

AUDRA GOACH SOSTARECZ

Assistant Professor of Chemistry

Monmouth College

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EDUCATION

Ph.D., Chemistry, December 2004

The Pennsylvania State University, University Park, PA

Dissertation: "Structure Analysis of Langmuir-Blodgett Films with Time-of-Flight Secondary Ion Mass Spectrometry"

Advisor: Dr. Nicholas Winograd

B. S., Chemistry (summa cum laude), Phi Beta Kappa, May 1998

Muhlenberg College, Allentown, PA

PROFESSIONAL EXPERIENCE

2006-present **Assistant Professor**, Chemistry Department, Analytical Chemistry, Monmouth College

2004-2006 **Postdoctoral Fellow**, University of Pennsylvania

Principal Investigator: Dr. Paul A. Janmey

1998-2004 **Research Assistant**, The Pennsylvania State University

Advisor: Dr. Nicholas Winograd

TEACHING EXPERIENCE

2006 – present **Assistant Professor, Analytical Chemistry, Chemistry Department**, Monmouth College

Introduction to Analytical Chemistry - Quantitative Analysis (Fall 2006 and Fall 2007)

- Instructor for this sophomore level chemistry course which focuses on the comprehension of both the qualitative and quantitative nature of chemical analysis
- Topics include chemical equilibrium, activity, titrations, buffers, spectroscopy, and electrochemistry

Introduction to Analytical Chemistry Laboratory (Fall 2006 and Fall 2007)

- Instructor for this sophomore level chemistry laboratory with lecture that emphasizes accuracy and precision along with scientific reading and writing skills

Advanced Analytical Chemistry - Instrumental Analysis (Spring 2007)

- Instructor for this junior/senior level chemistry course emphasizing a comprehension of the most common analytical instrumentation used today in academic research and industry
- Instrumental methods covered include UV/Vis, Atomic Absorption, Chromatography (HPLC, TLC, GC), Mass Spectrometry, Fourier Transform Infrared Spectroscopy, Raman Spectroscopy (SERS), Scanning Electron Microscopy, Scanning Tunneling Microscopy, Atomic Force Microscopy, Fluorescence Imaging, and Electrochemistry

Integrated Laboratory (Spring 2007)

- Instructor for this capstone laboratory class that is taken concurrently with Advanced Analytical Chemistry and enforces the use of chemistry, biology, and/or biochemistry skills acquired in a chemistry/biochemistry major's first three years in college
- Require students to propose, plan, and execute the projects that they research with each project resulting in a group written research report and presentation

Science Seminar (Fall 2006, Spring 2007, and Fall 2007)

- Advisor for student talks in chemistry, biochemistry, and biology

Research in Chemistry (Fall 2006 – Fall 2007)

- Advisor for sophomore, junior, and senior student research projects

Cultural Chemistry (Spring 2006 and Fall 2007)

- Instructor for this non-majors chemistry course that covers quantitative and qualitative chemistry principles in the context of air pollution, global warming, acid rain, polymers, and drug chemistry

Organic Chemistry I Laboratory (Fall 2006)

- Co-instructor for this freshman level introductory chemistry laboratory course that emphasizes organic principles including synthesis and distillation

Biochemistry (Fall 2006)

- Guest lecturer for three lectures on the principles of the cellular membrane and lipid structure

1998-1999

Teaching Assistant, Chemistry Department, The Pennsylvania State University

- Spectroscopic Analysis
- General Chemistry Recitation
- General Chemistry Problem Solving Course

1996-1998

Tutor, Student Resource Center, Muhlenberg College

- Trained and certified to tutor students with learning disabilities
- General Chemistry Workshop
- General Chemistry I and II, Organic Chemistry I and II, and Calculus

RESEARCH EXPERIENCE

2006 – Present **Assistant Professor**, Monmouth College

Langmuir monolayers serve as ideal model membranes used to provide insight into many biologically related conditions. The Langmuir technique involves analytical, biological and physical chemistry theory and methods. The following projects are currently in progress with Monmouth College undergraduate chemistry, biochemistry, and biology majors:

- Investigation of the interaction of antibacterial molecules with the bacterial membrane in Cystic Fibrosis (CF) airway environment (collaboration with Dr. Paul Janmey and Dr. Robert Bucki at the University of Pennsylvania School of Medicine and Dr. Paul Savage at Brigham Young University)
- Investigation of the existence of lipid domains in the inner leaflet of the plasma membrane
- Analysis of lipid-drug interactions in Isotretanoin loaded liposomes (collaboration with Dr. Eliana Lima at the School of Pharmacy, UFG-Brazil)
- Investigation into the molecular interactions involved in Vanadium complexes as insulin mimics (collaboration with Dr. Debbie Crans and Dr. Nancy Levinger at Colorado State University)

2004-2006

Postdoctoral Researcher, University of Pennsylvania

Principal Investigator: Dr. Paul A. Janmey

Domains or rafts in supported lipid monolayers and cellular samples were investigated with bioanalytical imaging techniques. In particular, domains or lipid phases in Langmuir-Blodgett (LB) monolayers and freeze-dried cells were probed with epifluorescence microscopy, atomic force microscopy (AFM) and multi-isotope imaging mass spectrometry (MIMS). The specific lipid investigated was phosphatidylinositol 4,5-bisphosphate (PIP₂).

- Used AFM to demonstrate that cells retain their morphology upon freeze-drying
- Confirmed that MIMS can potentially be used to determine the location of PIP₂ in freeze-dried cells through chemical identification of acyl chain deuterated PIP₂ (collaboration with Dr. Claude Lechene at the NRIMS at Harvard Medical School)
- Utilized AFM as a tool for qualitative and quantitative analysis of biological samples

1998-2004 **Research Assistant**, The Pennsylvania State University
Advisor: Dr. Nicholas Winograd

Model membrane systems consisting of lipids which exist in both the inner and outer leaflet of the plasma membrane were developed and analyzed for their chemical composition. The Langmuir-Blodgett (LB) technique was used to make the model systems and analysis was performed by time-of-flight secondary ion mass spectrometry (TOF-SIMS). Model systems substantiated the use of TOF-SIMS for the analysis of cellular samples. Specific ideas investigated included cholesterol domain formation and TOF-SIMS depth profiling of cellular samples.

- Deposited Langmuir monolayers onto self-assembled monolayers or silicon to form LB films
- Analyzed monolayers by TOF-SIMS, AFM and ellipsometry
- Studied the effect of LB model membrane structure, film packing density and LB film molecular orientation on TOF-SIMS analysis
- Determined that TOF-SIMS is useful for investigating lipid domains in LB model membranes
- Determined that a C_{60}^+ cluster ion source for TOF-SIMS can be used for depth profiling of organic LB multilayer films of arachidic acid

Summer 1998 **Research Assistant**, The Pennsylvania State University
Advisor: Dr. Nicholas Winograd

Energy and angular distributions of neutral species from keV Ar^+ bombardment of $C_6H_6/Ag\{111\}$ were investigated. This mass spectrometry technique uses a Nd:YAG pumped dye laser system for ionizing neutral secondary species characteristic of the sample.

- Assisted a senior graduate student on this project

Summer 1997 **Undergraduate Research Assistant in Analytical Chemistry**, Muhlenberg College
Advisor: Dr. Donald W. Shive

A novel technique for the analysis of K^+ in serum through the use of K^+ standards and various cage dyes was investigated. Analysis was performed with a thin layer chromatography scanner.

Summer 1996 **Undergraduate Research Assistant in Inorganic Chemistry**, Muhlenberg College
Advisor: Dr. Marion W. Smith

New heterobimetallic porphyrin complexes composed of zinc and copper metals were synthesized. These inorganic complexes were analyzed with Atomic Absorption and Ultraviolet/Visible spectroscopy.

PUBLICATIONS

R. Bucki, A. G. Sostarecz, J. Byfield, P. B. Savage, and P. A. Janmey, “**Resistance of the Antibacterial Agent Ceragenin CSA-13 to Inactivation by DNA or F-actin, and its Activity in Cystic Fibrosis Sputum**”, *Journal of Antimicrobial Chemotherapy*, **60(3)**, 535-545 (2007).

C. M. McQuaw, A. G. Sostarecz, L. Zheng, A. G. Ewing, and N. Winograd, “**Investigating Lipid Interactions and the Process of Raft Formation in Cellular Membranes Using TOF-SIMS**”, *Appl. Surf. Sci.* **252**, 6716-66718 (2006).

C. M. McQuaw, A. G. Sostarecz, L. Zheng, A. G. Ewing, and N. Winograd, “**Lateral Heterogeneity of Dipalmitoylphosphatidylethanolamine-Cholesterol Langmuir-Blodgett Films Investigated with Imaging Time-of-Flight Secondary Ion Mass Spectrometry and Atomic Force Microscopy**”, *Langmuir* **21(3)**, 807-813 (2005).

A. G. Sostarecz, C. M. McQuaw, A. Wucher, and N. Winograd, “**Depth Profiling of Langmuir-Blodgett Films with a Buckminsterfullerene Probe**”, *Anal. Chem.* **76(22)**, 6651-6658 (2004).

A. G. Sostarecz, C. M. McQuaw, A. G. Ewing, and N. Winograd, “**Phosphatidylethanolamine-Induced Cholesterol Domains Chemically Identified with Mass Spectrometric Imaging**”, *J. Am. Chem. Soc.* **126(43)**, 13882-13883 (2004).

A. G. Sostarecz, D. M. Cannon, Jr., C. M. McQuaw, S. Sun, A. G. Ewing, and N. Winograd, **“Influence of Molecular Environment on the Analysis of Phospholipids by Time-of-Flight Secondary Ion Mass Spectrometry”**, *Langmuir* **20(12)**, 4926-4932 (2004).

A. G. Sostarecz, S. Sun, C. Szakal, A. Wucher, and N. Winograd, **“Depth Profiling Studies of Multilayer Films with a C_{60}^+ Ion Source”**, *Appl. Surf. Sci.* **231-232**, 178-182 (2004).

C. A. Meserole, E. Vanderweert, R. Chatterjee, A. Sostarecz, B. J. Garrison, N. Winograd, and Z. Postawa, **“Resonant Postionization of Neutral Species Desorbed by keV Ar^+ Bombardment of $C_6H_6/Ag\{111\}$ ”**, in *Secondary Ion Mass Spectrometry (SIMS XII)*, A. Benninghoven, P. Bertrand, H.-N. Migeon and H. W. Werner, Eds., 2000, pgs 321-324.

E. Vanderweert, C. A. Meserole, A. Sostarecz, Y. Dou, N. Winograd, and Z. Postawa, **“State-Selective Energy and Angular Resolved Detection of Neutral Species Ejected from keV Ion Bombarded $C_6H_6/Ag\{111\}$ ”**, *Nucl. Inst. and Meth. Phys. Rev. B.* **164-165**, 820-826 (2000).

PRESENTATIONS

A. G. Sostarecz, **“Langmuir Monolayers for the Analysis of Membrane Structure”**, The 42nd Midwest Regional American Chemical Society Meeting, November 2007. (talk)

A. G. Sostarecz, **“Langmuir Monolayers for the Analysis of Membrane Structure”**, Kent State University Colloquium, Kent, OH, March 2007. (invited talk)

A. G. Sostarecz, I. Levental, A. Taraseviciute, H. S. Rapoport, R. Bucki, J. Stewart, M. McCormick, P. B. Savage, A. R. Kennedy, R. J. Levy, P. L. Jones, and P. A. Janmey, **“Atomic Force Microscopy – A Qualitative and Quantitative Approach to the Analysis of Biological Samples”**, IME Interdisciplinary Research Symposium, University of Pennsylvania, Philadelphia, PA, May 2006. (poster)

A. G. Sostarecz, **“Instrumental Analysis of Membrane and Cellular Structure”**, Institute for Medicine and Engineering Chalk Talk, University of Pennsylvania, March 2006. (oral)

A. G. Sostarecz, **“Bioanalytical Techniques for the Analysis of Membrane Structure”**, Faculty Job Talk, Penn State Erie, The Behrend College, December 2005. (oral)

A. G. Sostarecz, **“Bioanalytical Imaging Techniques for the Analysis of Membrane and Cellular Structure”**, Faculty Job Talk, Holy Cross College, December 2005. (oral)

A. G. Sostarecz, **“Bioanalytical Imaging Techniques for the Analysis of Membrane and Cellular Structure”**, Faculty Job Talk, Washburn University, December 2005. (oral)

A. G. Sostarecz, **“Investigating Molecular Interactions in Relation to Domain Formation”**, Monmouth College, Faculty Job Talk, November 2005. (oral)

A. G. Sostarecz, **“Bioanalytical Imaging Techniques for the Analysis of Membrane and Cellular Structure”**, Faculty Job Talk, Swarthmore College, November 2005. (oral)

A. G. Sostarecz, **“Bioanalytical Imaging Techniques for the Analysis of Membrane and Cellular Structure”**, Faculty Job Talk, Trinity University, November 2005. (oral)

A. G. Sostarecz, N. Winograd, and P. A. Janmey, **“Investigation of Lateral Lipid Heterogeneity in Model Membranes and Cells”**, The 4th Annual Biomedical Postdoctoral Research Symposium, University of Pennsylvania, Philadelphia, PA, October 2005. (oral)

A. G. Sostarecz, N. Winograd, and P. Janmey, **“Investigation of Lateral Lipid Heterogeneity in Model Membrane Systems”**, The 230th American Chemical Society Meeting, Washington, DC, August 2005. (poster)

A. G. Sostarecz, S. Sun, C. Szakal, A. Wucher, and N. Winograd, **“Depth Profiling Studies of Multilayer Films with a C_{60}^+ Ion Source”**, The 14th International Conference on Secondary Ion Mass Spectrometry, San Diego, CA, September 2003. (oral)

A. G. Sostarecz, D. M. Cannon Jr., S. Sun, A. G. Ewing, and N. Winograd, “**Effects of Varying the Chemical Components and Structure of Model Membranes on TOF-SIMS Analysis**”, The 47th Annual Meeting of the Biophysical Society, San Antonio, TX, March 2003. (poster)

A. G. Sostarecz, D. Cannon, Jr., S. Sun, A. G. Ewing, and N. Winograd, “**Effects of Molecular Environment, Packing Density, and Molecular Orientation on TOF-SIMS Analysis of Model Membranes**”, The 224th American Chemical Society Meeting, Boston, MA, August 2002. (poster)

CONTRIBUTED PRESENTATIONS

R. Bucki, A. G. Sostarecz, P. B. Savage, and P. A. Janmey, “**Activity of Ceragenin CSA-13 in the Polyelectrolyte Environment of Cystic Fibrosis Airway Fluid Compared to Cathelicidin LL-37**”, 46th International Conference on Antimicrobial Agents and Chemotherapy, San Francisco, CA, September 2006. (poster)

I. Levental, A. G. Sostarecz, and P. A. Janmey, “**PIP₂ Organization Mediated by Hydrogen Bonding Not Electrostatic Repulsion**”, IME Interdisciplinary Research Symposium, University of Pennsylvania, Philadelphia, PA, May 2006. (poster)

I. Levental, J. Solon, A. Sostarecz, and P. A. Janmey, “**Domain Formation and PIP₂ Segregation in Biomimetic Monolayer Membranes**”, Biomedical Engineering Society Meeting, Baltimore, MD, October 2005. (oral)

C. McQuaw, A. G. Sostarecz, L. Zheng, A. G. Ewing, and N. Winograd, “**Investigating Lipid Interactions and the Process of Raft Formation in Cellular Membranes Using TOF-SIMS**”, The 15th International Conference on Secondary Ion Mass Spectrometry, Manchester, UK, September 2005. (oral)

I. Levental, J. Solon, A. Sostarecz, and P. Janmey, “**Domain Formation and PIP₂ Segregation in Biomimetic Monolayers**”, Institute for Medicine and Engineering 2004 Symposium, University of Pennsylvania, Philadelphia, PA, December 2004. (poster)

C. McQuaw, A. G. Sostarecz, L. Zheng, A. G. Ewing, and N. Winograd, “**Lateral Heterogeneity of Dipalmitoylphosphatidylethanolamine-Cholesterol Langmuir-Blodgett Films Investigated with Imaging Time-of-Flight Secondary Ion Mass Spectrometry and Atomic Force Microscopy**”, Biophysical Society Discussions, Asilomar, CA, October 2004. (poster)

STUDENT PRESENTATIONS (names of undergraduate research students underlined)

A. I. Magnelli, K. R. Watson, C. P. I. Alves, E. M. Lima, A. G. Sostarecz, “**Lipid Monolayers Provide Insight into Lipid-Drug Interactions in Isotretinoin Loaded Unilamellar Liposomes**”, The 42nd Midwest Regional American Chemical Society Meeting, November 2007. (poster)

L. Ditzler, K. King, and A. G. Sostarecz, “**The Use of Phosphatidylserine/cholesterol Monolayers to Investigate the Existence of Inner Leaflet Domains**”, The 42nd Midwest Regional American Chemical Society Meeting, November 2007. (poster)

S. Distin, R. Gordon, M. A. Choudhary, D. Crans, A. G. Sostarecz, “**Langmuir Monolayers for the Investigation of the Molecular Interactions Involved in the Insulin-enhancing Effect of Vanadium Dipicolinato Complexes**”, The 42nd Midwest Regional American Chemical Society Meeting, November 2007. (poster)

L. Ditzler and A. G. Sostarecz, “**Lipid Domains: Existence in the Inner Leaflet of the Plasma Membrane?**”, Illinois-Iowa American Chemical Society Meeting, Clinton Community College, IL, April 2007. (oral)

P. Rogers and A. G. Sostarecz, “**Langmuir Monolayers for the Investigation of the Interaction of Antibacterial Molecules with the Bacterial Membrane in Cystic Fibrosis (CF) Airways Environment**”, Illinois-Iowa American Chemical Society Meeting, Clinton Community College, IL, April 2007. (oral)

L. Ditzler, K. King, and A. G. Sostarecz, “**Lipid Domains: Existence in the Inner Leaflet of the Plasma Membrane?**”, The 233rd American Chemical Society Meeting, Chicago, IL, March 2007. (poster)

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A. I. Magnelli, K. R. Watson, C. P. I. Alves, E. M. Lima, A. G. Sostarecz, “**Lipid Monolayers Provide Insight into Lipid-Drug Interactions in Isotretinoin Loaded Unilamellar Liposomes**”, The 233rd American Chemical Society Meeting, Chicago, IL, March 2007. (poster)

P. Rogers, R. Bucki, P. B. Savage, P. A. Janmey, A. G. Sostarecz, “**Langmuir Monolayers for the Investigation of the Interaction of Antibacterial Molecules with the Bacterial Membrane in Cystic Fibrosis (CF) Airways Environment**”, The 233rd American Chemical Society Meeting, Chicago, IL, March 2007. (poster)

AWARDS AND RECOGNITIONS

2007 FIDC Faculty Development Award/FIDC Student Travel Funds
2006 FIDC Faculty Development Award/ FIDC Student Travel Funds
2005 Postdoctoral Fellow, NIH Training Grant, Department of Radiation Oncology
2003 Student Award, SIMS XIV International Conference on Mass Spectrometry
2002,2003 Travel Award, The Pennsylvania State University
1998-1999 Dan Waugh Memorial Teaching Award, The Pennsylvania State University
1998 Undergraduate Student Award, American Chemical Society Chemistry Award

PROFESSIONAL SOCIETIES

1998-present Member, Phi Beta Kappa
1998-present Member, American Chemical Society
2001-present Member, Biophysical Society
2003-2004 Member, American Society for Mass Spectrometry

SERVICE

2008 Chair-elect Illinois-Iowa American Chemical Society
2007 Research Coordinator, Chemistry Department
2007 Advisory Committee Member, Melinger Learning Center, Monmouth College
2007 Advisory Committee Member, Communication Across the Curriculum, Monmouth College
2007 Chair of the Admissions and Academic Status Committee, Monmouth College
2006-present Webmaster, Chemistry Department
2006-present Academic Advisor
2006 Faculty co-founder, American Chemical Society Student Affiliates Club, Monmouth College
2006 Participant, “Missions and Majors: The First Steps”, an assessment symposium sponsored by the Teagle Foundation
2006 Participant, “Advising in the Major”, Monmouth College faculty symposium
2003 Judge, Pennsylvania Junior Academy of Science state competition – chemistry section
1999-2003 Graduate student host, Penn State chemistry department graduate school open house