Highly Functionalized Polystyrene-Bound Triorganotin Hydrides"; 19th Central Regional Meeting, American Chemical Society, 1987.

CONTRIBUTED POSTERS

Miller, B. L. "Expanding the Range of Dynamic Diversity Methods for Ligand Identification: Pd Pi-Allyl Chemistry as a Mutation Mechanism" Bioorganic Gordon Research Conference, 1999.

Miller, B. L., Horner, S. R., "Towards the Smart Bandage: Development of Biosensors for *in situ* Bacterial Serotyping" Chemical Sensors Gordon Research Conference, Il Ciocco, Italy, May 2001.

Miller, B. L.; Karan, C., "Identification of RNA-Selective Coordination Complexes via Dynamic Combinatorial Chemistry" Bioorganic Gordon Research Conference, 2001.

CONTRIBUTED LECTURES BY STUDENTS (PUBLISHED ABSTRACTS)

Hari, A.; Miller, B. L. "Phase-transfer catalysis between two solid phases: Reduction of aryl nitro groups on solid support" 218th National Meeting, American Chemical Society, New Orleans, Louisiana, August 1999.

Klekota, B.; Miller, B. L. "Evolving combinatorial libraries as a novel method for ligand identification: Pd pi-allyl chemistry as a mutation mechanism" 217th National Meeting, American Chemical Society, Anaheim, CA, March 1999.

Klekota, B.; Hammond, M. H.; Miller, B. L. "Self-assembled, self-amplifying combinatorial libraries as a new method for ligand discovery: Application to DNA-binding compounds" 213th National Meeting, American Chemical Society, April, 1997.

CONTRIBUTED POSTERS BY STUDENTS

Hubbard, R. D.; Miller, B. L., National Organic Symposium, 1997.

Karan, C.; Miller, B. L. "A Dynamic Combinatorial Chemistry Approach to the Identification of Inhibitors of Group I Intron Self-Splicing" Bioorganic Gordon Research Conference, 1999.

Horner, S. R.; Miller, B. L.; Chan, S.; Fauchet, P. M. "?????" Chemical Sensors Gordon Research Conference, Il Ciocco, Italy, May 2001.

BOOK REVIEW

Review of "Rational Molecular Design in Drug Research", Liljefors, T., et al., eds, *J. Am. Chem. Soc.*, 1999

PAPERS REVIEWED: for *J. Org. Chem.*, *J. Am. Chem. Soc.*, *Tetrahedron Lett.*, *Synlett*, *Bioorg. Med. Chem. Lett.*

CONSULTING

Eastman Kodak Corporation, 1997-present
Evident Technologies, 2001-present.

RECENT UNDERGRADUATE AND GRADUATE STUDENTS

Nathan Wagner, B. S., 1996, Rochester
Sara E. Lazaroff, B. S., 1996, Rochester
Mark H. Hammond, B. S., 1996, Rochester; M. S., 1997, Rochester
John D. Pickert, M. S., 1997, Rochester
Nancy L. Booth, M. S., 1999, Rochester
Edward Gublo, M. S., 1999, Rochester
Robert Hubbard, Ph. D., 2000, Rochester
Bryan Klekota, Ph. D., 2000, Rochester

CURRENT UNDERGRADUATE RESEARCH STUDENTS: 2

CURRENT GRADUATE RESEARCH STUDENTS: 7

CURRENT POSTDOCTORAL RESEARCH FELLOWS: 1

STUDENT ADVISING:

University of Rochester ski team faculty advisor, 2000-

DEPARTMENT SERVICE (CHEMISTRY)

Graduate Recruiting Committee, 1996-1999
Faculty Search Committee, 1998-2000
Space and Services Committee, 1999-

DEPARTMENT SERVICE (BIOCHEMISTRY AND BIOPHYSICS CLUSTER)

Graduate Education Committee, 1999-2001
Steering Committee, 2001-

ADDITIONAL UNIVERSITY SERVICE

Strategic Advisory Board, Center for Future Health, 2001-

PROFESSIONAL SERVICE

Harrison-Howe Awards Committee, Rochester Section of the American Chemical Society, 1998-present; Chair 1999-present.

Upstate Alliance for Innovation, 2001-present.