

## RUTH WADDELL SMITH

Forensic Science Program, School of Criminal Justice  
Chemistry Building, 578 S. Shaw Lane, Rm 319  
Michigan State University, East Lansing, MI 48824-1322  
Phone: 517-353-5283  
E-mail: [rwsmith@msu.edu](mailto:rwsmith@msu.edu)

### PROFESSIONAL EXPERIENCE

**Associate Professor of Forensic Chemistry**  
2011-present

**Michigan State University**  
Forensic Science Program

**Assistant Professor of Forensic Chemistry**  
2005-2011

**Michigan State University**  
Forensic Science Program

**Postdoctoral Research Associate**  
2003-2005

**Los Alamos National Laboratory**  
Analytical Chemistry Division

**Research Assistant**  
2002-2003

**University of Strathclyde**  
Forensic and Analytical Chemistry

### EDUCATION

**PhD Forensic and Analytical Chemistry**  
1999-2003

**University of Strathclyde**

Dissertation title: *Organic and Trace Metal Impurity Profiling in Illicit Ecstasy Seizures with the Application of Chemometric Procedures*

Illicit MDMA tablets were analyzed using a variety of analytical techniques to determine the inorganic and organic content. Techniques used included liquid chromatography with an ultraviolet detector, gas chromatography-mass spectrometry, atomic absorption spectrometry, and inductively coupled plasma-mass spectrometry.

**BS Forensic and Analytical Chemistry**  
1994-1999

**University of Strathclyde**

### RESEARCH INTERESTS

- New and emerging analytical techniques applicable to the forensic sciences
- Multivariate statistical procedures for classification of forensic evidence

## **CURRENT RESEARCH**

- Developing high-resolution mass spectrometry (MS) methods for rapid characterization of synthetic designer drug analogs according to structural class
- Investigating the association and discrimination of ignitable liquids using gas chromatography-mass spectrometry (GC-MS) and multivariate statistical procedures
- Developing MS methods for the characterization of plants of forensic interest, using multivariate statistical procedures for association and discrimination
- Investigating the persistence of gunshot residue in decomposing tissue samples using scanning electron microscopy-energy dispersive spectroscopy (SEM-EDS) and inductively-coupled plasma-mass spectrometry (ICP-MS)
- Developing ICP-MS methods and multivariate statistical procedures for the association and discrimination of forensic samples based on trace element profiles

## **GRADUATE COMMITTEES CHAIRED**

1. Kristen L. Reese. Association and Differentiation of Corresponding Unburned and Burned Smokeless Powders utilizing Physical Characteristics, Chemical Characteristics, and Multivariate Statistical Analysis. Masters, October 2015.
2. Rebecca J. Brehe. Overcoming Challenges in Fire Debris Analysis Caused by Evaporation. Masters, August 2015.
3. Fanny Chu. Improving Methods for the Analysis of Amphetamine-Type Stimulants. Masters, July 2015.
4. Jordyn L. Geiger. Development of Class Reference Standards for Multivariate Statistical Analysis of Fire Debris. Masters, August 2014.
5. John W. McIlroy. Effects of Data Pretreatment on the Multivariate Statistical Analysis of Chemically Complex Samples. Masters, March 2014.
6. Christine E. Hay. Elemental Analysis of Gunshot Residue to Differentiate Bullet Type and Firing Distance. Masters, September 2013.
7. Seth R. Hogg. Analysis of Lead-Free Ammunition by Scanning Electron Microscopy using Energy Dispersive X-Ray Spectroscopy and Discrimination of Samples using Principal Components Analysis. Masters, May 2013.
8. Emily G. Riddell. Differentiation of Paper Types using Elemental Profiles Generated using Inductively Coupled Plasma Optical Emission Spectroscopy and Inductively Coupled Plasma Mass Spectrometry. Masters, April 2013.
9. Melissa A. Bodnar Willard. Development and Application of a Statistical Approach to Establish Equivalence of Unabbreviated Mass Spectra. Doctoral (Co-chair), December 2012.
10. Monica L. Bugeja. Comparison of Gas Chromatography-Mass Spectrometry and Liquid Chromatography-Mass Spectrometry for Discrimination of *Salvia divinorum* and Related *Salvia* Species Using Chemometric Procedures. Masters, December 2012.
11. Suzanne E. Towner. An Investigation of Unsupervised and Supervised Multivariate Statistical Procedures for the Analysis of Fire Debris. Masters, August 2012.

12. Karlie M. McManaman. Effects of Extraction Procedure and Gas Chromatography Temperature Program on Discrimination of MDMA Exhibits using Impurity Profiles. Masters, July 2012.
13. Kaitlin R. Prather. Using Multivariate Statistical Procedures to Identify Ignitable Liquid Residues in the Presence of Interferences. Masters, July 2011.
14. Tiffany P. Van De Mark. Influence of Evaporation and Matrix Interferences on the Association and Discrimination of Ignitable Liquids using Chemometric Procedures. Masters, August 2010.
15. Ruth N. Udey. Differentiation of Bullet Type Based on Analysis of Gunshot Residue using Inductively Coupled Plasma Mass Spectrometry. Masters, May 2010.
16. Melissa A. Bodnar. Forensic Analysis of *Salvia divinorum* and Related *Salvia* Species using Chemometric Procedures. Masters, March 2010.
17. Patricia J. Joiner. Optimization of a Microwave-Assisted Extraction Procedure for the Extraction of Organic Impurities from Seized MDMA Tablets. Masters, August 2009.
18. Sarah C. Meisinger. Comparison of Extraction Procedures for the Extraction of Organic Impurities from Seized MDMA Tablets. Masters, August 2009.
19. Jamie M. Baernkopf. Association and Discrimination of Ignitable Liquids from Matrix Interferences using Chemometric Procedures. Masters, June 2009.
20. Lisa M. LaGoo. Persistence of GSR in Decomposing Tissue and Blowfly Larvae. Masters, May 2008.
21. Lucas J. Marshall. Association and Discrimination of Diesel Fuels using Chemometric Procedures for Forensic Arson Investigations. Masters, May 2008.
22. Jennifer M. Froelich. Development of a Small-Scale Single-Tube Proteomics Approach for the Analysis of Protein Biomarkers from Biological Threat Agents. Masters, April 2008.
23. Melissa S. Meaney. Separation and Quantitation of Nitrated Explosives using Thin-Layer Chromatography and Charge-Coupled Device Camera Imaging. Masters, October 2007.
24. Gwynyth Scherperel. Electrospray Ionization Mass Spectrometry for the Detection and Characterization of Smokeless Powders. Masters, August 2007.
25. Carl I.D. Newman. Microchip Separations of Alkaloids with UV-Absorbance Spectral Detection. Masters, July 2007.
26. Heather M. Dotzauer. Optimization of Headspace-Solid Phase Microextraction for the Extraction of Organic Impurities in Seized Ecstasy Tablets. Masters, June 2007.
27. Srividhya Kidambi. Analysis of Amphetamine and Methamphetamine by Surface- Enhanced Infrared Spectroscopy. Masters, May 2007.
28. Luther S. Schaeffer. The Persistence of Gunshot Residue on Decomposing Tissue. Masters, May 2007.
29. Agnieszka N. Steiner. Performance of the Reflected Ultraviolet Imaging System (RUVIS) in Visualizing Latent Fingerprints on Various Nonporous and Semiporous Surfaces. Masters, May 2007.

30. Elizabeth A. McGaw. Determination of Trace Elemental Concentrations in Document Papers for Forensic Comparison using Inductively Coupled Plasma-Mass Spectrometry. Masters, April 2007.
31. Kelly M. Greenough. Forensic Analysis of Cosmetic Face Powders. Masters, April 2007.
32. Audrey N. Martin. The Application of Single Particle Aerosol Mass Spectrometry for the Detection and Identification of High Explosives and Chemical Warfare Agents. Masters, November 2006.
33. Chadwick L. Douglass. Artificial Aging and the Effect on Adhesives and Backings of Office and Packaging Tapes. Masters, July 2006.
34. Ellyn L. Schuette. Enhanced Latent Fingerprint Detection in Missing and Exploited Children Investigations. Masters, August 2005.

### **UNDERGRADUATE RESEARCH DIRECTED**

1. Joshua Champine. Characterization of Smokeless Powders using Gas Chromatography-Mass Spectrometry, Liquid Chromatography-Mass Spectrometry, and Infrared Spectroscopy. Summer 2015-present.
2. Johanna M. Smeeckens. Quantifying Diesel Fuel Extracted from Water for Fuel Spill Remediation using Univariate and Multivariate Calibration Procedures. Summer 2011-Spring 2012.
3. Johanna M. Smeeckens. Optimization of Pulsed Pressure Injection Procedures for the Analysis of Ignitable Liquids using Gas Chromatography-Mass Spectrometry. Summer 2010-Spring 2011.
4. Emily G. Riddell. Effect of Pulsed Pressure Injection on the Analysis of Gasoline using Gas Chromatography-Mass Spectrometry and Chemometric Procedures. Summer 2009-Summer 2010.
5. Dahlia I. Campbell. Identification and Correlation of Potential Chemical Fingerprints in Diesel using Gas Chromatography and Mass Spectrometry. McNair/SROP Scholars Program, co-supervised with Dr. Victoria L. McGuffin. Summer 2006.

### **COURSES TAUGHT**

#### **Courses Taught at Michigan State University**

CJ805	Survey in Forensic Science (team-taught)	Fall 2005-present
CJ819	Forensic Analysis of Drugs and Alcohol	Fall 2005-present
CJ820	Forensic Chemistry and Trace Evidence	Spring 2006-present
FRS809	Issues in Forensic Science	Spring 2008-present
CJ809	Understanding Controlled Substances Analysis Online course	Spring 2010-present

CJ809                      Understanding Trace Evidence Analysis                      Spring 2010-present  
Online course

### **Courses Taught at Professional Meetings**

Workshop Instructor, *Statistical Comparison of Mass Spectral Data*  
Midwestern Association of Forensic Scientists 42<sup>nd</sup> Annual Fall Meeting, Dayton, OH,  
September 2013.  
Workshop Instructor, *Methods for Statistical Evaluation of Evidence Comparisons*  
Midwestern Association of Forensic Scientists 44<sup>th</sup> Annual Fall Meeting, Mackinac  
Island, MI, September 2015.

### **PROFESSIONAL AFFILIATIONS**

American Academy of Forensic Sciences, Fellow                      2005-present  
American Society for Mass Spectrometry, Member                      2005-present  
American Chemical Society, Member                      2002-2011

### **PROFESSIONAL SERVICE**

#### **Professional Service for Michigan State University, School of Criminal Justice**

- Reappointment, Promotion, and Tenure Advisory Subcommittee                      2013-2015
- Hearing Board                      2013-present
- Academic Policies Committee                      2006-2008
- Forensic Science Program Admissions Committee                      2005-present

#### **Professional Service for Michigan State University, College of Social Science**

- Curriculum Committee                      Spring 2014

#### **Professional Service for Michigan State University**

- Faculty Grievance Appeal Panel                      October 2015

#### **Professional Service for the Scientific Community, Editorial and Review Positions**

- Editorial Board for *Journal of Forensic Sciences*
- Technical Report Reviewer for National Institute of Justice
- Reviewer of Forensic Science II. Advanced Investigations  
Published by Cengage Learning
- Guest Editor for *Analytical and Bioanalytical Chemistry*  
Special Issue on Forensic Analysis (August 2009)
- Guest Reviewer for the following journals:
  - *Analytical Chemistry*
  - *Journal of Chromatography A*
  - *Rapid Communications in Mass Spectrometry*

- *Spectrochimica Acta Part B*
- *Forensic Science International*
- *Analyst*
- *Analytical Methods*

### **Professional Service for the Scientific Community, Leadership**

- Moderator, Annual Meeting of the American Academy of Forensic Sciences (2009, 2013, 2014)
- Symposium Organizer, Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Philadelphia, March 2013.  
*New and Emerging Analytical Technologies in Forensic Science*
- Panelist, *Strengthening Forensic Science through Connections with Analytical Sciences*, National Science Foundation Workshop, December 2012.
- Chair, American Chemical Society Local Section (MSU), 2009-2010.
- Symposium Organizer, Federation of Analytical Chemistry and Spectroscopy Societies Annual Meeting, Lake Buena Vista, FL. September 2006.  
*Highlighting the Diversity of Mass Spectrometry for Forensic Applications*

### **Professional Service for the Public**

- Co-Organizer, Crime Scene Investigation Program, East Lansing, 2012-present
- Supervisor, Science Olympiad Forensic Science Section (State Finals), East Lansing, 2005-present
- Organizer, Chemistry Day Forensic Science Demonstration, Lansing, 2005-2011
- Organizer, Girls Math Science Conference Forensic Science Demonstration, East Lansing, 2005-2009

## **PUBLICATIONS**

### **Peer-Reviewed Articles and Reviews**

1. S.R. Hogg, B.C. Hunter, and R. Waddell Smith. Elemental Characterization and Discrimination of Non-Toxic Ammunition using Scanning Electron Microscopy with Energy Dispersive X-Ray Analysis and Principal Components Analysis. *Journal of Forensic Sciences*. In press.
2. J.W. McIlroy, R. Waddell Smith, and Victoria L. McGuffin. Assessing the Effect of Data Pretreatment Procedures for Principal Components Analysis of Chromatographic Data. *Forensic Science International* **2015**, 257, 1.
3. K.M. McManaman; R. Waddell Smith. Effect of Extraction Procedure and Gas Chromatography Temperature Program on Discrimination of MDMA Exhibits. *Journal of Forensic Sciences* **2014**, 59, 327.

4. K.R. Prather; S.E. Towner; V.L. McGuffin; R. Waddell Smith. Effect of Substrate Interferences from High-Density Polyethylene on Association of Simulated Ignitable Liquid Residues to the Corresponding Liquid. *Journal of Forensic Sciences* **2014**, 59, 52.
5. M.A. Bodnar Willard; R. Waddell Smith; V.L. McGuffin. Statistical Approach to Establish the Equivalence of Unabbreviated Mass Spectra. *Rapid Communications in Mass Spectrometry* **2014**, 28, 83.
6. K.R. Prather; V.L. McGuffin; R. Waddell Smith. Effect of Evaporation and Matrix Interferences on the Association of Simulated Ignitable Liquid Residues to the Corresponding Liquid Standard. *Forensic Science International* **2012**, 222, 242.
7. M.A. Bodnar Willard; V.L. McGuffin; R. Waddell Smith. Forensic Analysis of *Salvia divinorum* using Multivariate Statistical Procedures. Part I: Discrimination from Related *Salvia* Species. *Analytical and Bioanalytical Chemistry* **2012**, 402, 833.
8. M.A. Bodnar Willard; V.L. McGuffin; R. Waddell Smith. Forensic Analysis of *Salvia divinorum* using Multivariate Statistical Procedures. Part II: Association of Adulterated Samples to *S. divinorum*. *Analytical and Bioanalytical Chemistry* **2012**, 402, 843.
9. P. J. Giebink; R. Waddell Smith. Development of Microwave-Assisted Extraction Procedure for Organic Impurity Profiling of Seized 3,4-Methylenedioxymethamphetamine. *Journal of Forensic Sciences* **2011**, 56, 1483.
10. R.N. Udey; B.C. Hunter; R. Waddell Smith. Differentiation of Bullet Type Based on Analysis of Gunshot Residue Using Inductively Coupled Plasma Mass Spectrometry. *Journal of Forensic Sciences* **2011**, 56, 1268.
11. J.M. Baerncof; V.L. McGuffin; R. Waddell Smith. Association of Ignitable Liquid Residues to Neat Ignitable Liquids in the Presence of Matrix Interferences using Chemometric Procedures. *Journal of Forensic Sciences* **2011**, 56, 71.
12. L.M. LaGoo; L.S. Schaeffer; David W. Szymanski; R. Waddell Smith. Detection of Gunshot Residue in Blowfly Larvae and Decomposing Porcine Tissue using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). *Journal of Forensic Sciences* **2010**, 55, 624.
13. J.M. Baerncof; V.L. McGuffin; R. Waddell Smith. Effect of GC Temperature Program on the Association and Discrimination of Diesel Samples. *Journal of Forensic Sciences* **2010**, 55, 185.
14. E.A. McGaw; D.W. Szymanski; R. Waddell Smith. Determination of Trace Elemental Concentrations in Document Papers for Forensic Comparison using Inductively Coupled Plasma Mass Spectrometry. *Journal of Forensic Sciences* **2009**, 54, 1163.
15. E.A. McGaw; D.W. Szymanski; R. Waddell Smith. Characterization of Undigested Particulate Material following Microwave Digestion of Recycled Document Papers. *Journal of Forensic Sciences* **2009**, 54, 1171.
16. R. Waddell Smith; V.L. McGuffin. The Need for Research in Forensic Science. Editorial for Special Issue on Forensic Analysis. *Analytical and Bioanalytical Chemistry* **2009**, 394, 1985.

17. L.J. Marshall; J.W. McIlroy; V.L. McGuffin; R. Waddell Smith. Association and Discrimination of Diesel Fuels using Chemometric Procedures. *Analytical and Bioanalytical Chemistry* **2009**, 394, 2049.
18. G.A. Scherperel; G.E. Reid; R. Waddell Smith. Characterization of Smokeless Powders using Nano electrospray Ionization Mass Spectrometry (nESI-MS). *Analytical and Bioanalytical Chemistry* **2009**, 394, 2019.
19. A.M. Hupp; L.J. Marshall; Dahlia I. Campbell; R. Waddell Smith; V.L. McGuffin. Chemometric Analysis of Diesel Fuel for Forensic and Environmental Applications. *Analytica Chimica Acta* **2008**, 606, 159.
20. R.J.H. Waddell Smith. A Review of Recent Advances in Profiling Illicit MDMA Samples. *Journal of Forensic Sciences* **2007**, 52, 1297.
21. N. NicDaéid; R.J.H. Waddell. The Analytical and Chemometric Procedures used to Profile Illicit Drug Seizures. *Talanta* **2005**, 67, 280.
22. D. Fliegel; R. Waddell; V. Majidi; D. Günther; C. Lewis. Quantification of Aromatic and Halogenated Hydrocarbons and Alcohol Mixtures at the Elemental, Structural, and Parent Molecular Ion Level. *Analytical Chemistry* **2005**, 77, 1847.
23. R. Waddell; C. Lewis; W. Hang; C. Hassell; V. Majidi. Inductively Coupled Plasma Mass Spectrometry for Elemental Speciation: Applications in the New Millennium. *Applied Spectroscopy Reviews* **2005**, 40, 33.
24. R. Waddell; D.E. Dale; M. Monagle; S.A. Smith. Determination of High Explosives from a PTFE Wipe using Thermal Desorption-Gas Chromatography with Electron-Capture Detection. *Journal of Chromatography A* **2005**, 1062, 125.
25. A. Nordon; R.J.H. Waddell; L.J. Bellamy; A. Gachagan; D. McNab; D. Littlejohn; G. Hayward. Monitoring of a Heterogeneous Reaction by Acoustic Emission. *Analyst* **2004**, 129, 463.
26. R.J.H. Waddell; N. NicDaéid; D. Littlejohn. Classification of Ecstasy Tablets using Trace Metal Analysis with the Application of Chemometric Procedures and Artificial Neural Network Algorithms. *Analyst* **2004**, 129, 235.
27. K.C. Carter; Y.S. Finnon; N. NicDaéid; D. Robson; R. Waddell. The Effect of Nitrostyrene on Cell Proliferation and Macrophage Immune Responses. *Immunopharmacology and Immunotoxicology* **2002**, 24, 2.
28. R.J.H. Waddell; D. Littlejohn; N. NicDaéid. Preliminary Studies Identifying and Quantifying Trace Metal Impurities in Illicit Ecstasy Tablets using Atomic Spectrometry Techniques. *Problems of Forensic Sciences* **2001**, 47, 413.

### Book Chapters

1. R. Waddell Smith. Chemometrics in Forensic Chemistry. In: J. Siegel, editor. *Forensic Chemistry: Fundamentals and Applications*. Chichester: John Wiley & Sons. In press.

2. S.A. Smith, R. Waddell Smith, Y. Xia, Z. Ouyang. Introduction to Mass Spectrometry. In: B. Pramanik, M.S. Lee, G. Chen, editors. *Characterization of Impurities and Degradants Using Mass Spectrometry*. New Jersey: John Wiley and Sons, 2011.

### **Encyclopedia Articles**

1. Ruth Waddell Smith. Mass Spectrometry. In: Siegel J.A. and Saukko P.J. (eds) *Encyclopedia of Forensic Sciences*, Second Edition, pp.603-608. Waltham: Academic Press, 2013.
2. Ruth Waddell Smith. Gas Chromatography. In: Embar-Seddon, A., Pass, A.D., editors. *Forensic Science*. Hackensack, NJ: Salem Press, 2008.
3. Ruth Waddell Smith. Mass Spectrometry. In: Embar-Seddon, A., Pass, A.D., editors. *Forensic Science*. Hackensack, NJ: Salem Press, 2008.
4. Ruth Waddell Smith. Fourier Transform Infrared Spectrophotometer. In: Embar-Seddon, A., Pass, A.D., editors. *Forensic Science*. Hackensack, NJ: Salem Press, 2008.
5. Ruth Waddell Smith. Gunshot Residue. In: Embar-Seddon, A., Pass, A.D., editors. *Forensic Science*. Hackensack, NJ: Salem Press, 2008.
6. Ruth Waddell Smith. Glass (including optical properties). In: Embar-Seddon, A., Pass, A.D., editors. *Forensic Science*. Hackensack, NJ: Salem Press, 2008.
7. Ruth Waddell Smith. Microcrystalline tests. In: Embar-Seddon, A., Pass, A.D., editors. *Forensic Science*. Hackensack, NJ: Salem Press, 2008.
8. Ruth Waddell Smith. Separation tests. In: Embar-Seddon, A., Pass, A.D., editors. *Forensic Science*. Hackensack, NJ: Salem Press, 2008.

### **Presentations at Meetings and Conferences**

(\*Denotes invited presentation; presenter underlined)

1. Melissa A. Bodnar-Willard, Ruth Waddell Smith\*, and Victoria L. McGuffin. Statistical Method for Comparison of Mass Spectra: Applications for the Identification of Controlled Substances. Oral presentation at the SciX Conference, Providence, RI. September 2015.
2. Alexandria Anstett and Ruth Waddell Smith. Absolute and Kendrick Mass Defects for the Characterization of Synthetic Phenethylamines According to Structural Subclass. Poster presentation at the 44<sup>th</sup> Annual Meeting of the Midwestern Association of Forensic Scientists, Mackinac Island, MI. September 2015.
3. Trevor E. Curtis, John Buchweitz, and Ruth Waddell Smith. Elemental Analysis of Tattoo Inks for Color Differentiation. Poster presentation at the 44<sup>th</sup> Annual Meeting of the Midwestern Association of Forensic Scientists, Mackinac Island, MI. September 2015.
4. Fanny Chu and Ruth Waddell Smith. Mass Defect Filters for the Classification of Emerging Synthetic Designer Drug Analogs. Poster presentation at the 63<sup>rd</sup> American Society for Mass Spectrometry & Allied Topics Annual Meeting, St. Louis, MO. June 2015.

5. Fanny Chu and Ruth Waddell Smith. Quantification of Controlled Substances in Simulated Samples using ATR-FTIR and Principal Components Regression. Oral presentation at the 67<sup>th</sup> American Academy of Forensic Sciences Annual Meeting, Orlando, FL. February 2015.
6. Rebecca J. Brehe, John W. McIlroy, Ruth Waddell Smith, and Victoria L. McGuffin. Mathematical Modeling of Evaporated Petroleum Distillate Standards. Poster presentation at the 67<sup>th</sup> American Academy of Forensic Sciences Annual Meeting, Orlando, FL. February 2015.
7. \*Fanny Chu and Ruth Waddell Smith. Mass Defect Filters for Classification of Synthetic Designer Drugs. Oral presentation at the American Society for Mass Spectrometry Sanibel Conference, Clearwater Beach, FL. January 2015.
8. Fanny Chu and Ruth Waddell Smith. Development of Mass Defect Filters for the Classification of Synthetic Phenethylamines. Poster presentation at the 43<sup>rd</sup> Annual Meeting of the Midwestern Association of Forensic Scientists, St. Paul, MN. October 2014.
9. Rebecca Brehe, Victoria L. McGuffin, and Ruth Waddell Smith. Investigation of Factors Influencing Evaporation of Gasoline. Poster presentation at the 43<sup>rd</sup> Annual Meeting of the Midwestern Association of Forensic Scientists, St. Paul, MN. October 2014.
10. \*John W. McIlroy, Ruth Waddell Smith, and Victoria L. McGuffin. Evaluation of Data Pretreatment Procedures for Forensically Relevant Samples. Oral presentation at the SciX Conference, Reno, NV. September 2014.
11. Jordyn L. Geiger, Victoria L. McGuffin, and Ruth Waddell Smith. Further Investigation of Principal Components Analysis for Identification of Ignitable Liquids in Fire Debris. Poster presentation at the 65<sup>th</sup> Annual Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Chicago, IL. March 2014.
12. Ruth Waddell Smith and Andrew T. DeJarnette. Applications of Multivariate Statistical Procedures for the Identification of Controlled Substances. Oral presentation at the 66<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, Seattle, WA. February 2014.
13. Jordyn L. Geiger, Victoria L. McGuffin, and Ruth Waddell Smith. Classification Procedures for Identification of Ignitable Liquids in Fire Debris. Poster presentation at the 42<sup>nd</sup> Annual Meeting of the Midwestern Association of Forensic Scientists, Dayton, OH. September 2013.
14. John W. McIlroy, Victoria L. McGuffin, and Ruth Waddell Smith. Applications of Multivariate Statistics in Forensic Science. Oral presentation at the 64<sup>th</sup> Annual Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Philadelphia, PA. March 2013.
15. Andrew T. DeJarnette, Victoria L. McGuffin, and Ruth Waddell Smith. Investigation of Soft Independent Modeling of Class Analogy for the Classification of Ignitable Liquids in Simulated Fire Debris. Poster presentation at the 64<sup>th</sup> Annual Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Philadelphia, PA. March 2013.
16. Melissa A. Bodnar Willard, Victoria L. McGuffin, and Ruth Waddell Smith. Statistical Comparison of Mass Spectral Data in the Identification of Amphetamine-Type Stimulants.

Oral presentation at the 65<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, Washington D.C. February 2013.

17. Andrew T. DeJarnette, Victoria L. McGuffin, and Ruth Waddell Smith. Principal Components Analysis and Hierarchical Cluster Analysis for the Identification of Ignitable Liquids in Simulated Fire Debris. Oral presentation at the 65<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, Washington D.C. February 2013.
18. Emily G. Riddell and Ruth Waddell Smith. Characterization and Differentiation of Document Papers based on Element Profiles. Oral presentation at the 65<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, Washington D.C. February 2013.
19. Seth R. Hogg, Brian C. Hunter, and Ruth Waddell Smith. Analysis of Lead-Free Ammunition by Scanning Electron Microscopy using Energy Dispersive X-Ray Spectroscopy and Discrimination of Samples using Multivariate Statistical Methods. Oral presentation at the 65<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, Washington D.C. February 2013.
20. \*Ruth Waddell Smith. Multivariate Statistical Procedures in Fire Debris Analysis. Oral presentation at Adrian College, Adrian, MI. October 2012.
21. Emily G. Riddell and Ruth Waddell Smith. Elemental Analysis of Document Papers using Inductively Coupled Plasma Optical Emission Spectroscopy. Oral presentation at the 41<sup>st</sup> Annual Meeting of the Midwestern Association of Forensic Scientists, Milwaukee, WI. September 2012.
22. Andrew T. DeJarnette, Victoria L. McGuffin, and Ruth Waddell Smith. Effect of Extraction Time and Temperature on Extraction of Ignitable Liquids from Fire Debris. Poster presentation at the 41<sup>st</sup> Annual Meeting of the Midwestern Association of Forensic Scientists, Milwaukee, WI. September 2012.
23. Johanna M. Smeekens, John W. McIlroy, and Ruth Waddell Smith. Investigating the Efficiency of Extracting Diesel Fuel from Water using Univariate and Multivariate Calibration Procedures. Poster presentation at the University Undergraduate Research and Arts Forum, Michigan State University, East Lansing, MI. April 2012.
24. Karlie M. McManaman and Ruth Waddell Smith. Comparison of Analytical Methods for Ecstasy Profiling. Poster presentation at the 4<sup>th</sup> Annual Graduate Academic Conference, Michigan State University, East Lansing, MI. March 2012.
25. Suzanne E. Towner, Victoria L. McGuffin, and Ruth Waddell Smith. Identification of Gasoline, Kerosene, and Lighter Fluid in Simulated Fire Debris Samples of Surface-Treated Wood Flooring. Poster presentation at the 4<sup>th</sup> Annual Graduate Academic Conference, Michigan State University, East Lansing, MI. March 2012.
26. Kaitlin R. Prather, Suzanne E. Towner, Victoria L. McGuffin, and Ruth Waddell Smith. Investigating the Use of Multivariate Statistical Procedures in Fire Debris Analysis. Oral presentation at the presentation at the 63<sup>rd</sup> Annual Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Orlando, FL. March 2012.

27. Johanna M. Smeekens, John W. McIlroy, and Ruth Waddell Smith. Investigating the Extraction of Diesel Fuel from Water for Fuel Spill Remediation. Poster presentation at the presentation at the 63<sup>rd</sup> Annual Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Orlando, FL. March 2012.
28. Monica L. Bugeja, Victoria L. McGuffin, and Ruth Waddell Smith. Objective Discrimination of *Salvia divinorum* from related *Salvia* species using Chromatographic Techniques and Multivariate Statistical Procedures. Oral presentation at the 64<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, Atlanta, GA. February 2012.
29. Christine E. Hay, Brian C. Hunter, and Ruth Waddell Smith. Elemental Analysis of Gunshot Residue to Differentiate Bullet Type and Firing Distance. Oral presentation at the 64<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, Atlanta, GA. February 2012.
30. Karlie M. McManaman and Ruth Waddell Smith. Differentiation of MDMA Exhibits using Liquid-Liquid Extraction, Headspace Solid Phase Microextraction, and Gas Chromatography-Mass Spectrometry. Oral presentation at the 64<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, Atlanta, GA. February 2012.
31. Suzanne E. Towner, Kaitlin R. Prather, Victoria L. McGuffin, and Ruth Waddell Smith. The Association and Discrimination of Gasoline and Lighter Fluid Using Multivariate Statistical Procedures in the Presence of Evaporation, Thermal Degradation, and Matrix Interferences from Surface-Treated Wood. Oral presentation at the 64<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, Atlanta, GA. February 2012.
32. Suzanne E. Towner, Kaitlin R. Prather, Victoria L. McGuffin, and Ruth Waddell Smith. Effect of Evaporation, Matrix Interferences, and Thermal Degradation on the Association and Discrimination of Ignitable Liquids Extracted from High Density Polyethylene. Poster presentation at the 40<sup>th</sup> Annual Meeting of the Midwestern Association of Forensic Scientists, Chicago, IL. September 2011.
33. Karlie M. McManaman and Ruth Waddell Smith. Comparison of Gas Chromatography Temperature Programs in MDMA Profiling. Poster presentation at the 40<sup>th</sup> Annual Meeting of the Midwestern Association of Forensic Scientists, Chicago, IL. September 2011.
34. John W. McIlroy, Gavin E. Reid, and Ruth Waddell Smith. Lipid Profiling of Decomposed Tissue by Nano-Electrospray Ionization Tandem Mass Spectrometry for Postmortem Interval Determination. Oral presentation at the 42<sup>nd</sup> Central Regional Meeting of the American Chemical Society, Indianapolis, IN. June 2011.
35. Kaitlin R. Prather, Victoria L. McGuffin, and Ruth Waddell Smith. Using Multivariate Statistical Procedures to Identify Ignitable Liquid Residues in the Presence of Interferences. Oral presentation at the 42<sup>nd</sup> Central Regional Meeting of the American Chemical Society, Indianapolis, IN. June 2011.
36. Monica L. Bugeja, Melissa A. Bodnar Willard, Victoria L. McGuffin, and Ruth Waddell Smith. Discrimination of *Salvia divinorum* from Related *Salvia* Species using Chromatographic Techniques and Chemometric Procedures. Oral presentation at the 42<sup>nd</sup> Central Regional Meeting of the American Chemical Society, Indianapolis, IN. June 2011.

37. Johanna M. Smeekens, John W. McIlroy, and Ruth Waddell Smith. Optimization of the Extraction of Diesel Fuel from Water for Fuel Spill Clean-Up Applications. Poster presentation at the University Undergraduate Research and Arts Forum, Michigan State University, East Lansing, MI. April 2011.
38. Kaitlin R. Prather, Victoria L. McGuffin, and Ruth Waddell Smith. Analysis of Fire Debris using Gas Chromatography-Mass Spectrometry and Multivariate Statistical Procedures. Poster presentation at the 3<sup>rd</sup> Annual Graduate Academic Conference, Michigan State University, East Lansing, MI. March 2011.
39. Kaitlin R. Prather, Victoria L. McGuffin, and Ruth Waddell Smith. Effects of Matrix Interference, Weathering, and Thermal Degradation on the Association of Ignitable Liquid Residues to Neat Ignitable Liquids. Oral presentation at the 63<sup>rd</sup> Annual Meeting of the American Academy of Forensic Sciences, Chicago, IL. February 2011.
40. Monica L. Bugeja, Melissa Bodnar Willard, Victoria L. McGuffin, and Ruth Waddell Smith. Development of a Chemical Fingerprint for *Salvia divinorum* using Liquid Chromatography-Mass Spectrometry for Association and Discrimination from Related *Salvia* Species. Poster presentation at the 63<sup>rd</sup> Annual Meeting of the American Academy of Forensic Sciences, Chicago, IL. February 2011.
41. Emily G. Riddell, Christine E. Hay, Johanna M. Smeekens, and Ruth Waddell Smith. Multivariate Statistical Procedures for the Analysis of Questioned Documents. Poster presentation at the 63<sup>rd</sup> Annual Meeting of the American Academy of Forensic Sciences, Chicago, IL. February 2011.
42. Kaitlin R. Prather, Victoria L. McGuffin, and Ruth Waddell Smith. Effects of Matrix Interference and Weathering on the Association of Ignitable Liquid Residues to Neat Ignitable Liquids. Poster presentation at the 39<sup>th</sup> Annual Meeting of the Midwestern Association of Forensic Scientists, Kansas City, MO. October 2010.
43. Monica L. Bugeja, Melissa A. Bodnar Willard, Victoria L. McGuffin, and Ruth Waddell Smith. Comparison of Methods for the Extraction of Volatile Compounds from *Salvia divinorum*. Poster presentation at the 39<sup>th</sup> Annual Meeting of the Midwestern Association of Forensic Scientists, Kansas City, MO. October 2010.
44. \* Ruth Waddell Smith. Trace Evidence. Oral presentation for the Crime Scene Investigation Summer Camp, Gifted and Talented Education, Honors College, Michigan State University, East Lansing, MI. June 2010.
45. \* Ruth Waddell Smith. Are University Forensic Science Programs Meeting the Needs of Forensic Science Laboratories. Oral Presentation at the Forensic Science Education Forum, IUPUI, Indianapolis, IN. June 2010.
46. Emily G. Riddell, John W. McIlroy, Victoria L. McGuffin, and Ruth Waddell Smith. Effect of Pulsed Pressure Injection on the Analysis of Gasoline using Gas Chromatography-Mass Spectrometry and Chemometric Procedures. Poster presentation at the University Undergraduate Research and Arts Forum, Michigan State University, East Lansing, MI. April 2010.

47. Melissa A. Bodnar, Victoria L. McGuffin, and Ruth Waddell Smith. Forensic Analysis of *Salvia divinorum* and Related Salvia Species Using Chemometric Procedures. Oral presentation at the 62<sup>nd</sup> Annual Meeting of the American Academy of Forensic Sciences, Seattle, WA. February 2010.
48. Ruth N. Udey, Brian C. Hunter, and Ruth Waddell Smith. Differentiation of Bullet Type Based on Analysis of Gunshot Residue Using Inductively Coupled Plasma-Mass Spectrometry. Oral presentation at the 62<sup>nd</sup> Annual Meeting of the American Academy of Forensic Sciences, Seattle, WA. February 2010.
49. John W. McIlroy and Ruth Waddell Smith. Use of Volatile Organic Compounds and Chemometric Procedures to Determine Postmortem Interval. Poster presentation at the 62<sup>nd</sup> Annual Meeting of the American Academy of Forensic Sciences, Seattle, WA. February 2010.
50. Emily G. Riddell, John W. McIlroy, Victoria L. McGuffin, and Ruth Waddell Smith. Effect of Pulsed Pressure Injection on the Analysis of Gasoline using Gas Chromatography-Mass Spectrometry and Chemometric Procedures. Poster presentation at the 62<sup>nd</sup> Annual Meeting of the American Academy of Forensic Sciences, Seattle, WA. February 2010.
51. Tiffany P. Van De Mark, Melissa A. Bodnar, Victoria L. McGuffin, and Ruth Waddell Smith. Effects of Matrix Interferences on the Identification of Mixed Ignitable Liquids in Fire Debris Using Chemometric Procedures. Poster presentation at the 62<sup>nd</sup> Annual Meeting of the American Academy of Forensic Sciences, Seattle, WA. February 2010.
52. Patricia J. Joiner and Ruth Waddell Smith. Comparison of Extraction Procedures for Organic Impurity Profiling of Seized MDMA. Oral presentation at the Joint Meeting of the Southwestern, Southern, Midwestern, and Mid-Atlantic Associations of Forensic Scientists, Orlando, FL. October 2009.
53. Tiffany P. Van De Mark, Melissa A. Bodnar, Victoria L. McGuffin, and Ruth Waddell Smith. Association of Evaporated Ignitable Liquids to their Neat Counterparts using Pearson Product Moment Correlation Coefficients and Principal Components Analysis. Poster Presentation at the Joint Meeting of the Southwestern, Southern, Midwestern, and Mid-Atlantic Associations of Forensic Scientists, Orlando, FL. October 2009.
54. \*Ruth Waddell Smith. Chromatography and Mass Spectrometry: Analysis of Controlled Substances and Fire Debris. Guest lecture for LAW 623F Trial Practice Institute: Forensic Science, College of Law, Michigan State University, East Lansing, MI. September 2009.
55. \*Ruth Waddell Smith. Chromatography and Mass Spectrometry: Theory and Instrumentation. Guest lecture for LAW 623F Trial Practice Institute: Forensic Science, College of Law, Michigan State University, East Lansing, MI. September 2009.
56. \*Ruth Waddell Smith. Forensic Science at Michigan State University. Oral presentation for the Crime Scene Investigation Program, Gifted and Talented Education, Honors College, Michigan State University, East Lansing, MI. June 2009.

57. \*Ruth Waddell Smith. Trace Evidence. Oral presentation for the Crime Scene Investigation Program, Gifted and Talented Education, Honors College, Michigan State University, East Lansing, MI. June 2009.
58. \*John. W. McIlroy, Jamie M. Baernkopf, Ruth Waddell Smith, A. Daniel Jones, and Victoria L. McGuffin. Association of Evaporated Ignitable Liquids Using Gas Chromatography-Mass Spectrometry and Chemometric Procedures. Oral presentation at the Central Regional Meeting of the American Chemical Society, Cleveland, OH. May 2009.
59. \*Patricia J. Joiner and Ruth Waddell Smith. Optimization of a microwave-assisted extraction (MAE) procedure for the extraction of organic impurities from seized MDMA tablets. Oral presentation at the Central Regional Meeting of the American Chemical Society, Cleveland, OH. May 2009.
60. John W. McIlroy, Lucas J. Marshall, Ruth Waddell Smith, Victoria L. McGuffin. Pretreatment of Gas Chromatography-Mass Spectrometry Data prior to Chemometric Analysis. Poster presentation at the 60<sup>th</sup> Annual Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Chicago, IL. March 2009.
61. Melissa A. Bodnar, Ruth Waddell Smith, and Victoria L. McGuffin. Comparison of Gas Chromatography-Mass Spectrometry and Liquid Chromatography-Mass Spectrometry for Discrimination of Salvia Divinorum from Related Salvia Species using Chemometric Procedures. Poster presentation at the 60<sup>th</sup> Annual Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Chicago, IL. March 2009.
62. Jamie M. Baernkopf, Victoria L. McGuffin, and Ruth Waddell Smith. Discrimination of Ignitable Liquids from Burned Matrix Interferences using Chemometric Procedures. Oral presentation at the 61<sup>st</sup> Annual Meeting of the American Academy of Forensic Sciences, Denver, CO. February 2009.
63. Patricia J. Joiner and Ruth Waddell Smith. Optimization of a Microwave-Assisted Extraction/Headspace Solid Phase Microextraction (MAE/HS-SPME) Procedure for Organic Impurity Profiling of Seized MDMA. Poster presentation at the 61<sup>st</sup> Annual Meeting of the American Academy of Forensic Sciences, Denver, CO. February 2009.
64. \* Lisa LaGoo, Brian C. Hunter, David W. Szymanski, Ruth Waddell Smith. Chemical Identification of Gunshot Residue in Decomposing Tissue and Blowfly Larvae Samples using ICP-MS. Oral presentation at the Anachem Symposium, Livonia, MI. October 2008.
65. Jamie M. Baernkopf, Victoria L. McGuffin, and Ruth Waddell Smith. Effect of GC Temperature Program on the Discrimination of Diesel Samples for Forensic Arson Investigations. Oral presentation at the Fall Meeting of the Midwestern Association of Forensic Scientists, Des Moines, IA. October 2008.
66. Patricia J. Joiner and Ruth Waddell Smith. Development of a Microwave-Assisted Extraction/Headspace Solid Phase Microextraction (MAE/HS-SPME) Procedure for Organic Impurity Profiling of Seized MDMA Tablets. Poster presentation at the Fall Meeting of the Midwestern Association of Forensic Scientists, Des Moines, IA. October 2008.

67. Lisa LaGoo, Brian C. Hunter, David W. Szymanski, and Ruth Waddell Smith. Detection of Gunshot Residue from Decomposing Tissue Samples and Blowfly Larvae using ICP-MS. Poster presentation at the 35<sup>th</sup> Annual Meeting of the Federation of Analytical Chemistry and Spectroscopy Societies, Reno, NV. September 2008.
68. \*Ruth Waddell Smith. Chromatography and Mass Spectrometry-Theory and Instrumentation. Invited speaker for LAW 623F Trial Practice Institute: Forensic Science. September 2008.
69. \*Ruth Waddell Smith. Chromatography and Mass Spectrometry-Applications in Controlled Substance and Fire Debris Analysis. Invited speaker for LAW 623F Trial Practice Institute: Forensic Science. September 2008.
70. Sarah C. Meisinger, Patricia J. Joiner, and Ruth Waddell Smith. Development of a Microwave-Assisted Extraction Procedure for Organic Impurity Profiling of Seized MDMA Tablets. Poster presentation at the 236<sup>th</sup> American Chemical Society National Meeting and Exhibition, Philadelphia, PA. August 2008.
71. \*Ruth Waddell Smith. Chromatography. Oral presentation at the Forensic Science Educators Conference, Michigan State University, East Lansing, MI. August 2008.
72. \*David W. Szymanski and Ruth Waddell Smith. Glass, Paint and Soil Evidence. Oral presentation at the Forensic Science Educators Conference, Michigan State University, East Lansing, MI. August 2008.
73. \*Ruth Waddell Smith. Overview of the Forensic Science Program at Michigan State University. Oral presentation for the Crime Scene Investigation Program, Gifted and Talented Education, Honors College, Michigan State University, East Lansing, MI. June 2008.
74. Lucas J. Marshall, Amber M. Hupp, Ruth Waddell Smith, and Victoria L. McGuffin. Association and Discrimination of Diesel Fuels using Chemometric Procedures for Fire Debris Analysis in Forensic Arson Investigations. Oral presentation at the 60<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, Washington D.C. February 2008.
75. Lisa LaGoo, David W. Szymanski, and Ruth Waddell Smith. Correlation of GSR Persistence in Decomposing Tissue to GSR Persistence in Blowfly Larvae. Poster presentation at the 60<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, Washington D.C. February 2008.
76. Sarah C. Meisinger and Ruth Waddell Smith. Comparison of Extraction Procedures for Organic Impurity Profiling of Seized MDMA Tablets. Poster presentation at the 60<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, Washington D.C. February 2008.
77. Lucas J. Marshall, Amber M. Hupp, Ruth J.H. Waddell, and Victoria L. McGuffin. Association and Discrimination of Diesel Fuels using Chemometric Procedures for Arson Investigations. Poster presentation at the Fall Meeting of the Midwestern Association of Forensic Scientists, Traverse City, MI. September 2007.
78. Sarah C. Meisinger and Ruth J.H. Waddell. Optimization of Headspace-Solid Phase Microextraction (HS-SPME) for Organic Impurity Profiling of Seized MDMA Tablets.

- Poster presentation at the Fall Meeting of the Midwestern Association of Forensic Scientists, Traverse City, MI. September 2007.
79. Amber M. Hupp, Dahlia I. Campbell, Lucas J. Marshall, Ruth J.H. Waddell, and Victoria L. McGuffin. Chemical Fingerprinting of Diesel Fuels using GC-MS and Chemometric Methods for Forensic Analysis. Oral presentation at the 58<sup>th</sup> Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Chicago, IL. March 2007.
  80. Agnieszka Steiner and Ruth J.H. Waddell. Performance of the Reflected Ultraviolet Imaging System (RUVIS) in Visualizing Latent Fingerprints on Various Non-porous and Semi-porous Surfaces. Poster presentation at the 59<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, San Antonio, TX. February 2007.
  81. Luther S. Schaeffer and Ruth J.H. Waddell. Persistence of Gunshot Residue in Decomposing Tissue. Poster presentation at the 59<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, San Antonio, TX. February 2007.
  82. Heather M. Dotzauer and Ruth J.H. Waddell. Optimization of Solid-Phase Microextraction-GC-MS for the Extraction of Organic Impurities in Seized MDMA. Poster presentation at the 59<sup>th</sup> Annual Meeting of the American Academy of Forensic Sciences, San Antonio, TX. February 2007.
  83. \*Ruth J.H. Waddell, Dahlia I. Campbell, Amber M. Hupp, Victoria L. McGuffin. Forensic Discrimination of Diesel Samples. Oral presentation at the 33<sup>rd</sup> Annual Meeting of the Federation of Analytical Chemistry and Spectroscopy Societies, Lake Buena Vista, Florida, September 2006.
  84. Ruth Waddell, Don E. Dale, and Matthew Monagle. Thermal Desorption of HMX from a PTFE Wipe using Gas Chromatography with Electron-Capture Detection using a Dual Column-Dual Detector Configuration. Poster presentation at the 229<sup>th</sup> American Chemical Society Annual Meeting, San Diego, California, March 2005.
  85. Ruth Waddell, Cris L. Lewis, and D. Christian Hassell. Chemical Speciation of Hydrocarbon Mixtures using Gas Chromatography Time-of-Flight Mass Spectrometry with a Pulsed Glow Discharge Ion Source. Oral presentation at the 30<sup>th</sup> Annual Meeting of the Federation of Analytical Chemistry and Spectroscopy Societies, Fort Lauderdale, Florida, October 2003.