ROBERT E. SYNOVEC **April 10, 2023**

UNIVERSITY OF WASHINGTON, Seattle WA, USA
College of Arts and Sciences

Basic Data:

Department: Chemistry Date of last promotion: 2001
Academic Rank: Professor
Birth Date: March 4, 1959

Educational Background:

Institution	Degree	Dates
Bethel College, St. Paul, MN	B.A., Chemistry (Summa Cum Laude)	1977-1981
Iowa State University, Ames, IA	Ph.D., Anal. Chem.	1981-1986

Ph.D. dissertation title: "Instrumental and Computational Techniques for Obtaining Analytical Data in High Performance Liquid Chromatography"

Employment Record:

1978-1981, Teaching Assistant, Chemistry and Mathematics, Bethel College, St. Paul, MN.
1981-1982, Teaching Assistant, Iowa State University, Ames, IA.
1982-1986, Research Assistant, Iowa State University, Ames, IA.
1986-1992, Assistant Professor of Chemistry, University of Washington, Seattle, WA.
1992-2001, Associate Professor of Chemistry, University of Washington, Seattle, WA.
2001-present, Professor of Chemistry, University of Washington, Seattle, WA

Other Professional Positions and Memberships:

1983-present, American Chemical Society (ACS)
2007-2011, Faculty Director, Center for Process Analytical Chemistry (CPAC), UW
2007-2020, Associate Chair, Graduate Education Program, Department of Chemistry, UW
2022-present Co-Director, MS Applied Chemical Science and Technology Program, Department of Chemistry University of Washington, Seattle, WA
1992-2018, Assistant Editor for *TALANTA*
2018-2020, Associate Editor for *TALANTA*
2019-2022, Contributing Editor for *Trends in Analytical Chemistry (TrAC)*
2003-present, Editorial Board for *J. Chromatography A*
2020-present, Editorial Board for *Talanta*

2021-presnt, Editorial Board for *J. Chromatography Open*
2010-present, member of the GC×GC Symposium Scientific Committee

Fellowships, Honors and Awards:

1984, Alpha Chi Sigma Graduate Research Award in Analytical Chemistry, ISU
1984, ACS Fellowship, ACS Division of Analytical Chemistry, ISU
1985-1986, Phillips Petroleum Fellowship in Analytical Chemistry, ISU
1986, Excellence in Graduate Research Award, Iowa State University (ISU)
1999, DuPont Educational Aid Grant, DuPont
1999, Visiting Faculty, Royal Golden Jubilee PhD Program, Chiang Mai University, Chiang Mai, Thailand
2000, Amersham Pharmacia Professor in Residence, Molecular Dynamics, Sunnyvale, CA
2009, L. S. Palmer Award, Minnesota Chromatography Forum, Minneapolis, MN
2013, GC×GC Scientific Achievement Award, 10th GC×GC Int. Symposium, Palm Springs, CA
2016, Marcel Golay Lifetime Achievement Award, 40th ISCC Symposium, Riva del Garda, Italy

Brief Biographical Summary:

Robert E. Synovec is a Professor of Chemistry at the University of Washington (UW) in Seattle WA. He obtained his Ph.D. in 1986 from Iowa State University under the direction of Edward S. Yeung, and then joined the UW Faculty that year. He served as Associate Chair of the Chemistry Graduate Education Program from 2007-2020 and is currently the Co-Director of the MSACST Program (2022-present). Synovec has graduated 49 PhDs, 4 Thesis Masters, and 10 Non-Thesis Masters students, with 10 Post Docs and over 60 Undergraduate Researchers. His group pioneers the development of novel analytical instrumentation and methodology based upon chemical separation science, coupled with chemometric data analysis. The group investigates the basic principles of separation science, detection, and data analysis at both a fundamental and problem-solving level. He has nearly 300 publications, and over 670 research presentations which includes over 270 invited lectures and invited presentations. The tile-based Fisher ratio software pioneered by the group to perform discovery-based analysis of GC×GC-TOFMS data was licensed by LECO corportation, and now commercialized as *ChromaTOF Tile*. He co-chaired the International Symposium on Capillary Chromatography (ISCC) three times with Frank Svec: Portland, OR, 2009, San Diego, CA, 2011, and Palm Springs, CA, 2013. In May 2013, Synovec was awarded the GC×GC Scientific Achievement Award at the 10th GC×GC International Symposium. This award has been instituted to recognize the pioneering contributions of key scientists in promoting GC×GC instrumentation, method development and/or applications. In May 2016, Synovec received the Marcel Golay Award at the 40th ISCC meeting in Riva del Garda, Italy, which is presented annually to a scientist in recognition of a lifetime of achievement in capillary chromatography.

RESEARCH PROGRAM SUMMARY

The Synovec group is working in the areas of traditional analytical chemistry and bioanalytical chemistry, centered upon fundamental studies and applications of separation science. Primarily, we develop and apply gas chromatography (GC) based instrumentation, coupled with analytical methodology, chemical measurement science and multivariate data analysis (chemometrics). Overall, the group seeks to find a better fundamental understanding of the right balance of chemical separation and mathematical separation required to optimally glean the desired chemical information from analytical separation data. We complement our interest in developing and applying novel instrumentation and chemometrics with a deep interest in modeling the chromatographic separation processes based upon theory. Our theoretical modeling has provided fundamental insight and guidance for instrumental design improvements. Application of our separations technology in many exciting areas such as metabolomics, forensics, petroleum-based fuels, biofuels, and environmental systems are being explored.

In the area of GC, the fields of two-dimensional GC and chemometric data analysis are being integrated. Comprehensive two-dimensional GC instrumentation with time-of flight mass spectrometry detection (GC×GC-TOFMS) has been developed, improved upon, and applied, using two different modulation interfaces: flow-based and thermal-based. The GC×GC-TOFMS instrument provides an information-rich chemical fingerprint for complex samples, and the data is ideally suited for chemometric data analysis. Chemometrics plays a pivotal role in the analytical workflow for the translation of the raw data into useful information. We are exploring and developing advanced approaches for non-targeted discovery-based analysis of cross-sample comparisons of GC×GC–TOFMS data, coupled with robust deconvolution (decomposition), identification and quantification of meaningful analytes. Specifically, we have been developing Fisher-ratio (F-ratio) analysis, a statistically based data mining technique to discover analytes that distinguish sample classes based upon the experimental design. A recently developed tile-based F-ratio algorithm substantially improves chemical selectivity in the discovery process for the determination of an analyte "hit list." In turn, important features discovered by the F-ratio analysis, the "hits", are further analyzed using complementary chemometric methods. For this purpose, parallel factor analysis (PARAFAC), multivariate curve resolution alternating least squares (MCR-ALS), and a recently developed Signal-ratio algorithm have been shown to confidently analyze GC×GC–TOFMS data for many studies, readily providing analyte pure signal isolation, and analyte identification with quantification. For example, we are pioneering the development and implementation of the F-ratio software to find up- and down-regulated biomarker metabolites in metabolomics studies. Additionally, we are involved with forensic studies, where the goal is to find small concentration changes in chemical marker compounds that have significant forensic value.

The group has also developed comprehensive three-dimensional gas chromatography instrumentation (GC^3), which provides interesting opportunities to study selectivity advantages of three separation dimensions working in concert. The GC^3 research has been extended to include detection with TOFMS, producing a fourth order analytical instrument, opening new opportunities for chemometric analysis of complex data sets. Concurrently, work in the area of ultra-high-speed GC has been pioneered, with separations on the time scale of a chemical sensor (e.g., separations in the range of 50 ms to 500 ms). These ultra-high-speed GC separations are opening new opportunities in developing faster, more informative multi-dimensional GC instrumentation.

TEACHING

I have taught the following Lecture Courses the number of times indicated.

Chem 140, 142, 152	General Chemistry – 16 times
Chem 321	Quantitative Analysis – 50 times
Chem 426	Instrumental Analysis – 10 times
Chem 429 / 529	Chemical Separation Techniques – 37 times

RESEARCH SUPPORT / FUNDING

Funding/support has been obtained from the following sources.

Government / National Laboratories: USAF-AFRL, PNNL, ARL/ARO-DOD, NIH, DOE, LLNL/DOE, DARPA (Honeywell), NOAA, NSF-STTR, LANL, Idaho NEEL

Industry: Agilent, Applied Automation, ARCO, Ashland Chem. Co., ASTM-CRC Council, Boeing, BRASKEM Chem. Co., Cargill, Chevron, Dionex, DOW, DuPont, Hewlett Packard, Kraft, LECO, Restek, Rohm & Haas, Starbucks, Supelco, Union Carbide

University of Washington Research Centers: Center for Process Analytical Chemistry (CPAC), Washington Technology Center

INVITED LECTURES AND INVITED RESEARCH PRESENTATIONS

1985 University of Washington, Seattle, WA
SUNY Buffalo, Buffalo, NY

1986 University of Arizona, Tucson, AZ
University of Texas, Austin, TX
Texas A&M University, College Station, TX

1987 194th ACS National Meeting, New Orleans, LA

1988 2nd International Forum for Process Analytical Chemistry, Chicago, IL (**2 lectures**)
JANNAF Conference on Fuels and High Speed Flight Vehicles, Woods Hole, MA
ILS Conference, American Physical Society, Atlanta, GA

1989 Perkin-Elmer Corp., Norwalk, CT
SPIE Conference on Chemical, Biochemical and Environmental Sensors, Boston, MA
Union Carbide, South Charleston, WV

1990 4th International Forum for Process Analytical Chemistry, Houston, TX (**2 lectures**)
14th International Symposium on Liquid Chromatography (HPLC 1990), Boston, MA
Cargill Research, Wayzata, MN
21st Ohio Valley Chromatography Symposium, Hueston Woods Lodge, OH
Wright-Patterson AFB (USAF), Dayton, OH
Gordon Research Conference on Analytical Chemistry, New Hampton, NH
Texas Tech University, Lubbock, TX
FACSS Conference, Cleveland, OH
Washington State University, Pullman WA
SOQUE 13th Int. Conf. on Lasers and Applications (Lasers '90), San Diego, CA

1991 SPIE Conf. on Optical Methods for Ultrasensitive Detection and Analysis, Los Angeles, CA
SPIE Conf. on Environmental Sensing and Combustion Diagnostics, Los Angeles, CA
West 91 Conference, Seattle, WA
201st ACS National Meeting, Atlanta, GA
Shanghai Institute of Metallurgy, Shanghai, P.R. China
Hunan University, Changsha, P.R. China
Union Carbide, South Charleston, WV

1992 Exxon, Florham Park, NJ
Cargill, Sidney, OH
Wright-Patterson AFB (USAF), Dayton, OH

1993 206th ACS National Meeting, Chicago, IL

1994 207th ACS National Meeting, San Diego, CA
18th International Symposium on Liquid Chromatography (HPLC 1994), Minneapolis, MN
SPIE Conf. on Chemical, Biochemical, and Environmental Fiber Sensors, San Diego, CA

1995 University of Cincinnati, Cincinnati, OH
Applied Automation, Bartlesville, OK
Western Biotech Conference, San Diego, CA
University of Idaho, Moscow, ID

1996 Boeing, Seattle, WA
ACS Boulder Dam Section, Las Vegas, NV
1st CPAC Summer Institute, Seattle, WA
E. I. DuPont Co., Wilmington, DE
ARCO, Cherry Point Refinery, Blaine, WA

1997 11th International Forum for Process Analytical Chemistry, Blaine, WA
University of Washington, Seattle, WA
(50) 19th Int. Symposium on Capillary Chromatography (ISCC), Wintergreen, VA
2nd CPAC Summer Institute, Seattle, WA
DOW Chemical Corporation, Freeport, TX

1998 12th International Forum for Process Analytical Chemistry, Orlando, FL
MEMS Technical Advisory Committee Meeting, University of Washington, Seattle, WA
29th Ohio Valley Chromatography Symposium, Hueston Woods Lodge, OH
3rd CPAC Summer Institute, Seattle, WA
2nd MEMS Annual Workshop: Micro Structures - Mega Opportunities, Seattle, WA

1999 13th International Forum for Process Analytical Chemistry, San Antonio, TX
50th Pittsburgh Conference, Orlando, FL
21st ISCC, Park City, UT
4th CPAC Summer Institute, Seattle, WA
Chiang Mai University, Chiang Mai, Thailand (**2 lectures**)
Mahidol University, Bangkok, Thailand (**2 lectures**)
Visiting Faculty, Royal Golden Jubilee PhD Program, Chiang Mai University, Chiang Mai, Thailand
Akzo Nobel, Dobbs Ferry, NY
University of Arkansas, Fayetteville, AR
FACSS Conference, Vancouver, British Columbia, Canada

2000 14th International Forum for Process Analytical Chemistry, Las Vegas, NV
Sensors Technology Symposium (LANL), Santa Fe, NM
Texas Tech University, Lubbock, TX
83rd Canadian Society for Chemistry Conference, Calgary, Alberta, Canada
24th Int. Symp. on High Performance Liquid Phase Separations (HPLC 2000), Seattle, WA
5th CPAC Summer Institute, Seattle, WA
Gordon Research Conference on Bioanalytical Sensors, Proctor Academy, NH
Bristol-Myers Squibb, New Brunswick, NJ
4th International Conference on Environmetrics and Chemometrics, Las Vegas, NV
University of Alberta, Edmonton, Alberta, Canada
University of New Mexico, Albuquerque, NM
Ashland Chemical Co., Analytical Services and Technology, Dublin, OH
Molecular Dynamics, Sunnyvale, CA **(2 lectures)**

Amersham Pharmacia Professor in Residence

2001 15th International Forum for Process Analytical Chemistry, Amelia Island, FL
Arizona State University, Tempe, AZ
North Dakota State University, Fargo, ND
University of North Dakota, Grand Forks, ND
221st ACS National Meeting, San Diego, CA
24th ISCC, Las Vegas, NV
6th CPAC Summer Institute, Seattle, WA

2002 16th International Forum for Process Analytical Chemistry, San Diego, CA **(2 lectures)**
7th Int. Symp. on Hyphenated Techniques in Chromatography and Hyphenated Chromatographic Analyzers (HTC-7), Bruges, Belgium **(lecture and short course)**
85th Canadian Society for Chemistry Conference, Vancouver, British Columbia, Canada
Micronics, Redmond, WA
7th CPAC Summer Institute, Seattle, WA
8th Int. Conference on Chemometrics in Analytical Chemistry (CAC-2002), Seattle WA
USAF, Patrick AFB, Satellite Beach, FL

2003 16th Int. Symp. on Microscale Separations and Analysis (HPCE 2003), San Diego, CA
(101) 17th Int. Forum for Process Analytical Chemistry, Scottsdale, AZ **(2 lectures)**
1st Int. Symp. on GC × GC, Volendam, Netherlands
Food and Drug Administration (FDA) Practicum, Seattle, WA
CPAC Micro-Analytics Workshop, Seattle, WA
26th ISCC, Las Vegas, NV
8th CPAC Summer Institute, Seattle, WA
LECO, St. Joseph, MI **(2 lectures)**
Dow, Freeport TX
Gulf Coast Conference, Galveston, TX

2004 18th Int. Forum for Process Analytical Chemistry, Arlington, VA
8th International Symposium on Hyphenated Techniques in Chromatography and Hyphenated Chromatographic Analyzers (HTC-8), Bruges, Belgium – **Keynote**
17th Int. Symp. on Microscale Separations and Analysis (HPCE 2004), Salzburg, Austria
DOD Technology Program Review, Aberdeen Proving Ground, Edgewood, MD
9th CPAC Summer Institute, Seattle, WA
2nd Int. Symp. on GC × GC, Atlanta, GA – **Keynote**
University of Montana, Missoula, MT

2005 19th Int. Forum for Process Analytical Technology, Arlington, VA
Colorado State University, Society of Western Analytical Professors, Ft. Collins, CO
DOD Technology Program Review, MRI Florida Division, Melbourne, FL
PittCon 2005, Orlando, FL – **Keynote**
Minnesota Chromatography Forum, Earle Brown Heritage Center, Minneapolis, MN – **Keynote**
28th ISCC, Las Vegas, NV – **Keynote**
Dow Chemical Canada Inc., Fort Saskatchewan, Canada
79th ACS Colloid & Surface Science Symp., Clarkson University, Potsdam, NY – **Keynote**

10th CPAC Summer Institute, Lake Kachess Club House, WA
32nd FACSS and 51st ICASS, Quebec City, Canada – **Keynote**
Chico State University, Chico, CA
LECO Corporation, St. Joseph, MI

2006 DOD Technology Program Review, ENSCO, Melbourne, FL
PittCon 2006, Orlando, FL – **Keynote**
Florida State University, Tallahassee, FL
ExxonMobil, Corporate Strategic Research Laboratory, Clinton, NJ
Minnesota Chromatography Forum, Nye's Polonaise, Minneapolis, MN
11th CPAC Summer Institute, Seattle, WA
Pacific Northwest National Laboratory, Richland, WA
Fort Lewis College, Durango, CO
University of South Florida, Tampa, FL

2007 4th Int. Symp. Austrian Proteomics Platform, Seefeld, Austria – **Keynote**
University of Regensburg Medical School, Regensburg, Germany – **Keynote**
LECO Corporation, St. Joseph, MI
4th Int. Symposium on GC × GC, Dalian, China – **Keynote**
University of Alberta, Edmonton, Alberta, Canada
12th CPAC Summer Institute, Seattle, WA
Pacific Northwest National Laboratory, Richland, WA
31st ISCC, Albuquerque, NM – **Keynote**

2008 Boeing, Seattle, WA
10th International Symposium on Hyphenated Techniques in Chromatography and Hyphenated Chromatographic Analyzers (HTC-10), Bruges, Belgium – **Keynote**
PittCon 2008, New Orleans, LA – **Keynote**
(150) Purdue University, Bindley Bioscience Center, West Lafayette, IN
LECO Corporation, St. Joseph, MI
32nd International Symposium on High Performance Liquid Phase Separations and Related Techniques (HPLC 2008), Baltimore, MD – **Keynote**
Iowa State University, Ames, IA
5th GC × GC and 32nd ISCC, Riva del Garda, Italy – **Plenary**
13th CPAC Summer Institute, Seattle, WA
Pacific Northwest National Laboratory, Richland, WA
Siena Conference on Product and Process Optimization, Siena, Italy
Instituto per i Processi Chimico-Fisici, Pisa, Italy
Bethel University, Arden Hills, MN
University of St. Thomas, St. Paul, MN

2009 Association for Lab Automation (ALA09), Palm Springs, CA
PittCon 2009, Chicago, IL
Weyerhaueser Technology Center, Federal Way, WA
6th GC × GC and 33rd ISCC, Portland, OR – **Plenary lecture and short course**
14th CPAC Summer Institute, Seattle, WA

SRI, International, Menlo Park, CA
Kidney Research Institute, Seattle, WA
Idaho State University, Pocatello, ID
Oregon State University, Corvallis, ID
Pacific Northwest National Laboratory (PNNL), Richland, WA
Metabolomics Users Group (MUG), Seattle, WA

2010 Association for Lab Automation (ALA10), Palm Springs, CA
24th Int. Forum for Process Analytical Chemistry, Baltimore, MD **(2 lectures)**
7th GC × GC and 34th ISCC, Riva del Garda, Italy – **Plenary**
U.S. Army Research Laboratory (ARL), Adelphi, MD
Sandia National Laboratories, Albuquerque, NM
15th CPAC Summer Institute, Seattle, WA
PNNL, Richland, WA
2010 Int. Chemical Congress of the Pacific Basin Societies, Honolulu, Hawaii

2011 8th GC × GC and 35th ISCC, San Diego, CA – **Keynote lecture and short course**
Siemens Industry, Seattle, WA
PNNL, Richland, WA
ASMS Asilomar Conference on Mass Spectrometry, Pacific Grove, CA
Eli Lilly and Company, Indianapolis, IN
Joint Army-Navy-NASA-Airforce (JANNAF) Meeting, Hunstville, AL

2012 University of British Columbia, Vancouver, BC, CANADA
University of Montana, Missoula, MT
243rd National ACS Meeting, San Diego, CA
9th GC × GC and 36th ISCC, Riva del Garda, Italy **– Keynote lecture and short course**
2012 NWMRC Metabolomics Symposium, Seattle, WA
National Institute of Standards and Technology (NIST), Boulder, CO
ACS Rocky Mountain Regional Meeting, Denver, CO
University of Puget Sound, Tacoma, WA

2013 PittCon 2013, Philadelphia, PA
Seattle Pacific University, Seattle, WA
(200) JANNAF, Colorado Springs, CO
10th GC×GC and 37th ISCC, Palm Springs, CA **– GC×GC award lecture and short course**
PNNL, Richland, WA
AFRL/DLA Meeting, Fort Belvoir, VA
246th National ACS Meeting, Indianapolis, IN
Pacific University, Forest Grove, OR
U. of Puget Sound, Tacoma, WA

2014 PittCon 2014, Chicago, IL
Chemometrics in Analytical Chemistry (CAC International Conference), Richmond, VA
ACS Northwest Regional Meeting (NORM 2014), Missoula, MT
AMGEN, Thousand Oaks, CA
Gonzaga University, Spokane, WA
University of Puget Sound, Tacoma, WA

2015 12th GC × GC and 39th ISCC, Arlington, TX **– Keynote lecture and short course**
JANNAF, Nashville, TN
ACS Northwest Regional Meeting (NORM 2015), Pocatello, ID
LECO, St. Joseph, MI **(three lectures)**

2016 PittCon 2016, Atlanta, GA
ACS National Meeting, San Diego, CA
13th GC × GC and 40th ISCC, Riva del Garda, Italy **– Golay Award lecture, short course**
PNNL, Richland, WA
Applied Technology Center, FDA, Bothell, WA
SciX 2016, Minneapolis, MN
MARKES International, Sacramento, CA
Iowa State University, Ames, IA
University of Puget Sound, Tacoma, WA
JANNAF, Phoenix, AZ

2017 ACS National Meeting, San Francisco, CA
14th GC × GC and 41st ISCC, Arlington, TX **– Keynote lecture and short course**
ExxonMobil
IASH
PNNL
LANL
University of Puget Sound

2018 PittCon 2018, Orlando, Fl
15th GC × GC and 42nd ISCC, Riva del Garda, Italy **– Keynote lecture and short course**
JANNAF, Long Beach, CA
PNNL
University of Puget Sound

2019 Gonzaga University, Spokane, WA
16th GC × GC and 43st ISCC, Arlington, TX **– Keynote lecture and short course**
JANNAF, Dayton, OH
(250) PNNL
Honeywell/UOP, Chicago, IL
University of Puget Sound
JANNAF, Tampa, FL

2020 PittCon 2020
ASMS – LECO
LECO Symposium
University of Puget Sound

2021 LECO CCE-MSP
JANNAF
18th International GC×GC Symposium **– Keynote**
ACS National Meeting

AFRL Kickoff
5th International Caparica Conference on Sample Treatment
XI Congreso Argentino, Quimica Analytica – **Plenary**
PACIFICHEM

2022 13th Multidimensional Chromatography Workshop (MDCW) **– Keynote**
Seattle University
19th International GC×GC Symposium **– Keynote and short course**
(270) PNNL - Bioproducts Institute Seminar
University of Puget Sound

2023 20th International GC×GC Symposium **– Keynote**
Minnesota Chromatography Forum **– Keynote**

GRADUATE and UNDERGRADUATE RESEARCH STUDENTS, POST DOCS, COLLABORATORS and VISITING SCIENTISTS

Name	PhD Thesis Topic (title if granted)	Date PhD Degree Granted
Curtiss N. Renn	High Temperature Microbore Liquid Chromatography Separation and Detection	Spring, 1991
Veeravagu Murugaiah	Properties and Applications of Hydrodynamically Generated Concentration Gradients	Spring, 1993
Leslie K. Moore	High Temperature Gradient Techniques for Microbore Liquid Chromatography	Summer, 1993
Daniel B. Taylor	Speciation of Copper in Jet Fuel by High Performance Liquid Chromatography	Summer, 1993
Lawrence R. Lima III	Separation and Detection of Chromophore Lacking Analytes	Summer, 1994
Timothy J. Bahowick	Techniques for Rapid Chromatographic Analysis of Partially-Resolved Peaks Using Sequentially-Injected Samples and Single-Channel Detection	Summer, 1995
Marc D. Foster	Liquid Chromatographic Separation and Sensing Principles with a Water Only Mobile Phase	Autumn, 1996
Nels A. Olson	Development of an Analyzer for Surface Active Species in Flow Injection and Liquid Chromatography Environments	Autumn, 1997
Carsten A. Bruckner	Rapid Chromatographic Analysis Using Novel Detection Systems and Chemometric Techniques	Spring, 1998
Bryan J. Prazen	Development of High Speed Hyphenated Chromatographic Analyzers and Second Order Data Analysis Techniques	Summer, 1998

Jeanne M. Link	Mixed-Mode Chromatographic Separation and Whole Column Radiation Detection to Improve Sensitivity in Radiometabolite Analysis: Application to Carbon-11-Meta-Hydroxyephedrine in Plasma	Autumn, 1998
Toby E. Young	Water-Only Chemical Analysis Methodologies: Investigations of Water Liquid Chromatography, Subcritical Water Extraction, and Dynamic Surface Tension Detection	Autumn, 1998
M. Benton Free	Thermal Modulation of Microcalorimetric Sensors for Chemical Analysis	Autumn, 1999
Keith E. Miller	Dynamic Surface Tension Detector in Flow Injection Analysis and Liquid Chromatography	Spring, 2000
Carlos G. Fraga	GC × GC with Chemometric Pattern Recognition	Summer, 2000
Paul G. Vahey	Broadening the Applicability of Water Liquid Chromatography through Novel Methodologies and Micro-Fabrication	Autumn, 2000
Wes W. C. Quigley	The Analysis of Flowing Liquids Utilizing Drop-Based Instrumentation	Spring, 2002
Kevin J. Johnson	Stratagies for Chemometric Analysis of Gas Chromatographic Data	Spring, 2003
Colin D. Costin	Development of a Universal Microfluidic Detector for Applications in Separation Science and Process Monitoring	Autumn, 2003
Amanda E. (Moses) Sinha	Comprehensive Two-Dimensional Gas Chromatography Time-of-Flight Mass Spectrometry with Chemometric Analysis	Summer, 2004

Bethany A. Staggemeier	Dynamic Surface Tension Detection: Novel Applications to Continuous Flow Analysis and Interfacial Analysis	Autumn, 2004
Gwen M. L. Gross	The Development of Novel ChromatographicTools for Application in High-Speed and Multi-Dimensional Gas and Liquid Chromatography	Autumn, 2004
Janiece L. Hope	Comprehensive Gas Chromatography with Chemometric Data Analysis for Pattern Recognition and Signal Deconvolution of Complex Samples	Spring, 2005
Adam D. McBrady	Microfabricated Chromatographic Instrumentation for Micro Total Analysis Systems	Autumn, 2006
Karisa M. Pierce	Objectively Obtaining Information from Gas Chromatographic Separations Of Complex Samples using Novel Data Processing and Chemometric Techniques	Winter, 2007
Rachel E. Mohler	Discovery Based Yeast Metabolic Analysis using GC × GC – TOFMS and Chemometrics	Summer, 2007
Vanessa R. Reid	Novel Separation Technology for High-Speed GC: Theoretical and Experimental Approaches to Separation Optimization	Summer, 2008
Jamin C. Hoggard	Automation of Parallel Factor Analysis PARAFAC for Peak Resolution in GC × GC – TOFMS	Winter, 2008
Andrew W. Sulya	Annular Column Liquid Chromatography and other Enhancements in Instrumentation and Data Analysis for Conventional and Microbore High Performance Liquid Chromatography	Spring, 2009
Elizabeth M. Humston	Multi-Dimensional Separations and Data Analysis Technologies for the Elucidation Of Information from Complex Samples	Winter, 2010

Christopher W. Siegler	Development of Novel Multi-Dimensional Separation-Based Instrumentation and Data Analysis Strategies for Complex Samples	Winter, 2011
Jeremy S. Nadeau	Advanced Preprocessing Methods for Optimization of Chemometric Algorithms for Gas Chromatography	Spring, 2011
Ryan B. Wilson	Novel Injection Techniques to Enable, Fast, High Peak Capacity Gas Chromatography Separations	Summer, 2012
Luke C. Marney	Metabolomics and the Development of Nontarget Discovery Analysis Methods for GC × GC – TOFMS	Summer 2013
Benjamin Kehimkar	Fundamental Studies of Rocket Propellant Fuel using GC × GC – TOFMS Instrumentation With Chemometric Data Analysis	Summer, 2014
Brian D. Fitz	Advances in Instrumentation and Data Analysis Techniques for Increasing Peak Capacity and Peak Capacity Production in One and Two Dimensional Gas Chromatography	Summer, 2015
Brendon A. Parsons	Development and Application of Improvements to the Tile-based Fisher Ratio Method and Fundamental Instrument Considerations for Non-targeted Analysis using Two-Dimensional Gas Chromatography	Summer, 2016
Nathanial E. Watson	Development of Instrumental and Computational Methods for Accessing Information in Multi-Dimensional Gas Chromatography with Mass Spectrometry	Winter, 2017
Brooke C. Reaser	Advanced Chemometric Techniques for the Analysis of Complex Samples using 1D and 2D Chromatography coupled with TOFMS	Winter, 2017
David K. Pinkerton	Fundamental Considerations in One and Two Dimensional Chromatography for Improved Chemometric Analysis	Spring, 2017
Christopher E. Freye	Development of Instrumental and Chemometric Techniques for the Analysis of Complex Samples Via Multi-Dimensional Gas Chromatography	Spring 2018

H. Daniel Bahaghighat	Development of Ultra-Fast Modulation for Application in Multi-Dimensional Gas Chromatography	Spring 2018
Derrick V. Gough	Development of New Modulation Methods Using the Pulse Valve Modulator in Multidimensional Gas Chromatography	Winter 2020
Kelsey L. Berrier	Advances in Feature Selection in One- and Two-Dimensional Gas Chromatography with Mass Spectrometry	Summer 2020
Sarah E. Prebihalo	Advanced Chemometrics and Fundamental Considerations for Non-Targeted Analysis with Comprehensive Multidimensional Gas Chromatography coupled with Time-of-Flight Mass Spectrometry	Summer 2020
Paige E. Sudol	Investigation of Supervised and Unsupervised Discovery–Based Chemometric Tools to Expand the Scope of Multidimensional Gas Chromatography	Winter 2022
Timothy J. Trinklein	Development of Theory, Instrumentation, and Chemometric Tools for Comprehensive Two- and Three-Dimensional Gas Chromatography	Winter 2023
Sonia Schöneich	Advances in Instrumentation and Chemometric Analysisfor Multidimensional Chromatography with Mass Spectrometry Detection	Winter 2023
Grant S. Ochoa	Development of Chemometric Methodologies for Supervised Class-Based Discovery Experiments using GC×GC-TOFMS: Application to Aerospace Fuel	Spring 2023
Caitlin N. Cain		Current
Lina Mikaliunaite		Current
Austin Dobrecevich		Current

MS Students Supervised (Thesis title noted):

Darrell O. Hancock	Concentration Gradient Detection by Near-Infrared Diode-Laser Interferometry **(Thesis)**	Summer, 1988
Ana Kristine Torgerson	The H-Sensor: An Absorbance-Based	Winter, 2006

	Microfluidic Sensor **(Thesis)**	
Nathanial E. Watson	Techniques to Maximize Information in Multidimensional Chromatography and Mass Spectrometry **(Thesis)**	Spring, 2007
Yan Zhang	GC × GC – TOFMS of Metabolites	Spring, 2008
Mahmoud S. Al-Shaer	Process LC and NeSSI Applications	Summer, 2009
Jin H. Chen	Studies with GC	Summer, 2010
Irina Oelgiesser	Metabolomics and F-Ratio	Summer, 2012
Emilie A. Viglino	Forensic Analysis using GC × GC – TOFMS and Chemometrics	Autumn, 2012
Nicholas Moore	Development of GC × GC – HRTOFMS	Summer, 2017
Derrick V. Gough	Partial Modulation for Gas Chromatography **(Thesis)**	Spring, 2019
Warren P. Sadler	Studies of Cacao and Hops with GC-MS	Winter, 2020
Riley Rogan	Fundamental Study of the Agilent Invuto GC MSACST Program	Spring, 2021
Sunny Jiang	Analysis of Olefins using Bromination Chemistry and GC×GC-TOFMS MSACST Program	Spring, 2022
Joe Mohammad	Studies using the INTUVO GC MSACST Program	Spring, 2022
Robert Halvorsen		Current
Vlada Olkhovych		Current
Owen Lee		Current
Wenjing Ma		Current

Post Docs Supervised:

Bryan J. Prazen	May 1999-May 2005

Marc K. Boysworth	June 2001-May 2002
Louis Scampavia	January 2005 – June 2005
Karisa M. Pierce	March 2007 – June 2007
Thomas I. Dearing	April 2008 – September 2009
Jamin C. Hoggard	December 2008 – 2011 Research Staff Scientist 2011 – 2013
Elizabeth M. Humston	March 2010 – May 2011
Christopher W. Siegler	March 2011 – April 2011
Jeremy S. Nadeau	June 2011 – July 2011
Rachelle M. Burks	June 2011 – May 2012

Undergraduate Research Students Supervised:

Perry Thornton (1987 – 1988)	Riboflavin Analysis in Vitamins
Tara Felix-Slinn (1988 – 1989)	Oxalate Determination in Blood Plasma by an Ion Chromatographic Method (1 publication)
Sara Downing (1989 – 1990)	Protein-ICG Chemistry and Analysis
Darren Dunphy (1990 – 1993)	Application of the Sequential Chromatogram Ratio Technique, and Development of a Surface Tension Detector for HPLC (3 publications)
Chris Stork (1992 – 1993)	Analysis of DNA by Flow Injection Analysis and Fluorescence Detection
Leonardo Lopez (1993 – 1994)	Application of Dynamic Surface Tension Detector
Katerina Hutterer (1994 – 1995) **NSF-REU student**	Analysis of Wine Components, Synthetic Cork
Mike Kobel (1994 – 1995)	Use of Surfactants in RP-HPLC
Scott Ecker (1995 – 1998)	Water-Only RP-HPLC (3 publications)
Dana M. Alloway (1996) **NSF-REU student**	Pressure-Based Dynamic Surface Tension Detector (1 publication)
Christine Devine (1997 – 1998)	Analysis of High Fructose Corn Syrup by Water Liquid Chromatography

Jon Watts (1997)	Dynamic Surface Tension Detection
Marianne Cavleti (1998 – 2002)	High Speed GC of Complex Samples (1 Publication)
Sean Green (1999) **NSF-REU student**	LC of Surfactants and Proteins with a Water Mobile Phase
Drew Santos (2000)	Ion Chromatography of Natural Water Samples: an Environmental Study
Marcelle Ulep (2000)	Ion Chromatography of Natural Water Samples: an Environmental Study
Joshua Rains (2000)	Ion Chromatography of Natural Water Samples: an Environmental Study
Ingrid R. Dimalouw (2000 – 2001)	HPLC and Surface Tension Detection of Proteins
Jane Kim (2001 – 2002) **NASA Space GRANT (SURP)**	HPLC and Surface Tension Detection of Proteins
Janiece (Flick) Hope (Summer 2001)	High Speed GC of Complex Samples (1 Publication as UG)
Rob Coleman (2003 – 2004)	GC and LC of Complex Samples
Jessica Smith (Summer 2003)	GC of Complex Samples with Data Analysis
Matthew M. Van Wingerden (Winter 2004 – Spring 2005 and Autumn 2006 – Spring 2007) **Mary Gates Endowment for Students Research Training Grant (twice)**	GC, GC × GC and Chemometrics for High Throughput Analysis (1 Publication)
Elizabeth Spencer-Green (Summer 2004) **NSF-REU student**, Bucknell U.	High Speed GC
Bokyong (Christine) Chun (2004 – 2005)	Applications of Microfluidic Diffusion Coefficient Sensor
Elizabeth-Clare M. Reed (2004 – 2005)	Studies of High-Speed GC
Lianna F. Wood (2004 – 2006)	GC and GC × GC of Complex Samples with Chemometrics (1 Publication)
Michael J. Barker (2006 – 2007)	GC – MS
Toby E. Guetschow (2007 – 2007)	GC – MS
Hyun Seo (Kevin) Ahn (2007 – 2008)	SPME – GC × GC, ChromaTOF Peak Table Study
Diana C. Brosten (2007 – 2008)	SPME – GC of fuels and yeast cell head-space

Gregory F. Brabeck (2008 – 2009)	Study of Cacao Beans using SPME sampling
Tyler J. Carter (2008 – 2009)	GC × GC using ionic liquid columns
Brian D. Fitz (2008 – 2010)	GC × GC using ionic liquid columns, high speed GC
Jason T. Reed (2010 – 2010)	High speed GC
Jessica K. Cao (2010 – 2011)	SPME – GC/MS study of Cacao Beans
Andrew D. Haass (2010 – 2011)	Studies with GC-qMS instrumentation
Tina Lai (2011 – 2012)	High speed GC development
Lauren Alexander (2012 – 2013)	Metabolomics studies
Trinh K. Hoac (2011 – 2014)	Studies with diesel fuel samples and metabolomics
Brandyn C. Mannion (2011 – 2014)	High speed GC development
Carey Dixon (2013 – 2014)	Metabomomics studies
Khang To (2013 – 2014)	High speed GC development
Kyeong Min Yu (2013 – 2014)	High speed GC development
Kelli Stoneburner (2013 – 2014)	GC × GC and running integration
Christine Buffalow (2014 – 2015)	High speed GC with the LTM
Kia To (2014-2015)	High speed GC (1 publication)
Trin Hoac (2014-2015)	High speed GS (1 publication)
Lan Mu (2014 – 2016)	High temperature valve GC × GC (1 publication)
Ke Cui (Vicki) (2014 – 2016)	GC × GC × GC (1 publication)
Kendra Cochran (2014 – 2016)	LTM-GC
Anisha Uppugonduri (2016 – 2017)	PARAFAC studies
Dong H. Song (2018-2019)	GC with pulse valve modulation (1 publication)
Riley D. Rogan (2019-2020)	GC of cocoa
Arielle M. Bulmoja (2019-2020)	GC of metabolites
Cable G. Warren (2019-2021)	GC with pulse valve modulation (5 publications)
MacKenzie Marlahan (2019-2021)	GC of vaping products

Niza Matzick (2020-2022)	GC studies using the Intuvo GC
Jakob Klein (2023-present)	GC with membrance sampling

Visiting Scholars, Visiting Scientists, Visiting Graduate Students:

Emilia Bramanti	Institute for Chemical and Physical Processes (IPCF) – CNR, PISA Italy **(CNR Fellowship, Visiting Scientist, Summers: 1999, 2001, 2003, Spring 2006, Summer 2007, Summer 2008)**
Abdul Nabi	University of Balochistan, Quetta, Pakistan **Visiting Fulbright Fellow, January 2000-September2000**
Andy Weber	DOW Chemical Corporation, Freeport TX September 2000
Kate Gradpan	Chiang Mai University, Chiang Mai, Thailand Summer 1999, March 2004 **Royal Golden Jubilee PhD Program**
Mongkon Rayanakorn	Chiang Mai University, Chiang Mai, Thailand Summer 1999 **Royal Golden Jubilee PhD Program**
Jaroon Jakmunee	Chiang Mai University, Chiang Mai, Thailand March 2002 **Royal Golden Jubilee PhD Program**
Narong Lenghor	Chiang Mai University, Chiang Mai, Thailand 2002 – 2003 ***(Visiting Graduate Student)*** **Royal Golden Jubilee PhD Program**
Sumalee Tanikkul	Chiang Mai University, Chiang Mai, Thailand 2001 – 2003 ***(Visiting Graduate Student)*** **Royal Golden Jubilee PhD Program**
Yuthapong Udnan	Chiang Mai University, Chiang Mai, Thailand 2002 – 2003 ***(Visiting Graduate Student)*** **Royal Golden Jubilee PhD Program**
Rattikan (Jin) Chantiwas	Chiang Mai University, Chiang Mai, Thailand Summer 2004 (4 months) ***Visiting Scientist***
Supaporn Kradtap	Chiang Mai University, Chiang Mai, Thailand June 2004

Nisa Chawapun	Chiang Mai University, Chiang Mai, Thailand June 2004
Subhachai Jayasvasti	Chiang Mai University, Chiang Mai, Thailand June 2004
Sam Lucas	Battelle, Columbus, OH August 2002, May 2005
Erich Stozier	Battelle, Columbus OH June 2004, May 2005, December 2005
Terry Collier	3M, Engineering Systems Technology Center, St. Paul, MN July 2003
Gary Mallard	NIST, U.S. Dept. of Commerce, Gaithersburg, MD August 2004
Donald Young	Chevron-Texaco, Research and Technology, Richmond, CA May 2002, Nov. 2002, May 2003, Nov. 2003
Ulrich Bonne	Honeywell Laboratories, Plymouth, MN Nov. 2003, May 2004
Bob Wright	Pacific Northwest National Laboratory, Richland, WA Various visits 1998 - present
Jay Grate	Pacific Northwest National Laboratory, Richland, WA Various visits, 1999 – present
Elena Morosanova	Lomonosov Moscow State Univesity, Moscow, Russia Feb. – March, 2002
Jose Martinez Calatayud	Dept. of Analytical Chemistry, Facultad de Ciencias Quimicas, Universidad de Valencia, Valencia, Spain October 2003
Ricardo Santelli	Universidade Federal Fluminense, Instituto de Química, Rio de Janeiro, Brazil November 2004
Mark Merrick	LECO Corporation, St. Joseph MI August 2005
Carl Rechsteiner, Jr.	Chevron-Texaco, Research and Technology, Richmond, CA November 2004, May 2005, September 2005, November 2005
Wayne Rohrbaugh	Ashland Specialty Chemical Co., Columbus, OH November, 2004, May 2005
Ed Marti	Ashland Specialty Chemical Co., Columbus, OH May 2005

Daniel Dershowitz	Ashland Specialty Chemical Co., Columbus, OH May 2005, November 2005
Milton McDonnell	Honeywell, Morriston, NJ July 2005
Scott Ramos	Infometrix, Bothel, WA August 2005, March 2009
Brian Rohrback	Infometrix, Bothel, WA August 2005, March 2009
Cathy Zelenski	Midwest Research Institute, Kansas City, KS September 2005
John Van Scoy	Midwest Research Institute, Kansas City, KS September 2005
Chad Fisher	Midwest Research Institute, Kansas City, KS December 2005
Maribel Valero	Los Andes University, Merida, Venezuela Visiting Scholar, March-September 2006
Thomas Skov	Copenhagen University, Copenhagen, Denmark, March – May 2007. (Visiting Graduate Student)
Joshua Knowles	BBSRC David Phillips Fellow, School of Computer Science, The University of Manchester, UK, January – June 2009.
Nate Watson	Major, Course Director CH151/152, Department of Chemistry and Life Science, United States Military Academy (USMA), West Point, NY July 2009, Feb 2010
Beth Frinak	Postdoctoral Research Associate USMA Network Science Center, West Point, NY April 2010
Dan Burgard	Visiting Scholar University of Puget Sound, Tacoma, WA Summer 2011
Celina Monzon	Fulbright Scholar Argentina Nov 2019-Feb 2020
Meriem Gaida	Visiting Graduate Student OBiAChem Group University of Liège Liège, Belgium Oct 2022-Feb 2023

Collaborators (2000 – present):

Air Force Research Laboratory/RZSA, Edwards AFB: Matt Billingsley
Ashland Chemical Company: Dan Dershowitz, Wayne Rohrbaugh, Ed Marti
3M, Engineering Systems Technology Center: Terry Collier
Battelle, Columbus: Samuel Lucas, Erich Stozier
BiogenIdec: Maureen Lanan, Li Zang
Boeing: Bruce Davis, Paul Vahey, Oren Hadallar
Cargill: Colin Costin, Mike Blackburn
Chevron-Texaco, Research and Technology: Donald Young, Carl Rechsteiner, Jr.
Chiang Mai University, Department of Chemistry: Rattikan Chantiwas, Kate Grudpan, Jaroon Jakmunee, Narong Lenghor, Mongkon Rayanakorn, Sumalee Tanikkul, Yuthapong Udnan
Children's Hospital, Seattle: Rhona Jack
Copenhagen University: Rasmus Bro, Thomas Skov
DOW: Hernan Cortes, Andrew Weber
Eigenvector Research: Neal Gallagher, Barry Wise
Georgia Tech University, Mechanical Engineering Department: Peter Hesketh
Honeywell: Ulrich Bonne, Milton McDonnell, Adam Mc Brady
ICI: Jim Scrivens, Bill Campbell
Infometrix: Scott Ramos, Brain Rohrback
Insilicos: Erik Nilsson, Brian Pratt
Institute for Chemical and Physical Processes (IPCF) – CNR, PISA Italy: Chiara Allegrini, Francesca Beni, Emilia Bramanti, Fabrizio Ferri, Leonardo Lampugnani, Massimo Onor, Giorgio Raspi, Chandra Sortino, Maria Carla Spinetti
Johns Hopkins University, Whiting School of Engineering, Baltimore MD: Nicholas Keim
Kraft: Bob Magaletta, Carol Zrybko, Bruce Campbell
Lawrence Livermore National Laboratory: Olgica Bakajin, Michael Stadermann
Naval Research Laboratory, Chemical Dynamics and Diagnostics Branch: Kevin Johnson
New Mexico State University: Gary A. Eiceman, Satendra Prasad, Hartwig Schmidt
NIST, Boulder, CO: Tom Bruno
NIST, U.S. Dept. of Commerce, Gaithersburg, MD: Gary Mallard
Johns Hopkins University: Nicholas Keim, B. Hill-Lam, and J.C. Wilhelm
Pacific Northwest National Laboratory: Oleg Egorov, Carlos Fraga, Jay Grate, Kristin Jarman, David Nelson, Rhonda Skaggs, Jon Wahl, Bob Wright
Royal Institute of Technology, Dept. of Surface Chemistry, Stockholm, Sweden: Per Claesson
Seattle University, Department of Chemistry: Kristen Skogerboe
SRI International, Menlo Park, CA: Dave Flamm
Theo Chocolate, Seattle, WA: Andy McShea
United States Air Force Academy, Department of Chemistry: Carlos Fraga
United State Military Academy, West Point: Kenneth L. Cameron, Beth Frinak, J. Kenneth Wickiser
University of Balochistan, Department of Chemistry, Quetta, Pakistan: Abdul Nabi
University of Denver, Department of Chemistry and Biochemistry: Keith Miller
Univeristy of Texas, Arlington, Department of Chemistry: Dan Armstrong
University of Texas Southwestern Medical Center, Department of Biochemistry, Dallas, TX: Benjamin P. Tiu, Steven L. McKnight
University of Washington, Various Departments: Anatol Brodsky, Lloyd Burgess, Gary Christian, Bruce Kowalski, Brian Marquardt, Mel Koch, Mary Lidstrom, Jarda Ruzicka, Glenn VanBlaricom, Younan Xia, Elton (Ted) Young, Ken Dombek, Pete Rainey, Andrew Hoofnagle, Richard Palmiter, Thomas Montine, Sandra Juul, Rong Tian, Jonathan Himmelfarb
YKI, Institute for Surface Chemistry, Stockholm, Sweden: Bengt Kronberg

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Publications:

An * indicates an INVITED publication. An # indicates co-first author. Each entry is a peer reviewed manuscript unless noted otherwise. Principal author is underlined.

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2. "Quantitative Gel-Permeation Chromatography Without Standards," R.E. Synovec, E.S. Yeung, *J. Chromatogr.*, 1984, **283**, 183-190.

3. "Correlation of Elution Orders in Different Liquid Chromatographic Systems Without Analyte Identification," R.E. Synovec, E.S. Yeung, *Anal. Chem.,* 1984, **56**, 1452-1457.

4.* "Characterization of Crude Oils using Liquid Chromatography Without Standards," R.E. Synovec, E.S. Yeung, in *Characterization of Heavy Crude Oils and Petroleum Residues,* B. Tissot, Ed., Editions Technip, Paris, 1984, pp-268-272. **Invited, peer reviewed conference proceeding.**

5. "Quantitation of Components in Crude Oils using Liquid Chromatography Without Identification," R.E. Synovec, E.S. Yeung, *J. Chromatogr. Sci.,* 1985, **23**, 214-221.

6. "Improvement of the Limit of Detection in Chromatography by an Integration Method," R.E. Synovec, E.S. Yeung, *Anal. Chem.,* 1985, **57**, 2162-2167. (Patent Awarded)

7. "A Laser-Based Circular Dichroism Detector for Conventional and Microbore Liquid Chromatography," R.E. Synovec, E.S. Yeung, *Anal. Chem.,* 1985, **57**, 2606-2610.

8. "Comparison of an Integration Procedure to Fourier Transform and Data Averaging Procedures in Chromatographic Data Analysis," R.E. Synovec, E.S. Yeung, *Anal. Chem.,* 1986, **58**, 2093-2095.

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10.* "Detectors for Liquid Chromatography," E.S. Yeung, R.E. Synovec, *Anal. Chem.,* 1986, **58**, 1237A-1256A. **Invited, peer reviewed A-page article**.

11.* "Laser-Based Circular Dichroism Detection of Molecules in Flowing Systems using High-Frequency Polarization Modulation," R.E. Synovec, E.S. Yeung, *AIP Conf. Proc.*, 1987, **160** (Adv. Laser Sci.-2), 615-617. **Invited, peer reviewed conference proceeding.**

12. "Effect of Ultrasonic Agitation in High Performance Size Exclusion Chromatography," R.E. Synovec, E.S. Yeung, *J. Chromatogr.,* 1987, **388**, 105-112.

13. "Refractive Index Effects in Cylindrical Detector Cell Designs for Microbore High Performance Liquid Chromatography," R.E. Synovec, *Anal. Chem.,* 1987, **59**, 2877-2884.

14. "High Speed and Super Speed Size-Exclusion Chromatography of Polymers for Process Analysis," C.N. Renn, R.E. Synovec, *Anal. Chem.,* 1988, **60,** 200-204.

15. "Dual Beam Absorbance Measurements by Position Sensitive Detection," C. N. Renn, R. E. Synovec, *Anal. Chem.,* 1988, **60**, 1188-1193.

16. "Improved Detection in Super-Speed Size-Exclusion Chromatography by Reducing On-Column Dilution and Detector Noise," C. N. Renn, R. E. Synovec, *Anal. Chem.,* 1988, **60**, 1829-1832.

17. "Refractive Index Gradient Detection of Femtomole Quantities of Polymers by Microbore Size-Exclusion Chromatography," D. O. Hancock, R. E. Synovec, *Anal. Chem.,* 1988, **60**, 1915-1920.

18. "Rapid Characterization of Linear and Star-Branched Polymers by Concentration Gradient Detection," D. O. Hancock, R. E. Synovec, *Anal. Chem.,* 1988, **60**, 2812-2818.

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20. "Microbore LC and Refractive Index Gradient Detection of Low Nanogram and Low PPM Quantities of Carbohydrates," D. O. Hancock, R. E. Synovec, *J. Chromatogr.,* 1989, **464**, 83-91.

21. "Examination of the Automated Solute-Independent Calibration Technique," C. N. Renn, R. E. Synovec, *Anal. Chem.*, 1989, **61**, 1915-1921.

22. "Pointing Stability Limited, Dual Beam Absorbance Measurements by Position Sensitive Detection," C. N. Renn, R. E. Synovec, *Appl. Spectrosc.,* 1989, **43**, 1393-1398.

23.* "New Directions in Process Liquid Chromatography," R.E. Synovec, L.K. Moore, C.N. Renn, D.O. Hancock, *Am. Lab.,* 1989, October, 82-87. **Invited, non-peer reviewed article.**

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33.* "Liquid Chromatography: Equipment and Instrumentation," R.E. Synovec, E.L. Johnson, L.K. Moore, C.N. Renn, *Anal. Chem.,* 1990, **62**, 357R-370R. **Invited fundamental review.**

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Tile-based Fisher Ratio Analysis," T.J. Trinklein, R.E. Synovec, *J. Chromatogr. A*, 2022, **1677**, 463321. https://doi.org/10.1016/j.chroma.2022.463321

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287. "Using Solid Phase Extraction to Facilitate a Focused Tile-Based Fisher Ratio Analysis of Comprehensive Two-Dimensional Gas Chromatography Time-of-Flight Mass Spectrometry Data: Comparative Analysis of Aerospace Fuel Composition," G.S. Ochoa, M.C. Billingsley, R.E. Synovec, *Anal. Bioanal. Chem.*, October 1, 2022 (online), https://doi.org/10.1007/s00216-022-04348-1

288. "Application of Porous Layer Open Tubular Columns: Beyond Permanent Gases," L. Mikaliunaite, D.S. Bell, R.E. Synovec, *LCGC* North America, 2022, **40**, 476-483.

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290.* "GC×GC-TOFMS and Chemometric Data Analysis Applied to Aerospace Fuels: Modeling Thermal Stability of Complex Hydrocarbon Mixtures," G.S. Ochoa, C.N. Cain, R.E. Synovec, M.C. Billingsley, *Government Restricted Conference Proceeding, 13th JANNAF Liquid Propulsion Meeting*, Huntsville, AL, Dec 2022. **Invited Contribution**

291. "Valve-Based Comprehensive Two-Dimensional Gas Chromatography with Quadrupole Mass Spectrometry Detection using a Porous Layer Open Tubular Column in the First Dimension," L. Mikaliunaite, T.J. Trinklein, G.S. Ochoa, P.E. Sudol, D.S. Bell, R.E. Synovec, *J. Chromatogr. Open*, 2023, **3**, 100076, https://doi.org/10.1016/j.jcoa.2022.100076

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294. "Optimizing Column-to-Column Retention Time Alignment in High-Speed Gas Chromatography by Combining Retention Time Locking and Correlation Optimized Warping," R.C. Halvorsen[#], T.J. Trinklein[#], C.G. Warren, R.D. Rogan, R.E. Synovec, *Talanta*, 2023, **254**, 124173. https://doi.org/10.1016/j.talanta.2022.124173

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Variance Ranking," C.N. Cain, G.S. Ochoa, R.E. Synovec, *J. Chromatogr. A*, accepted 2023.

296. "Investigating Analyte Breakthrough Under Non-Linear Isotherm Conditions During Solid Phase Extraction Facilitated by Non-Targeted Analysis with Comprehensive Two-Dimensional Gas Chromatography Time-of-Flight Mass Spectrometry," G.S. Ochoa, R.E. Synovec, *Talanta*, accepted 2023.

297.* "Comprehensive Two-Dimensional Chromatography with Chemometric Data Analysis," C.N. Cain, T.J. Trinklein, S. Schöneich, G.S. Ochoa, S.C. Rutan, R.E. Synovec, Adv Chrom Chapter, in press, 2023. **Invited**

298.* "Recent Advances in Comparative Analysis for Comprehensive Two-Dimensional-Gas Chromatography-Mass Spectrometry Data," C.N. Cain, S. Schöneich, R.E. Synovec, with Alejandro C. Olivieri, Arsenio Muñoz de la Peña, Graciela M. Escandar and Héctor C. Goicoechea, editors, Elsevier. **Invited Book Chapter**

Abstracts or Accounts of Research Talks and Presentations:
(an * indicates an invited lecture or invited presentation, otherwise contributed)

1. "Getting More Detectability Out of Your Data," R.E. Synovec, E.S. Yeung, American Chemical Society (ACS) 190th National Meeting, September 1985, Chicago, IL, Division of Analytical Chemistry, Abstract #25.

2.* "Instrumental and Computational Techniques for Obtaining Analytical Data in High Performance Liquid Chromatography," R.E. Synovec, December 1985, University of Washington, Seattle, WA.

3.* "Instrumental and Computational Techniques for Obtaining Analytical Data in High Performance Liquid Chromatography," R.E. Synovec, December 1985, SUNY Buffalo, Buffalo, NY.

4.* "Instrumental and Computational Techniques for Obtaining Analytical Data in High Performance Liquid Chromatography," R.E. Synovec, January 1986, University of Arizona, Tucson, AZ.

5.* "Instrumental and Computational Techniques for Obtaining Analytical Data in High Performance Liquid Chromatography," R.E. Synovec, January 1986, University of Texas, Autsin, TX.

6.* "Instrumental and Computational Techniques for Obtaining Analytical Data in High Performance Liquid Chromatography," R.E. Synovec, February 1986, Texas A&M University, College Station, TX.

7. "Strategies for Developing Improved Liquid Chromatography Detectors," R.E. Synovec, May 13, 1986, CPAC Meeting, Seattle, WA.

8. "Laser-Based Circular Dichroism Detection of Molecules in Flowing Liquid Systems using High-Frequency Polarization Modulation," R.E. Synovec, E.S. Yeung, October 1986, Optical Society of America Annual Meeting, Seattle, WA. International Laser Science (ILS) Conference, Abstract #113.

9. "Process High Performance Liquid Chromatography," R.E. Synovec, January 27, 1987, Battelle Pacific Northwest Labs., Richland, WA.

10. "High Speed HPLC for Process Control," R.E. Synovec, C. N. Renn, May 19, 1987, CPAC Meeting, Seattle, WA.

11. "Solid State NIR Laser Diode Detectors," R.E. Synovec, D. O. Hancock, May 19, 1987, CPAC Meeting, Seattle, WA.

12.* "Opportunities for High Performance Liquid Chromatography in Process Analysis," R.E. Synovec, C.N. Renn, D.O. Hancock, September 1987, ACS 194th National Meeting, New Orleans, LA, Division of Analytical Chemistry, Abstract #83.

13. "Simultaneous Absorbance and Absorbance Corrected Refractive Index Measurements in Process Analysis," R.E. Synovec, C. N. Renn, October 1987, Federation of Analytical Chemistry and Spectroscopy Societies (FACSS), Detroit, MI, Abstract #457.

14. "Optimized Dual-Beam Absorbance Measurements by Position Sensitive Detection," R. E. Synovec, C. N. Renn, October 27, 1987, CPAC Meeting, Seattle, WA.

15. "Laser-Based Refractive Index Detection," R. E. Synovec, D. O. Hancock, October 27, 1987, CPAC Meeting, Seattle, WA.

16. "Monitoring Process Streams with Solute-Independent Calibration," R. E. Synovec, C. N. Renn, May 18, 1988, CPAC Meeting, Seattle, WA.

17. "Refractive Index Gradient Detection and Polymer Characterization by Near Infrared Diode Laser Interferometry," R. E. Synovec, D. O. Hancock, May 18, 1988, CPAC Meeting, Seattle, WA.

18.* "High-Speed and Super-Speed High Performance Liquid Chromatography: Optimization for Process Analysis," R. E. Synovec, May 1988, Chicago, IL, 2nd International Forum for Process Analytical Chemistry.

19.* "Applications of Position Sensitive Detectors in Absorbance and Refractive Index Measurements," R. E. Synovec, May 1988, Chicago, IL, 2nd International Forum for Process Analytical Chemistry.

20.* "Approaches to Trace Element Analysis in Fuel Coupled with Factor Analysis," D. O. Hancock, R. E. Synovec, June 20-24, 1988, JANNAF Conference on Fuels and High-Speed Flight Vehicles, Woods Hole.

21. "Dual-Beam Absorbance Measurements by Position Sensitive Detection," C. N. Renn, R. E. Synovec, June 29, 1988, ACS 43rd NW Regional Meeting, Spokane, WA, Abstract #60.

22.* "Novel Approaches in Detector Instrumentation for Process Liquid Chromatography," R. E. Synovec, October 1988, ILS Conference, Atlanta, GA, American Physical Society, September 1988.

23. "High-Speed and Super-Speed SEC of Polymers in Process Analysis," R. E. Synovec, C. N. Renn, November 1988, FACSS, Boston, MA, Abstract #K23. Session Co-Chair.

24. "Concentration Gradient Detection by Near Infrared Diode Laser Interferometry," R. E. Synovec and D. O. Hancock, November 1988, FACSS, Boston, MA, Abstract #K21.

25. "Analytical Applications of Position Sensitive Detectors," R. E. Synovec, D. O. Hancock, C. N. Renn, October 1988, West 88 Conference, Seattle, WA.

26. "Refractive Index Gradient Detection Techniques," R. E. Synovec, D. O. Hancock, Nov. 9, 1988, CPAC Meeting, Seattle, WA.

27. "Superheated Liquid Chromatography in Process Analysis," R. E. Synovec, C. N. Renn, Nov. 9, 1988, CPAC Meeting, Seattle, WA.

28. "Refractive Index Gradient Detection," R. E. Synovec, Jan. 27, 1989, Society of Western Analytical Professors (SWAP) Meeting, Seattle University, Seattle, WA.

29.* "Refractive Index and Absorbance Detection Strategies for Microbore and Capillary Liquid Chromatography," R. E. Synovec, March 17, 1989, Perkin-Elmer Corp., Norwalk, CT.

30. "High Temperature Liquid Chromatography Detection," R. E. Synovec, C. N. Renn, May 9-11, 1989, CPAC Meeting, Bellevue, WA.

31. "Process Liquid Chromatography Instrumentation," R. E. Synovec, C. N. Renn, L. K. Moore, D. B. Taylor, T. J. Bahowick, May 9-11, 1989, CPAC Meeting, Bellevue, WA.

32.* "Fiber Optic Absorbance and Fluorescence Measurements in High Temperature Liquid Chromatography," R. E. Synovec, C. N. Renn, L. K. Moore, Sept. 5-8, 1989, SPIE Conference on Chemical, Biochemical and Environmental Fiber Sensors, Boston, MA, #1172-06.

33. "Absorbance Spectrophotometry by Double-Bean Position Sensitive Detection," R.E. Synovec, ACS 198th National Meeting, Sept. 10-15, 1989, Miami Beach, FL, Division of Analytical Chemistry, Abstract #131. **(session chair)**

34. "High Temperature Liquid Chromatography in Process Analysis," R. E. Synovec, C. N. Renn, Oct. 1-6, 1989, FACSS, Chicago, IL, Abstract #542. **(session chair)**

35. "High Temperature Liquid Chromatography and Detection," R.E. Synovec, C.N. Renn, Nov. 1, 1989, CPAC Meeting, Bellevue, WA.

36. "New Quantitation Method for Process Chromatography," R. E. Synovec, T. J. Bahowick, A. W. Sulya, E. L. Johnson, Nov. 1, 1989, CPAC Meeting, Bellevue, WA.

37.* "Polymer Analysis Techniques for the Processing Environment," R.E. Synovec, Dec. 6, 1989, Union Carbide, So. Charleston, WV.

38.* "Sensitive Molecular Weight Determinations by FIA and Refractive Index Gradient Detection," R.E. Synovec, Jan. 30, 1990, 4th International Forum for Process Analytical Chemistry, Houston, TX.

39.* "Quantitation Method for Low Resolution Chromatography," R.E. Synovec, Jan. 31, 1990, 4th International Forum for Process Analytical Chemistry, Houston, TX.

40. "Refractive Index Gradient Detection for Thermal Gradient LC Separations," R.E. Synovec, C.N. Renn, May 8, 1990, CPAC Meeting, Bellevue, WA.

41. "Ratio of Sequential Chromatograms for Process Analysis," R.E. Synovec, T.J. Bahowick, May 8, 1990, CPAC Meeting, Bellevue, WA.

42.* "Refractive Index Gradient Detection of Biopolymers by High Temperature Liquid Chromatography," R.E. Synovec, C.N. Renn, May 22, 1990, 14th International Symposium on Column Liquid Chromatography (HPLC 1994), Boston, MA.

43.* "Sensitive, Universal Detection in Gradient Elution LC by Concentration Gradient Detection," R.E. Synovec, May 24, 1990, Cargill Research, Wayzata, MN.

44.* "Thermal Gradient Microbore Liquid Chromatography: A Technique for Process Analysis," R.E. Synovec, June 21, 1990, 21st Ohio Valley Chromatography Symposium, Dayton, OH.

45.* "Recent Advances in the Chemical Analysis of Jet Fuels," R.E. Synovec, D.B. Taylor, June 22, 1990, Wright-Patterson AFB (USAF), Dayton, OH.

46.* "Thermal Gradient Microbore Liquid Chromatography with Dual-Wavelength Absorbance Detection: A Tunable Analyzer for Remote Chemical Measurements," R.E. Synovec, August 7, 1990, Gordon Research Conference in Analytical Chemistry, New Hampton, NH.

47.* "Advances in Detection and Data Analysis for Liquid Chromatography," R.E. Synovec, Sept. 24, 1990, Texas Tech University, Lubbock, TX.

48.* "Sensitive Molecular Weight Determinations by FIA and Refractive Index Gradient Detection," R.E. Synovec, V. Murugaiah, Oct. 7-12, 1990, FACSS, Cleveland, OH.

49. "Sensitive Refractive Index Gradient Detection in Liquid Chromatography with the Z-Configuration Flow Cell," R.E. Synovec, D.O. Hancock, Oct. 7-12, 1990, FACSS, Cleveland, OH. **(session chair)**

50.* "Tunable Analyzers for Remote Chemical Measurements," R.E. Synovec, Oct. 29, 1990, Washington State University, Pullman, WA.

51. "High Temperature, High Speed SEC of Polymers," R.E. Synovec, C.N. Renn, Oct. 31, 1990, CPAC Meeting, Bellevue, WA.

52. "On-Column Preconcentration with Gradient Liquid Chromatography," R.E. Synovec, L.K. Moore, Oct. 31, 1990, CPAC Meeting, Bellevue, WA.

53. "Ratio Quantitation for Chromatography," R.E. Synovec, T. J. Bahowick, Oct. 31, 1990, CPAC Meeting, Bellevue, WA.

54.* "Sensitive Laser-Based Measurements of Hydrodynamically Generated Concentration Gradients," R.E. Synovec, December 13, 1990, 13th Int. Conf. on Lasers and Applications (Lasers '90), San Diego, CA.

55.* "A Novel Approach for the Refractive Index Gradient Measurement in Microliter Volumes using Fiber Optic Technology," R.E. Synovec, C.N. Renn, January 22, 1991, SPIE Conference on Optical Methods for Ultrasensitive Detection and Analysis, Los Angeles, CA.

56.* "Gradient Microbore Liquid Chromatography with Dual-Wavelength Absorbance Detection: Tunable Analyzers for Remote Chemical Measurements," R.E. Synovec, L.K. Moore, A.W. Sulya, January 25, 1991, SPIE Conference on Environmental Sensing and Combustion Diagnostics, Los Angeles, CA.

57.* "Tunable Analyzers and Sensors for Remote Chemical Measurements," R.E. Synovec, April 12, 1991, West 91 Conference, Seattle, WA.

58.* "Trace Analysis of Organics in Ground Water by On-Column Preconcentration and Thermal Gradient Microbore Liquid Chromatography with Dual Wavelength Absorbance Detection," L.K. Moore, R.E. Synovec, April 17, 1991, ACS 201st National Meeting, Atlanta, GA, Division of Environmental Chemistry Abstract #108.

59. "Multi-Component Ratio Chromatography," R.E. Synovec, T.J. Bahowick, May 7, 1991, CPAC Meeting, Bellevue, WA.

60. "Thermal Gradient LC with Dual Wavelength Absorbance Detection," R.E. Synovec, L.K. Moore, May 7, 1991, CPAC Meeting, Bellevue, WA.

61. "Sample Preconcentration and Transient Mobile Phase Gradient Liquid Chromatography," R.E. Synovec, A. W. Sulya, May 7, 1991, CPAC Meeting, Bellevue, WA.

62. "Rapid On-Line Polymer Analysis Techniques," R.E. Synovec, July 31, 1991, ACS Summer Symposium in Analytical Chemistry, Miami University, Oxford, OH. Cancelled by ACS.

63.* "Process Chromatography," L.K. Moore, T.J. Bahowick, C.N. Renn, A.W. Sulya, R.E. Synovec, Sept. 6-7, 1991, Shanghai Institute of Metallurgy, Shanghai, P.R. China.

64.* "Process Chromatography," L.K. Moore, T.J. Bahowick, C.N. Renn, A.W. Sulya, R.E. Synovec, Sept. 12-13, 1991, Hunan University, Changsha, P.R. China.

65. "Process Liquid Chromatography Resolution Based on Retention Time and Peak Shape," R.E. Synovec, T.J. Bahowick, Nov. 6, 1991, CPAC Meeting, Bellevue, WA.

66. "Axial and Radial Thermal Gradients for LC," R.E. Synovec, L.K. Moore, Nov. 6, 1991, CPAC Meeting, Bellevue, WA.

67. "Transient Mobile Phase Gradient LC," R.E. Synovec, A.W. Sulya, Nov. 6, 1991, CPAC Meeting, Bellevue, WA.

68.* "Molecular Weight Determination of Polyethylene Glycols by Flow Injection Analysis with Refractive Index Gradient Detection," V. Murugaiah R.E. Synovec, Dec. 20, 1991, Union Carbide, So. Charleston, WV.

69. "Comparison of the Absorbance Ratio and Sequential Chromatogram Ratio Techniques for Improved Data Analysis by Mathematical Suppression of Interfering Components," T.J. Bahowick, D.R. Dunphy, R.E. Synovec, April 5, 1992, ACS 203rd National Meeting, San Francisco, CA, #63.

70. "Molecular Weight Determination of Water Soluble Plymers by Flow Injection Analysis with Refractive Index Gradient Detection," V. Murugaiah, R.E. Synovec, April 5, 1992, ACS 203rd National Meeting, San Francisco, CA, #64.

71. "Sequential, High Speed HPLC Data Analysis," R.E. Synovec, T.J. Bahowick, May 6, 1992, CPAC Meeting, Bellevue, WA.

72. "Axial Thermal Gradient LC," R.E. Synovec, L.K. Moore, May 6, 1992, CPAC Meeting, Bellevue, WA.

73. "Low Pressure Open Tubular LC with Rapid Mobile Phase Gradient," R.E. Synovec, A.W. Sulya, May 6, 1992, CPAC Meeting, Bellevue, WA.

74. "Chromatographic Peak Suppression Using Single Channel Detection," R.E. Synovec, D.R. Dunphy, T.J. Bahowick, May 6, 1992, CPAC Meeting, Bellevue, WA.

75.* "Chemical Analysis by Chromatography," R.E. Synovec, June 6, 1992, Exxon, Florham Park, NJ.

76.* "Advances in the On-Line Analysis of Phospholipids in Soybean Oil," R.E. Synovec, L.R. Lima, III, July 16, 1992, Cargill, Sidney, OH.

77. "Determination of Copper Speciation in a Hydrocarbon Matrix by HPLC," D.B. Taylor, R.E. Synovec, Sept. 20-25, 1992, FACSS, Philadelphia, PA, Abstract #144.

78. "Axial Thermal Gradient Microbore LC," R.E. Synovec, L.K. Moore, Nov. 3, 1992, CPAC Meeting, Bellevue, WA.

79. "Model-Based Application of Retention Time Standards for Process LC," R.E. Synovec, T.J. Bahowick, Nov. 3, 1992, CPAC Meeting, Bellevue, WA.

80. "Low Pressure Open Tubular HPLC," R.E. Synovec, A.W. Sulya, Nov. 3, 1992, CPAC Meeting, Bellevue, WA.

81. "High Speed LC Analysis of High Fructose Corn Syrup," R.E. Synovec, D.R. Dunphy, Nov. 3, 1992, CPAC Meeting, Bellevue, WA.

82. "Trace Metal Analysis in Jet Fuel by LC," R.E. Synovec, D.B. Taylor, Nov. 3, 1992, CPAC Meeting, Bellevue, WA.

83.* "Determination of Copper Speciation in Jet Fuel by HPLC with Element Specific Detection," D.B. Taylor, R.E. Synovec, Dec. 3, 1992, Wright-Patterson AFC (USAF), Dayton, OH.

84. "Continuous Sample Chromatography," R.E. Synovec, M.D. Foster, May 4, 1993, CPAC Meeting, Bellevue, WA.

85. "Beating the Trade-off of Analysis Time and Resolution for Process Chromatography," R.E. Synovec, T.J. Bahowick, May 4, 1993, CPAC Meeting, Bellevue, WA.

86. "Low Pressure LC with a Torus-Shaped Column," R.E. Synovec, A.W. Sulya, May 4, 1993, CPAC Meeting, Bellevue, WA.

87. "Development of a Process Analyzer for Surface Active Species," R.E. Synovec, L.R. Lima, III, May 4, 1993, CPAC Meeting, Bellevue, WA.

88. "Dynamics of Surface Active Detection," R.E. Synovec, D.R. Dunphy, May 4, 1993, CPAC Meeting, Bellevue, WA.

89. "Speciation of Copper in Jet Fuel by LC Using PVA," R.E. Synovec, D.B. Taylor, May 4, 1993, CPAC Meeting, Bellevue, WA.

90.* "Molecular Weight Determination of Polymers by Flow Injection Analysis and Refractive Index Gradient Detection," R.E. Synovec, V. Murugaiah, L.R. Lima, III, August 25, 1993, ACS 206th National Meeting, Chicago, IL, #204, PMSE.

91. "Use of Short Columns and Reduced Resolution for Rapid, Low-Pressure Chromatographic Separation Data Analysis of Multiple Samples," T.B. Bahowick, R.E. Synovec, August 22, 1993, ACS 206th National Meeting, Chicago, IL, #57, ANYL.

92. "Use of Short Columns for Chromatographic Process Monitoring," R.E. Synovec, T.J. Bahowick, Nov. 10, 1993, CPAC Meeting, Seattle, WA.

93. "Band Broadening due to RTG's in LC," R.E. Synovec, M.D. Foster, L.K. Moore, Nov. 10, 1993, CPAC Meeting, Seattle, WA.

94. "Torus Column OT Chromatography with Fiber Optic Decoupled Light Detection," R.E. Synovec, A.W. Sulya, L.W. Burgess, Nov. 10, 1993, CPAC Meeting, Seattle, WA.

95. "Advantages of Chromatography Utilizing an Optical Fiber that both Separates and Detects," R.E. Synovec, C.A. Bruckner, Nov. 10, 1993, CPAC Meeting, Seattle, WA.

96. "Process Chromatography at CPAC," R.E. Synovec, February 11, 1994, Directors of Industrial Research Analytical Group (DIR-AG), Seattle, WA.

97. "Dynamic Surface Activity Detection for Liquid Chromatography and Flow Injection Analysis," L.R. Lima, III, D.R. Dunphy, R.E. Synovec, March 3, 1994, 45th Pittcon, Chicago, IL, #1066.

98.* "Dynamic Surface Tension Detection in Liquid Chromatography," R.E. Synovec, L.R. Lima, III, D.R. Dunphy, March 14, 1994, ACS 207th National Meeting, San Diego, CA, #79 ANYL. **(invited symposium organizer)**

99. "Process Chromatography Using Short Columns," R.E. Synovec, T.J. Bahowick, May 4, 1994, CPAC Meeting, Bellevue, WA.

100. "Parallel Column Chromatography with Multi-Channel Detection," R.E. Synovec, B.J. Prazen, B.R. Kowalski, May 4, 1994, CPAC Meeting, Bellevue, WA.

101. "On-Line Sampling by Torus Column Chromatography and Fiber Optic Decoupled Light Detection," R.E. Synovec, M.D. Foster, A.W. Sulya, L.W. Burgess, May 4, 1994, CPAC Meeting, Bellevue, WA.

102. "Gas Chromatography Incorporating Fiber Optic Decoupled Light Detection," R.E. Synovec, C.A. Bruckner, L.W. Burgess, May 4, 1994, CPAC Meeting, Bellevue, WA.

103. "High Speed Molecular Weight Determination with Flow Injection Peak Shape Analysis," R.E. Synovec, N.A. Olson, May 4, 1994, CPAC Meeting, Bellevue, WA.

104.* "Laser-Based Dynamic Surface Tension Detection in Liquid Chromatography," R.E. Synovec, L.R. Lima, III, D.R. Dunphy, May 11, 1994, 18th International Symposium on Column Liquid Chromatography (HPLC 1994), Minneapolis, MN.

105.* "Chemical Sensing of In-Situ Extracted Organics by Direct Detection of Mode-Filtered Light," R.E. Synovec, C.A. Bruckner, L.W. Burgess, M.D. Foster, A.W. Sulya, July 27, 1994, SPIE Conference on Chemical Biochemical and Environmental Fiber Sensors VI, San Diego, CA.

106. "Improved Sensitivity for Mode Filtered Light Detection by Using Thin Polymeric Films," R.E. Synovec, M.D. Foster, Nov. 9, 1994, CPAC Meeting, Bellevue, WA.

107. "Parallel Column Chromatography with Multi-Channel Detection," R.E. Synovec, B.J. Prazen, B.R. Kowalski, Nov. 9, 1994, CPAC Meeting, Bellevue. WA.

108. "Gas Chromatogrpahy Incorporating Fiber Optic Decoupled Light Detection," R.E. Synovec, C.A. Bruckner, L.W. Burgess, Nov. 9, 1994, CPAC Meeting, Bellevue, WA.

109.* "New Directions in Chemical Analysis: Chromatographic Sensing on an Optical Fiber and Dynamic Surface Tension Measurements of Surfactants," R. E. Synovec, January 23, 1995, University of Cincinnati, Cincinnati, OH.

110. "Chemical Analysis of the Supreme Corq Product in Contact with Wine," R. E. Synovec, N. A. Olson, February 8, 1995, WTC Legislative Reception, Olympia, WA. (invited poster)

111. "Process Chromatography: Waste Minimization in Liquid Chromatographic Analysis," R.E. Synovec, M.D. Foster, May 3, 1995, CPAC Meeting, Bellevue, WA.

112. "Rapid Comprehensive Two-Dimensional GC," R.E. Synovec and C.A. Bruckner, May 3, 1995, CPAC Meeting, Bellevue, WA.

113. Parallel Column Chromatography with Multi-Channel Detection: Probability of Success in Parallel Column Separations," R.E. Synovec, B.J. Prazen and B.R. Kowaski, May 3, 1995, CPAC Meeting, Bellevue, WA.

114. "Rapid Chemical Analysis of Surfactants for Process Monitoring and Quality Control," R.E. Synovec, T.E. Young and N.A. Olson, May 3, 1995, CPAC Meeting, Bellvue, WA.

115.* "Process Chromatography at CPAC," R. E. Synovec and C. A. Bruckner, August 1, 1995, Applied Automation, Bartlesville, OK.

116. "Chromatographic Sensing on an Optical Fiber by Mode-Filtered Light Detection: A New Concept for Flow Injection Analysis," R. E. Synovec and C. A. Bruckner, August 15, 1995, Int. Conf. FIA, Seattle, WA, L-16.

117. "Enhanced Surfactant Determination by Ion-Pair Formation Using Flow Injection Analysis and Dynamic Surface Tension Detection," R. E. Synovec and T. E. Young, August 15, 1995, Int. Conf. FIA, Seattle, WA, L-17.

118.* "Determination of Surfactants in Biomedical Samples by Flow Injection Analysis and Dynamic Surface Tension Detection," R. E. Synovec, N. A. Olson, T. E. Young and K. J. Skogerboe, October 20, 1995, Western Biotech Conference, San Diego, CA, #312.

119. "Process Chromatography: Liquid Chromatography of Organics with Water as the Mobile Phase," R. E. Synovec and M. D. Foster, November 8, 1995, CPAC Meeting, Bellevue, WA.

120. "Parallel Column Chromatography with Multichannel Detection," R. E. Synovec, B. J. Prazen and B. R. Kowalski, November 8, 1995, CPAC Meeting, Bellevue, WA.

121. "High Speed Comprehensive Two-Dimensional Gas Chromatography," R. E. Synovec and C. A. Bruckner, November 8, 1995, CPAC Meeting, Bellevue, WA.

122.* "New Directions in Chemical Analysis: Dynamic Surface Tension Measurements of Surfactants and Chromatographic Sensing on an Optical Fiber," R. E. Synovec, November 30, 1995, University of Idaho, Moscow, ID.

123. "Annular Column Chromatography with Mode-Filtered Light Detection: Chromatographic Sensing on an Optical Fiber," R. E. Synovec and M. D. Foster, December 20, 1995, Pacifichem Conference, Honolulu, HI, #230.

124. "Liquid Chromatography of Organics with Water as the Mobile Phase," R. E. Synovec, T. E. Young, S. T. Ecker and M. D. Foster, May 8, 1996, CPAC Meeting, Seattle, WA.

125. "Parallel Column Chromatography with Multi-Channel Detection," R. E. Synovec, B. J. Prazen and B. R. Kowalski, May 8, 1996, CPAC Meeting, Seattle, WA.

126. "High-Speed Comprehensive Two-Dimensional Gas Chromatography," R. E. Synovec and C. A. Bruckner, May 8, 1996, CPAC Meeting, Seattle, WA.

127. "Measurement of Metabolites of [C-11] Meta-Hydroxyephedrine, [C-11] MHED," J. M. Link, K. A. Krohn, J. H. Caldwell and R. E. Synovec, June 3-6, 1996, 43rd Annual Meeting of the Society of Nuclear Medicine, Denver, CO.

128.* "Dynamic Surface Tension and Viscosity Analysis of Concentrated Surfactant Solutions," R. E. Synovec and N. A. Olson, June 3, 1996, Boeing, Seattle, WA.

129.* "New Perspectives on Gas and Liquid Chromatography for Remote Analysis," R. E. Synovec, June 14, 1996, ACS Boulder Dam Section, Las Vegas, NV.

130. "RP-LC and Dynamic Surface Tension Detection of Long Chain Fatty Acids, Alkyl Sulfates and Alkyl Sulfonates," R. E. Synovec, T. E. Young, N. A. Olson and M. D. Foster, June 16-21, 1996, 20th Int. Symp. on Column Liquid Chromatography, San Francisco, CA.

131.* "New Perspectives on Gas and Liquid Chromatography for Remote Analysis," R. E. Synovec, July 17, l996, 1996 CPAC Summer Institute, Seattle, WA.

132.* "Reversed Phase Liquid Chromatography of Hydrophobic Analytes with a Water Mobile Phase," R. E. Synovec, August 16, 1996, E. I. DuPont, Wilmington, DE.

133. "Liquid Chromatography of Organics with Water as the Mobile Phase," R. E. Synovec and T. E. Young, November 5, 1996, CPAC Meeting, Bellevue, WA.

134. "High Speed Comprehensive Two-Dimensional Gas Chromatography," R. E. Synovec and C. A. Bruckner, November 5, 1996, CPAC Meeting, Bellevue, WA.

135. "Parallel Column Chromatography with Multi-Channel Detection," R. E. Synovec, B. J. Prazen and B. R. Kowalski, November 5, 1996, CPAC Meeting, Bellevue, WA.

136.* "Dynamic Surface Tension Detection with Water-Only Liquid Chromatography for the Analysis of Jet and Diesel Fuel Chemical Treatment Processes," R. E. Synovec and N. A. Olson, November 25, 1996, ARCO, Cherry Point Refinery, Blaine, WA.

137. "Chemical Analysis of Surfactants by Dynamic Surface Tension and Surface Adsorption Detection," R. E. Synovec, N. A. Olson, W. B. Bond, K. J. Skogerboe and D. M. Alloway, January 17, 1997, Science Partnerships in Action, Research Corporation, Tucson, AZ. (invited poster)

138.* "Bridging the Gap between Process Gas Chromatography and Chemometrics," R. E. Synovec, C. A. Bruckner and B. J. Prazen, February 5, 1997, 11th International Forum for Process Analytical Chemistry, Blaine, WA.

139. "Extreme Chromatography: Testing the Limits," R. E. Synovec, February 20, 1997, CPAC Industry Segment Meeting, Seattle, WA.

140.* "Separations in Water: Liquid Chromatography Without Organic Solvents," R. E. Synovec, April 28, 1997, University of Washington, Seattle, WA.

141. "Liquid Chromatography of Organics with Water as the Mobile Phase," R. E. Synovec and T. E. Young, May 5, 1997, CPAC Meeting, Seattle, WA.

142. "High-Speed Comprehensive Two-Dimensional Gas Chromatography," R. E. Synovec and C. A. Bruckner, May 5, 1997, CPAC Meeting, Seattle, WA.

143. "Parallel Column Chromatography with Multi-Channel Detection," R. E. Synovec, B. J. Prazen and B. R. Kowalski, May 5, 1997, CPAC Meeting, Seattle, WA.

144. "Thermal Modulation of Microcalorimetric Sensors," M. B. Free, L. W. Burgess, and R. E. Synovec, May 5, 1997, CPAC Meeting, Seattle, WA.

145.* "High-Speed Short Column Capillary Gas Chromatography with Chemometrics," R. E. Synovec, C. A. Bruckner and B. J. Prazen, May 22, 1997, 19th International Symposium in Capillary Chromatography and Electrophoresis, Wintergreen, VA.

146. "Parallel-Column Gas Chromatography Coupled with Mass Spectrometry and Chemometrics," R. E. Synovec, B. J. Prazen and B. R. Kowalski, May 20, 1997, 19th International Symposium in Capillary Chromatography (ISCC), Wintergreen, VA.

147.* "High Speed Gas Chromatography with Chemometrics," R. E. Synovec, July 16, 1997, 1997 CPAC Summer Institute, Seattle, WA.

148.* "High Speed GC × GC with Chemometrics and Liquid Chromatography with a Water Mobile Phase," R. E. Synovec, September 18, 1997, DOW Chemical Corp., Freeport, TX.

149. "Parallel Column Chromatography with Multichennel Detection," R. E. Synovec, B. J. Prazen and B. R. Kowalski, November 4, 1997, CPAC Meeting, Seattle, WA.

150. "High Speed Comprehensive Two-Dimensional Gas Chromatography," R. E. Synovec and C. A. Bruckner, November 4, 1997, CPAC Meeting, Seattle, WA.

151. "Liquid Chromatography of Organics with Water as a Mobile Phase," R. E. Synovec and P. G. Vahey, November 4, 1997, CPAC Meeting, Seattle, WA.

152. "Process Analysis of Interfacial Properties of Flowing Liquids," R. E. Synovec, K. E. Miller, T. E. Young and N. A. Olson, November 4, 1997, CPAC Meeting, Seattle, WA.

153. "Increasing the Dimensionality of Microcalorimetric Sensors through Thermal Modulation," M. B. Free, Lloyd W. Burgess, and R. E. Synovec, November 4, 1997, CPAC Meeting, Seattle, WA.

154.* "New Directions in Process Gas Chromatography," R. E. Synovec, January 16, 1998, 12th International Forum for Process Analytical Chemistry, Orlando, FL.

155. "The Slippery Slide of Surfactants," W. B. Bond, R. E. Synovec, N. A. Olson and K. J. Skogerboe, January 16-17, 1998, Science Partnership in Action, Research Corporation, Tucson, AZ.

156. "Dynamic Surface Tension and Adhesion Measurements on Flowing Aqueous Liquids," R. E. Synovec, K. E. Miller, N. A. Olson and K. J. Skogerboe, February 9, 1998, Gordon Research Conference on Colloidal, Macromolecular and Polyelectrolyte Solutions, Ventura, CA. (invited poster)

157. "High Speed Chromatography and Chemometrics: Development of High Speed Hyphenated Chromatographic Analyzers and Second Order Data Analysis Techniques," B. J. Prazen, R. E. Synovec and B. R. Kowalski, February 19, 1998, ICI Specialty Chemicals, New Castle, DE.

158. "High Speed Chromatography and Chemometrics: Development of High Speed Hyphenated Chromatographic Analyzers and Second Order Data Analysis Techniques," B. J. Prazen, R. E. Synovec and B. R. Kowalski, February 19, 1998, ICI Polyurethanes, West Deptford, NJ.

159. "High Speed Chromatography and Chemometrics: Development of High Speed Hyphenated Chromatographic Analyzers and Second Order Data Analysis Techniques," B. J. Prazen, R. E. Synovec and B. R. Kowalski, February 20, 1998, National Starch, Bridgewater, NJ.

160. "High Speed Chromatography and Chemometrics: Development of High Speed Hyphenated Chromatographic Analyzers and Second Order Data Analysis Techniques," B. J. Prazen, R. E. Synovec and B. R. Kowalski, February 25, 1998, ICI Technology, Wilton Middlesbrough Cleveland, UK.

161. "Process Surface Analysis for the Optimization of Metal Cleaning Processes," N. A. Olson and R. E. Synovec, March 4, 1998, EU, NUTEK, Industry Consortium, Voest-Alpine, Linz, Austria.

162. "High Speed GC × GC," C. A. Bruckner and R. E. Synovec, March 4, 1998, 1998 Pittsburgh Conference, New Orleans, LA.

163. "Whole-Column Radioactivity Detection: Simultaneous Liquid Chromatography Separation and Enhanced Detectability," J. M. Link and R. E. Synovec, March 29, 1998, 215th National ACS Meeting, Dallas, TX, Division of Nuclear Chemistry, Abstract #22.

164. "Process Gas Chromatography," C. A. Bruckner, W. W. C. Quigley, G. Fraga, M. B. Free, B. J. Prazen and R. E. Synovec, May 5, 1998, CPAC Meeting, Seattle, WA.

165. "Process Chromatography with Multivariate Analysis," B. J. Prazen, C. A. Bruckner, C. G. Fraga, W. W. C. Quigley, and R. E. Synovec, May 5, 1998, CPAC Meeting, Seattle, WA.

166. "Process Liquid Chromatography," P. G. Vahey, W. W. C. Quigley, T. E. Young, S. T. Ecker and R. E. Synovec, May 5, 1998, CPAC Meeting, Seattle, WA.

167. "On-Line Measurement of Interfacial Properties," K. E. Miller and R. E. Synovec, May 5, 1998, CPAC Meeting, Seattle, WA.

168. "Liquid Chromatographic Analysis of Organic Compounds with a Water Mobile Phase," T. E. Young, P. G. Vahey and R. E. Synovec, May 5, 1998, CPAC Meeting, Seattle, WA.

169. "Thermal Modulation of Micro-Calorimetric Sensors," M. B. Free, L. W. Burgess and R. E. Synovec, May 5, 1998, CPAC Meeting, Seattle, WA.

170. "Batch Process Monitoring, Control and Optimization," N. L. Ricker and R. E. Synovec, May 6, 1998, CPAC Meeting, Seattle, WA.

171.* "Microfabricated Chromatographic Analyzer," R. E. Synovec, May 19, 1998, MEMS Technical Advisory Committee Meeting for the Washington Technology Center, Seattle, WA.

172.* "Developing GC for High Speed Chemical Analysis," R. E. Synovec, June 23, 1998, 29th Ohio Valley Chromatography Symposium, Hueston Woods Lodge, OH.

173.* "Microfabricated Liquid Chromatographic Analyzer," R. E. Synovec, July 15, 1998, 1998 CPAC Summer Institute, Seattle, WA.

174.* "Microfabricated Liquid Chromatographic Analyzer," R. E. Synovec, September 15, 1998, Second Annual MEMS Workshop through the Washington Technology Center, Battelle Conference Center, Seattle, WA.

175. "Thermal Modulation of Microcalorimetric Sensors," M. B. Free, L. W. Burgess and R. E. Synovec, November 3, 1998, CPAC Meeting, Seattle, WA.

176. "On-Line Measurement of Interfacial Properties," K. E. Miller and R. E. Synovec, November 4, 1998, CPAC Meeting, Seattle, WA.

177. "Process Liquid Chromatography," P. G. Vahey and R. E. Synovec, November 4, 1998, CPAC Meeting, Seattle, WA.

178. "Advances in Process Gas Chromatography," R. E. Synovec, C. G. Fraga, W. W. C. Quigley and K. J. Johnson, November 4, 1998, CPAC Meeting, Seattle, WA.

179.* "Process Chromatography for Faster, Cleaner Chemical Analysis," R. E. Synovec, January 27, 1999, 13th International Forum for Process Analytical Chemistry, San Antonio, TX.

180. "Advances in Water Liquid Chromatography Separation and Detection," P. G. Vahey, W. W. C. Quigley and R. E. Synovec, March 9, 1999, 50th Pittsburgh Conference, Orlando, FL, Abstract #481.

181. "Dynamic Surface Tension Sensor for Process Monitoring and Microbore Liquid Chromatography Applications," K. E. Miller and R. E. Synovec, March 10, 1999, 50th Pittsburgh Conference, Orlando, FL, Abstract #948.

182.* "High Speed Hyphenated Gas Chromatography Followed by Chemometric Analysis of Environmental Pollutants," R. E. Synovec, C. A. Bruckner, B. J. Prazen and C. G. Fraga, March 11, 1999, 50th Pittsburgh Conference, Orlando, FL, Abstract #1210.

183. "Thermal Modulation of Microcalorimetric Sensors," M. B. Free, L. W. Burgess and R. E. Synovec, May 5, 1999, CPAC Meeting, Bellevue, WA.

184. "Process Gas Chromatography and Chemometric Analysis," R. E. Synovec, C. G. Fraga, W. W. C. Quigley and K. J. Johnson, May 5, 1999, CPAC Meeting, Bellevue, WA.

185. "Process Liquid Chromatography," P. G. Vahey and R. E. Synovec, May 5, 1999, CPAC Meeting, Bellevue, WA.

186. "On-Line Measurement of Interfacial Properties in Flowing Liquids," K. E. Miller and R. E. Synovec, May 5, 1999, CPAC Meeting, Bellevue, WA.

187. "Batch Process Monitoring, Control and Optimization," N. L. Ricker and R. E. Synovec, May 5, 1999, CPAC Meeting, Bellevue, WA.

188. "Rapid Standardization of Diesel Fuel Gas Chromatographic Data," K. J. Johnson and R. E. Synovec, May 26, 1999, IRS BTR Core Team Meeting at PNNL, Richland, WA.

189. "Cost-Effective Liquid Chromatography through a Water Mobile Phase and Microfabricated Instrumentation," P. G. Vahey and R. E. Synovec, 54th Northwest Regional ACS Meeting, Portland, OR, June 21, 1999. **(organized symposium)**

190. "Liquid Chromatography with a Water Mobile Phase Coupled to High-Speed Capillary Gas Chromatography," W. W. C. Quigley and R. E. Synovec, 54th Northwest Regional ACS Meeting, Portland, OR, June 21, 1999. **(organized symposium)**

191. "Dynamic Surface Tension Sensor for Process Monitoring Applications,"K. E. Miller and R. E. Synovec 54th Northwest Regional ACS Meeting, Portland, OR, June 21, 1999. **(organized symposium)**

192. "Thermal Modulation of Microcalorimetric Sensors for Chemical Analysis," M. B. Free, L. W. Burgess and R. E. Synovec, 54th Northwest Regional ACS Meeting, Portland, OR, June 21, 1999. **(organized symposium)**

193.* "Advances in High-Speed Multidimensional Gas Chromatography Coupled with Chemometric Analysis," R. E. Synovec, C. G. Fraga, W. W. C. Quigley and K. J. Johnson, June 22, 1999, 21st ISCC, Park City, UT.

194. "Hyphenated Chemical Analyzers Based Upon Coupling Water Liquid Chromatography to Capillary Gas Chromatography or a Novel, Capillary-Based Raman Spectrometer," R. E. Synovec, P. G. Vahey, W. W. C. Quigley, B. J. Marquardt and L. W. Burgess, June 23, 1999, 21st ISCC, Park City, UT.

195. "A Flow Injection System with a Dynamic Surface Tension Detector for Surfactants," N. Lenghor, B. J. Prazen, W. W. C. Quigley, R. E. Synovec, G. D. Christian and K. Grudpan, June 20-25, 1999, 10th Int. Conf. on FIA, Tokyo, Japan, poster.

196. "Jet Fuel Mixture Classification Aided by Variance-Based Feature Selection," K. J. Johnson and R. E. Synovec, June 28, 1999, PNNL, Richland, WA.

197.* "Microfabricated Liquid Chromatographic Chemical Analyzers: Development and Evaluation," R. E. Synovec, 1999 CPAC Summer Institute, Seattle, WA, July 22, 1999.

198.* "Advances in Chromatography and Chemometric Analysis of Chromatographic Data," R. E. Synovec, Chiang Mai University, Chiang Mai, Thailand, August 10, 1999.

199.* "A Road to International Publication," R. E. Synovec, Chiang Mai University, Chiang Mai, Thailand, August 10, 1999.

200.* "New Perspectives on Gas and Liquid Chromatography for Enhanced Chemical Analysis," R. E. Synovec, Mahidol University, Bangkok, Thailand, August 13, 1999.

201.* "A Road to International Publication," R. E. Synovec, Mahidol University, Bangkok, Thailand, August 13, 1999.

202. "Microfabricated Liquid Chromatographic Analyzer," P. G. Vahey and R. E. Synovec, MEMS Third Annual Workshop through the Washington Technology Center, Aljoya Conference Center, September 15, 1999. (invited poster)

203.* "Advances in Process Chromatography and Surface Tension Analysis," R. E. Synovec, Akzo Nobel, Dobbs Ferry, NY, October 15, 1999.

204.* "Advances in Multidimensional Separation Techniques with Chemometric Analysis," R. E. Synovec, University of Arkansas, Fayetteville, AR, October 18, 1999.

205. "Dynamic Surface Tension Sensor for Process Monitoring of Liquids," K. E. Miller and R. E. Synovec, 1999 FACSS Conference, Vancouver, British Columbia, Canada, October 27, 1999.

206. "Advances in Process Liquid Chromatography using a Water Mobile Phase and Microfabricated Instrumentation," P. G. Vahey and R. E. Synovec, 1999 FACSS Conference, Vancouver, British Columbia, Canada, October 28, 1999.

207. "Enhanced Headspace Analysis via Automated Liquid Chromatography Sampling Coupled to High Speed Gas Chromatography," W. W. C. Quigley and R. E. Synovec, 1999 FACSS Conference, Vancouver, British Columbia, Canada, October 28, 1999.

208.* "Enhanced High Speed Multi-Dimensional Gas Chromatography with Chemometrics," R. E. Synovec, B. J. Prazen, C. G. Fraga and K. J. Johnson, 1999 FACSS Conference, Vancouver, British Columbia, Canada, October 28, 1999.

209. "Thermal Modulation of Microcalorimetric Sensors," M. B. Free, L. W. Burgess and R. E. Synovec, November 2, 1999, CPAC Meeting, Bellevue, WA.

210. "Process Liquid Chromatography," P. G. Vahey and R. E. Synovec, November 3, 1999, CPAC Meeting, Bellevue, WA.

211. "Process Gas Chromatography and Chemometric Analysis," B. J. Prazen, R. E. Synovec, C. G. Fraga, W. W. C. Quigley and K. J. Johnson, November 3, 1999, CPAC Meeting, Bellevue, WA.

212. "On-Line Measurement of Interfacial Properties in Flowing Liquids," K. E. Miller and R. E. Synovec, November 3, 1999, CPAC Meeting, Bellevue, WA.

213.* "The Development of a Micro-Fabricated Open Tubular Liquid Chromatographic Analyzer," Paul G. Vahey, Sean A. Smith, Sang Hyun Park, Brian J. Marquardt, Younan Xia, Lloyd W. Burgess, Robert E. Synovec, 14th International Forum for Process Analytical Chemistry, Las Vegas, NV, January 24, 2000.

214.* "Small-volume, Multidimensional Separation Methods for Rapid Chemical Analysis," R. E. Synovec, Sensors Technology Symposium (LANL), Santa, Fe, NM, February 29, 2000.

215.* "Advances in Multidimensional Separation Techniques with Chemometric Analysis," R. E. Synovec, Texas Tech University, Lubbock, TX, March 1, 2000.

216. "Process Liquid Chromatography," P. G. Vahey and R. E. Synovec, May 2, 2000, CPAC Meeting, Seattle, WA.

217. "Process Gas Chromatography and Chemometric Analysis," K. J. Johnson, R. E. Synovec, and C. G. Fraga, May 2, 2000, CPAC Meeting, Seattle, WA.

218. "On-Line Measurement of Interfacial Properties in Flowing Liquids," R. E. Synovec and K. E. Miller, May 2, 2000, CPAC Meeting, Seattle, WA.

219.* "Enhanced High-Speed Multidimensional Gas Chromatography with Chemometrics," R. E. Synovec, 83rd Canadian Chemical Conference, Calgary, Alberta, Canada, May 28, 2000.

220.* "Novel Hyphenated Chemical Analyzers Using Liquid Chromatography with a Water Mobile Phase," R. E. Synovec, 24th International Symposium on High Performance Liquid Phase Separations (HPLC 2000), Seattle, WA, June 30, 2000.

221. "Comprehensive LC x GC of Volatile Compounds Using a Novel Drop Interface," W. W. C. Quigley and R. E. Synovec, 24th International Symposium on High Performance Liquid Phase Separations (HPLC 2000), Seattle, WA, June 27, 2000.

222. "Liquid Chromatography Characterization of Proteins and Polymers Using a Multidimensional Dynamic Surface Tension Detector," E. Bramanti, K. E. Miller, B. J. Prazen, M. Prezhdo, R. E. Synovec and K J. Skogerboe, 24th International Symposium on High Performance Liquid Phase Separations (HPLC 2000), Seattle, WA, June 29, 2000.

223. "Multidimensional, On-Column GLRS and Absorbance detection with a Micro-fabricated Liquid Chromatographic Analyzer," P. G. Vahey, S. A. Smith, R. E. Synovec, L. W. Burgess, Y. Xia and B. J. Marquardt, 24th International Symposium on High Performance Liquid Phase Separations (HPLC 2000), Seattle, WA, June 29, 2000.

224.* "Small-volume, Multidimensional Separation Methods for Rapid Chemical Analysis," R. E. Synovec, 2000 CPAC Summer Institute, Seattle, WA, July 19, 2000.

225.* "Automated, Multidimensional Interfacial Analysis on Flowing Liquids," R. E. Synovec, Gordon Research Conference on Bioanalytical Sensors, Proctor Academy, NH, July 26, 2000.

226.* "Multidimensional Separation Methods for Rapid Chemical Analysis," R. E. Synovec, Bristol-Myers Squibb, New Brunswick, NJ, July 28, 2000.

227.* "Integrating Chemometrics with High-Speed, Multidimensional Separation Techniques," R. E. Synovec, 4th International Conference on Environmetrics and Chemometrics, Las Vegas, NV, September 20, 2000.

228.* "Multidimensional Separation Methods for Rapid Chemical Analysis," R. E. Synovec, University of Alberta, Edmonton, Alberta, Canada, September 25, 2000.

229. "A Raman Waveguide Detector for HPLC," B. Marquardt, L.W. Burgess, G.M. Gross, R. E. Synovec, FACSS Conference, Nashville, TN, September 26, 2000, #323.

230. "Liquid Chromatography Characterization of Proteins using a Multidimensional Dynamic Surface Tension Detector," E. Bramanti, K. E. Miller, B. J. Prazen, M. Prezhdo, K. J. Skogerboe, R. E. Synovec, 23rd International Symposium on Chromatography, Olympia, London, October 5, 2000.

231.* "Multidimensional Separation Methods for Rapid Chemical Analysis," R. E. Synovec, University of New Mexico, Albuquerque, NM, October 6, 2000.

232.* "Multidimensional Separation Methods for Rapid Chemical Analysis," R. E. Synovec, Ashland Chemical Co., Analytical Services and Technology, Dublin, OH, October 12, 2000.

233. "Process Liquid Chromatography," R. E. Synovec, C.D. Costin and G. M. Gross, November 7, 2000, CPAC Meeting, Seattle, WA.

234. "Process Gas Chromatography and Chemometric Analysis," K. J. Johnson, B. J. Prazen and R. E. Synovec, November 7, 2000, CPAC Meeting, Seattle, WA.

235. "On-Line Measurement of Interfacial Properties in Flowing Liquids," W.W.C. Quigley, B.A. Staggemeier, R. E. Synovec, November 8, 2000, CPAC Meeting, Seattle, WA.

236.* "High Speed Comprehensive Two-Dimensional Separations with Chemometrics," R. E. Synovec, Molecular Dynamics, Sunnyvale, CA, Nov. 27, 2000.

237.* "Dynamic Surface Tension Analysis of Complex Samples," R. E. Synovec, Molecular Dynamics, Sunnyvale, CA, Dec. 4, 2000.

238.* "Process Gas Chromatography with Chemometrics," R. E. Synovec, 15th International Forum for Process Analytical Chemistry, Amelia Island, FL, January 24, 2001. **Invited symposium organizer and session chair**

239.* "Dynamic Surface Tension Analysis of Proteins," R. E. Synovec, Arizona State University, Society of Western Analytical Professors, Tempe, AZ, Feb. 9, 2001.

240.* "Multidimensional Separation Methods for Rapid Chemical Analysis," R. E. Synovec, North Dakota State University, March 29, 2001.

241.* "Multidimensional Separation Methods for Rapid Chemical Analysis," R. E. Synovec, University of North Dakota, March 30, 2001.

242.* "Process Chromatography and Green Chemistry," R. E. Synovec and B. J. Prazen, 221st ACS National Meeting, San Diego, CA, April 2, 2001.

243. "Process Liquid Chromatography and Sampling," C.D. Costin, G. M. Gross and R. E. Synovec, May 8, 2001, CPAC Meeting, Seattle, WA.

244. "Process Gas Chromatography and Chemometric Analysis," R. E. Synovec, K. J. Johnson, B. J. Prazen, May 8, 2001, CPAC Meeting, Seattle, WA.

245. "On-Line Measurement of Interfacial Properties in Flowing Liquids," W.W.C. Quigley, B.A. Staggemeier, R. E. Synovec, May 9, 2001, CPAC Meeting, Seattle, WA.

246.* "Increasing the Utility of High-Speed Comprehensive Two-Dimensional Separations with Chemometrics," R. E. Synovec, B. J. Prazen, K. J. Johnson, C. G. Fraga, 24th ISCC, Las Vegas, NV, May 22, 2001.

247. "High-Speed Valve-based Comprehensive GC × GC with Independently Controlled Temperature Programming," K. J. Johnson, B. J. Prazen, R. E. Synovec, 24th ISCC, Las Vegas, NV, May 23, 2001, poster #105.

248. "Objective Data Alignment and Chemometric Analysis of Two-Dimensional Separations with Peak Shifting on Both Dimensions," C. G. Fraga, B. J. Prazen, R. E. Synovec, 24th ISCC, Las Vegas, NV, May 22, 2001, poster #64.

249. "Real-Time Measurement of Interfacial Properties: Dynamic Surface Tension Detector," N. A. Staggemeier, W. W. C. Quigley, B. J. Prazen, E. Bramanti, K. J. Skogerboe, R. E. Synovec, Northwest Regional ACS Meeting, Seattle, WA, June 16, 2001, poster #322.

250. “Microfabricated Real-Time Sampling,” Colin D. Costin, R. E. Synovec, Northwest Regional ACS Meeting, Seattle University, Seattle, WA, June 14, 2001, poster #58.

251.* “Faster, More Informative Chemical Analyzers,” R. E. Synovec, CPAC Summer Institute, Seattle, WA, July 25, 2001.

252. “Flow Injection System with a Dynamic Surface Tension Detector for Surfactants,” N. Lenghor, B. J. Prazen, W. W. C. Quigley, R. E. Synovec, G. D. Christian, K.Grudpan, International Congress on Analytical Sciences, August 6-10, 2001, Tokyo, Japan, poster.

253. "Process Liquid Chromatography and Microfabricated Liquid Analyzers," C.D. Costin, G. M. Gross, R. E. Synovec, Nov. 6, 2001, CPAC Meeting, Seattle, WA.

254. "Process Gas Chromatography with Chemometrics," K. J. Johnson, B. J. Prazen, R. E. Synovec, Nov. 6, 2001, CPAC Meeting, Seattle, WA.

255. “On-Line Measurement of Interfacial Properties in Flowing Liquids," B.A. Staggemeier, R. E. Synovec, Nov. 7, 2001, CPAC Meeting, Seattle, WA.

256. “Sequential Injection Analysis for Surfactants with a Dynamic Surface Tension Detector,” N. Lenghor, B. Prazen, J. Jakmunee, R. E. Synovec, G. D. Christian, K. Grudpan, Dec. 17, 2001, 11th International Conference on Flow Injection Analysis, Chiang Mai, Thailand, P23.

257.* “Multidimensional Flow Injection Sensor Technologies,” R. E. Synovec, 16th International Forum for Process Analytical Chemistry, San Diego, CA, January 24, 2002.

258.* “The Gas Chromatography Sensor for Process Analysis,” R. E. Synovec, 16th International Forum for Process Analytical Chemistry, San Diego, CA, January 25, 2002.

259.* “Hyphenated Chromatographic Analyzers with Chemometrics: A Powerful Combination,” R. E. Synovec, 7th Int. Symp. on Hyphenated Techniques in Chromatography and Hyphenated Chromatographic Analyzers (HTC-7), Bruges, Belgium, Feb. 7, 2002.

260.* “Advances in Process Monitoring and Analysis Technologies,” R. E. Synovec, 7th Int. Symp. on Hyphenated Techniques in Chromatography and Hyphenated Chromatographic Analyzers (HTC-7), Bruges, Belgium, Feb. 5, 2002. 6 Hour Short Course

261. “Possibilities of Electroinjection Analysis for Phenols Determination,” E. Morosanova, K. Loginova, S. Fomina, Y. Zolotoz, C. D. Costin, R. E. Synovec, G. D. Christian, Flow Injection Analysis IX, Australia, Feb. 20, 2002.

262. “Chemometric Analysis of Two-Dimensional Gas Chromatographic Data,”

K. J. Johnson, B. J. Prazen, R. E. Synovec, PITTCON, March 20, 2002, lecture #893.

263. "Process Liquid Chromatography and Microfabricated Liquid Analyzers," C.D. Costin and R. E. Synovec, Nov. 5, 2002, CPAC Meeting, Seattle, WA.

264. "Process Gas Chromatography and Chemometrics," K. J. Johnson, B. J. Prazen, R. E. Synovec, Nov. 5, 2002, CPAC Meeting, Seattle, WA.

265. "On-Line Measurement of Interfacial Properties in Flowing Liquids using the DSTD," B.A. Staggemeier, R. E. Synovec, Nov. 5, 2002, CPAC Meeting, Seattle, WA.

266.* "Recent Advances in Hyphenated Separation Techniques with Chemometrics," R. E. Synovec, 85th Canadian Society for Chemistry Conference, Vancouver, British Columbia, Canada, June 5, 2002.

267.* "Development of a Microscale Molecular Mass Sensor," R. E. Synovec, Micronics, Redmond, WA, June 20, 2002.

268.* "Microscale Sensors Utilizing Surface Tension and Molecular Size," R. E. Synovec, 7th CPAC Summer Institute, Seattle, WA, July 17, 2002.

269. "Fundamental Studies of Monolayer-Protected Nanoparticles by Gas Chromatography," G. M. Gross, R. E. Synovec and J. W. Grate, Nanoscale Science and Technology Workshop, Seattle, WA, Sept. 19-20, 2002, poster.

270.* "Integrating Chemometrics with Chemical Separation Techniques," R. E. Synovec, 8th International Conference on Chemometrics in Analytical Chemistry (CAC-2002), Seattle WA, Sept. 24, 2002.

271. "High-Speed Gas Chromatographic Separations with Diaphragm Valve-Based Injection an Chemometric Analysis as a Gas Chromatographic Sensor," K. J. Johnson, M. A. Cavelti, J. L. Hope, J. W. Grate, R. E. Synovec, CAC-2002, Seattle WA, Sept. 23-24, 2002.

272. "Quantification of Two-Ring Aromatics in Jet Fuel with GC × GC/Tri-PLS and Objective Retention Time Alignment," K. J. Johnson, B. J. Prazen, D. C. Young, R. E. Synovec, CAC-2002, Seattle WA, Sept. 23-24, 2002, poster.

273. "Parallel Column Liquid Chromatography with a Single Multi-Wavelength Absorbance Detector for Enhanced Selectivity using Chemometric Analysis," G. M. Gross, B. J. Prazen, R. E. Synovec, CAC-2002, Seattle WA, Sept. 23-24, 2002, poster.

274. "Development of SIA-DSTD for Studying the Interfacial Properties of Surface Active Samples," N. Lenghor, J. Jakmunee, K. Grudpan, B. A. Staggemeier, W. W. C. Quigley, B. J. Prazen, G. D. Christian, J. Ruzicka, R. E. Synovec, 28th Congress of Science and Technology of Thailand, October 24-26, 2002, Bangkok, Thailand, poster.

275. "Characterization and Use of Raman Waveguide Sensor Using Preconcentration Principles", S. Tanikkul, J. Jakmunee, M. Rayanakorn, K. Grudpan, B. J. Marquardt, G. M. Gross, B. J. Prazen, G. D. Christian, R. E. Synovec, 28th Congress of Science and Technology of Thailand, October 24-26, 2002, Bangkok, Thailand, poster.

276. "Process Liquid Chromatography and Microfabricated Liquid Analyzers," C.D. Costin, R. E. Synovec, Nov. 5, 2002, CPAC Meeting, Seattle, WA.

277. "Process Gas Chromatography with Chemometrics," K. J. Johnson, R. E. Synovec, Nov. 5, 2002, CPAC Meeting, Seattle, WA.

278. "On-Line Measurement of Interfacial Properties in Flowing Liquids using the DSTD," B.A. Staggemeier, R. E. Synovec, Nov. 5, 2002, CPAC Meeting, Seattle, WA.

279.* "Instrumentation, Method Development and Chemometrics for Diaphragm Valve-Based GC × GC – TOFMS, A. E. Sinha, B. J. Prazen, R. E. Synovec, USAF, Patrick AFB, Satellite Beach, FL, 2002.

280.* "Diffusion Coefficient Measurement in a Microfluidic Analyzer using Dual-Beam RIG Detection: Application to On-Chip Molecular Size Determination," R. E. Synovec, C. D. Costin, A. K. Torgerson, 16th Int. Symp. on Microscale Separations and Analysis (HPCE 2003), San Diego, CA, January 19, 2003.

281.* "Recent Advances in Process Chromatography," R. E. Synovec, 17th Int. Forum for Process Analytical Chemistry, Scottsdale, AZ, January 23, 2003.

282.* "Process Chromatography with Chemometrics," R. E. Synovec, 17th Int. Forum for Process Analytical Chemistry, Scottsdale, AZ, January 23, 2003.

283. "Flow Injection and Sequential Injection Systems with Dynamic Surface Tension Detection for Anionic and Cationic Surfactants," N. Lenghor, J. Jakmunee, B. J. Prazen, W. W. C. Quigley, R. E. Synovec, G. D. Christian, K. Grudpan, 9th Int. Conf. on Flow Analysis, Geelong, Australia, Feb. 17-21, 2003, poster.

284. "Raman Liquid-core Waveguide Sensor for Preconcentration Characterization and Quantitation", S. Tanikkul, J. Jakmunee, M. Rayanakorn, K. Grudpan, B. J. Marquardt, G. M. Gross, B. J. Prazen, L. W. Burgess, G. D. Christian, R. E. Synovec, 9th Int. Conf. on Flow Analysis, Geelong, Australia, Feb. 17-21, 2003, Poster.

285.* "GC × GC – TOFMS with Chemometric Data Analysis," R. E. Synovec, C. G. Fraga, B. J. Prazen, A. E. Sinha, K. J. Johnson, 1st Int. Symp. on GC × GC, Volendam, Netherlands, March 6, 2003.

286. "Quantification of Two-Ring Aromatics in Jet Fuel with GC × GC/Tri-PLS and Objective Retention Time Alignment," R. E. Synovec, K. J. Johnson, B. J. Prazen, D. C. Young, 1st Int. Symp. on GC × GC, Volendam, Netherlands, March 6-7, 2003, poster.

287. "Comparison of Chemometric Algorithms for Deconvoluting Unresolved Mass Spectra in GC × GC – TOFMS Data," C. G. Fraga, B. J. Prazen, A. E. Sinha, R. E . Synovec, 1st Int. Symp. on GC × GC, Volendam, Netherlands, March 6-7, 2003, poster.

288.* "High-Throughput Analysis of Complex Mixtures," R. E. Synovec, Food and Drug Administration (FDA) Practicum, Seattle, WA, March 19, 2003.

289. "Sequential Injection System with the DSTD for Studying Surface Active Substance," N. Lenghor, J. Jakmunee, K. Grudpan, G. D. Christian, J. Ruzicka, R. E. Synovec, RGJ-PhD Congress IV, Aprial 25-27, 2003, Chonburi, Thailand, poster.

290. "Initial Instrumentation and Method Development for Thermal Modulation Based GC × GC – TOFMS," A. E. Sinha, J. L. Hope, B. J. Prazen and R. E. Synovec, USAF, Seattle, WA, April 30, 2003.

291.* "LC-related Technologies and NeSSI Compatibility," R. E. Synovec, CPAC Micro-Analytics Workshop, Seattle, WA, May 4, 2003.

292. "Process Liquid Chromatography and Microfabricated Liquid Analyzers," C.D. Costin, R. E. Synovec, May 6, 2003, CPAC Meeting, Seattle, WA.

293. "Process Gas Chromatography and Chemometrics," A. E. Sinha, J. L. Hope, R. E. Synovec, May 6, 2003, CPAC Meeting, Seattle, WA.

294. "On-Line Measurement of Interfacial Properties in Flowing Liquids using the DSTD," B.A. Staggemeier, R. E. Synovec, May 6, 2003, CPAC Meeting, Seattle, WA.

295. "High Throughput Analysis of Interfacial Properties of Surface-Active Samples by SIA-DSTD," N. Lenghor, J. Jakmunee, K. Grudpan, B. A. Staggemeier, W. W. C. Quigley, B. J. Prazen, G. D. Christian, J. Ruzicka, R. E. Synovec, 2nd PERCH Annual Scientific Conference, May 11-14, 2003, Chonburi, Thailand, poster.

296. "Analysis of Benzene, Toluene and *p*-Xylene Mixture using Raman Liquid-Core Waveguide Sensor," S. Tanikkul, K. Grudpan, M. Rayanakorn, J. Jakmunee, B. J. Marquardt, G. M. Gross, B. J. Prazen, L. W. Burgess, G. D. Christian, R. E. Synovec, 2nd PERCH Annual Scientific Conference, May 11-14, 2003, Chonburi, Thailand, poster.

297.* "Chemometric Analysis of GC × GC – TOFMS Data," R. E. Synovec, A. E. Sinha, B. J. Prazen, C. G. Fraga, 26th ISCC, Las Vegas, NV, May 22, 2003.

298. "Open Tubular Gas Chromatography using Monolayer Protected Gold Nanoparticles as the Stationary Phase," G. M. Gross, D. A. Nelson, J. W. Grate, R. E. Synovec, 26th ISCC, Las Vegas, NV, May 18-22, 2003, poster.

299. "High-Temperature Valve-Based GC × GC – TOFMS," A. E. Sinha, C. G. Fraga, B. J. Prazen, K. J. Johnson, R. E. Synovec, 26th ISCC, Las Vegas, NV, May 18-22, 2003, poster.

300. "A Microfluidic Detector for Measuring Diffusion Coefficients and Molar Mass," C. D. Costin, B. A. Staggemeier, R. E. Synovec, 26th ISCC, Las Vegas, NV, May 18-22, 2003, poster.

301.* "Using Microfluidics and Nanomaterials in Chemical Analyzers," R. E. Synovec, 8th CPAC Summer Institute, Seattle, WA, July 16, 2003.

302.* "GC × GC Instrumentation and Chemometric Analysis of GC × GC – TOFMS Data," R. E. Synovec, LECO Corporation, St. Joseph, MI, August 4, 2003.

303.* "Hyphenated Separation Methods (2D) and Chemometric Data Analysis," R. E. Synovec, LECO Corporation, St. Joseph, MI, August 4, 2003.

304. "Fundamental Studies of Monolayer-Protected Nanoparticles by Gas Chromatography," G. M. Gross, R. E. Synovec, J. W. Grate, Nanoscale Science and Technology Workshop, Seattle, WA, Sept. 22-23, 2003, poster.

305.* "Advances in Micro-Analytical Instrumentation and Data Analysis," R. E. Synovec Dow, Freeport TX, October 20, 2003.

306.* "Chemometric Analysis of GC × GC Data," R. E. Synovec, Gulf Coast Conference, Galveston, TX, October 22, 2003.

307. "Process LC and Microfabricated Liquid Analyzers," C. D. Costin, R. E. Synovec, CPAC Meeting, Seattle, WA, November 4, 2003.

308. "Process GC with Chemometrics," G. M. Gross, B. J. Prazen, R. E. Synovec, CPAC Meeting, Seattle, WA, November 4, 2003.

309. "On-Line Measurement of Interfacial Properties – DSTD," B. A. Staggemeier, R. E. Synovec, CPAC Meeting, Seattle, WA, November 4, 2003.

310. "A Dynamic Surface Tension Detector for Flow-Based Techniques," N. Lenghor, J. Jakmunee, B. A Staggemeier, B. J. Prazen, G. D. Christian, R. E. Synovec, K. Grudpan, 20th Anniversary of the Japanese Association for FIA, Okayama, Japan, November 6-7, 2003, poster.

311.* "Micro Gas Chromatography Tradeoff Study," U. Bonne, G. Eden, G. Frye-Mason, C. Herring, R. Sacks and R. Synovec, 18th Int. Forum for Process Analytical Chemistry, Arlington, VA, January 14, 2004.

312.* "GC × GC – TOFMS and Metabolomics," R. E. Synovec, J. L. Hope, A. E. Sinha and B. J. Prazen, 8th International Symposium on Hyphenated Techniques in Chromatography and Hyphenated Chromatographic Analyzers (HTC-8), Bruges, Belgium, February 6, 2004. **(Keynote Lecture)**

313.* "A Microfluidic Molecular Mass Sensor," R. E. Synovec, C. D. Costin, A. D. McBrady,

A. K. Torgerson, 17th Int. Symp. on Microscale Separations and Analysis (HPCE 2004), Salzburg, Austria, February 9, 2004.

314. "Process LC and Microfabricated Liquid Analyzers," A. D. McBrady, R. E. Synovec, CPAC Meeting, Seattle, WA, May 4, 2004.

315. "Process GC with Chemometrics," G. M. Gross, A. E. Sinha, R. E. Synovec, CPAC Meeting, Seattle, WA, May 4, 2004.

316. "On-Line Measurement of Interfacial Properties – DSTD," B. A. Staggemeier, R. E. Synovec, CPAC Meeting, Seattle, WA, May 4, 2004.

317. "Process Analyses for Yeast Fermentation using the DSTD," N. Lenghor, J. Jakmunee, K. Grudpan, B. A. Staggemeier, B. J. Prazen, G. D. Christian, R. E. Synovec, 3rd PERCH Annual Scientific Conference, May 9-12, 2004, Chonburi, Thailand.

318.* "Instrumentation, Method and Chemometric Development of GC × GC – TOFMS for Target Analysis," R. E. Synovec, DOD Technology Program Review, Aberdeen Proving Ground, Edgewood, MD, May 12, 2004.

319. "Characterization of Protein Denaturation by a Multidimensional Dynamic Surface Tension Detector," E. Bramanti, C. Allegrini, M. Onor, G. Raaspi, K. J. Skogerboe, R. E. Synovec, INFMeeting, National Conference on the Physics of Matter, Genova, Magazzini del Cotone, Italy, June 8-10, poster I-178.

320.* "Developments in Fast Gas Chromatography," R. E. Synovec, 9th CPAC Summer Institute, Seattle, WA, July 21, 2004.

321.* "GC×GC-TOFMS and Metabolomics," R. E. Synovec, 2nd Int. Symp. GC × GC, Atlanta, GA, September 1, 2004. **(Plenary Session – Keynote Lecture)**

322. "GC×GC-TOFMS and Metabolomics," J.L. Hope, A.E. Sinha, B.J. Prazen, R.E. Synovec, FACSS Meeting, Portland, OR, October 5, 2004, poster.

323.* "GC×GC-TOFMS for Metabolomics Analyses," R. E. Synovec, University of Montana, Missoula, MT, October 11, 2004.

324. "Process LC and Microfabricated Liquid Analyzers," A. D. McBrady, A. K. Torgerson, R. E. Synovec, CPAC Meeting, Seattle, WA, November 9, 2004.

325. "Process GC with Chemometrics," J. L. Hope, K. M. Pierce, R. E. Synovec, CPAC Meeting, Seattle, WA, November 9, 2004.

326. "On-Line Measurement of Interfacial Properties – DSTD," R. E. Synovec, CPAC Meeting, Seattle, WA, November 9, 2004.

327.* "Chromatography and Chemometrics: Developing the Instrument and Data Analysis Methods in Parallel to obtain the Most Informative Analytical Data," B. J. Prazen, R. E. Synovec, 19th Int. Forum for Process Analytical Technology, Arlington, VA, January 12, 2005.

328.* "GC×GC-TOFMS and Metabolomics," R. E. Synovec, Colorado State University, 38th Meeting of Society of Western Analytical Professors, Ft. Collins, CO, January 14, 2005.

329.* "Chemometric Software Development for GC×GC-TOFMS Analysis," R. E. Synovec, DOD Tech Program Review, MRI Florida Division, Melbourne, FL, Feb. 25, 2005.

330.* "Principles of Comprehensive 2D Separations with Chemometric Data Analysis," R. E. Synovec, J. L. Hope, A. E. Sinha, B. J. Prazen, K. M. Pierce, J. C. Hoggard, R. E. Mohler, PittCon 2005, Orlando, FL, February 28, 2005.
(Keynote Lecture – 2D Separations Session)

331.* "Stationary Phase Films for MicroAnalytical Measurements," U. Bonne, N. Iwamoto, N. Lytle, F. Nerenz, R. Higashi, C. Herring, R. Synovec, K. Johnson, PittCon 2005, Orlando, FL, February, 28, 2005.

332. "Tools for Extraction of Useful Information from Metabolic Profiles: Techniques for Mining the GC×GC-TOFMS Data Cube," J. L. Hope, K. M. Pierce, R. E. Mohler, B. J. Prazen, R. E. Synovec, PittCon 2005, Orlanda, FL, Feb. 27-March 3, poster.

333. "Process LC and Microfabricated Liquid Analyzers," A. D. McBrady, A. K. Torgerson and R. E. Synovec, CPAC Meeting, Seattle, WA, May 3, 2005.

334. "Process GC with Chemometrics," V. R. Reid, K. M. Pierce and R. E. Synovec, CPAC Meeting, Seattle, WA, May 3, 2005.

335. "GC × GC – TOFMS Project: PARAFAC GUI Development," J. C. Hoggard, K. M. Pierce, B. J. Prazen and R. E. Synovec, DOD Technology Program Review, University of Washington, Seattle, WA, May 6, 2005.

336.* "Gas Chromatography: Advances in Separation Technology," R. E. Synovec, Minnesota Chromatography Forum, Earle Brown Heritage Center, Minneapolis, MN, May 19, 2005.
(Keynote Lecture, GC Session)

337.* "GC × GC – TOFMS and Metabolomics," R. E. Synovec, J. L. Hope, K. M. Pierce, R. E. Mohler and B. J. Prazen, 28th ISCC, Las Vegas, NV, May 24, 2005.
(Keynote Lecture – GC × GC Special Session)

338. "Chemometric Analysis of Gas Chromatographic (GC and GC × GC) Data Using Retention Time Alignment, Feature Selection and Principal Component Analysis," K. M. Pierce, J. L. Hope, M. M. Van Wingerden, R. E. Mohler, B. J. Prazen and R. E. Synovec,

28th ISCC, Las Vegas, NV, May 24, 2005.

339. "Microfluidic Diffusion Coefficient Sensing for Molar Mass Determination and HPLC Mobile Phase Gradient Capable Refractive Index Detection," A. D. McBrady, A. K. Torgerson and R. E. Synovec, 28th ISCC, Las Vegas, NV, May 24, 2005.

340. "Tools for Extraction of Useful Information from Metabolic Profiles: Techniques for Mining the GC × GC – TOFMS Data Cube," J. L. Hope, K. M. Pierce, R. E. Mohler, B. J. Prazen and R. E. Synovec, 28th ISCC, Las Vegas, NV, May 22-25, 2005, poster #76.

341. "High Speed GC Instrumentation: Advances in GC Sample Injection and Portable GC × GC Instrumentation," R. E. Mohler, G. M. Gross, V. R. Reid, B. J. Prazen, R. E. Synovec, 28th ISCC, Las Vegas, NV, May 22-25, 2005, poster #114.

342.* "Gas Chromatography: Advances in Separation Technology," V. R. Reid, K. M. Pierce and R. E. Synovec, Dow Chemical Canada Inc., Fort Saskatchewan, Canada, June 7, 2005.

343.* "Development, Evaluation and Application of Nanoparticles as Stationary Phases for Gas Chromatography," R. E. Synovec, G. W. Gross, V. R. Reid and J. W. Grate, 79th ACS Colloid and Surface Science Symposium, Clarkson University, Potsdam, NY, June 14, 2005. **(Keynote Lecture, Analytical Uses of Nanoparticles Session)**

344.* "Gas Chromatography: Advances in Separation Technology," R. E. Synovec, 10th CPAC Summer Institute, Lake Kachess Club House, WA, July 21, 2005.

345.* "Retention Time Alignment Preprocessing for Chemometric Analysis of GC Separations of Complex Samples," K. M. Pierce, R. E. Synovec, J. C. Hoggard and J. S. Nadeau, Pacific Northwest National Laboratory (PNNL), Richland, WA, September 8, 2005.

346.* "Advances in Gas Chromatographic Instrumentation and Methodology," R. E. Synovec, 32nd FACSS and 51st ICASS, Quebec City, Canada, October 10, 2005. **(Keynote Lecture, Process Analytical Session)**

347. "Chemometrics and Chromatography: Extracting Information from Large Volumes of Multivariate Data," K. M. Pierce, R. E. Mohler, J. C. Hoggard and R. E. Synovec, 32nd FACSS and 51st ICASS, Quebec City, Canada, October 10, 2005.

348.* "Analytical Adventures with Gas Chromatography," R. E. Synovec, Chico State University, Chico, CA, October 21, 2005.

349.* "Advances in Software, Instrumentation and Methodology for Gas Chromatography," R. E. Synovec and J. C. Hoggard, LECO Corporation, St. Joseph, MI, November 3, 2005.

350. "Process LC and Microfabricated Liquid Analyzers," A. D. McBrady and R. E. Synovec, CPAC Meeting, Seattle, WA, November 8, 2005.

351. "Process GC with Chemometrics," V. R. Reid, K. M. Pierce and R. E. Synovec, CPAC Meeting, Seattle, WA, November 8, 2005.

352. "GC × GC – TOFMS Project: PARAFAC GUI Development," J. C. Hoggard, K. M. Pierce and R. E. Synovec, DOD Technology Program Review, University of Washington, Seattle, WA, December 2, 2005.

353. "MicroSeparation and Pre-Concentration Columns based on Carbon Nanotube Arrays," O. Bakajin, A. Noy, M. Stadermann, B. Dick, V. R. Reid, A. D. McBrady and R. E. Synovec, DARPA Program Review, Savannah, GA, January 11, 2006.

354.* "Recent Advances in the PARAFAC GUI Development," J. C. Hoggard, K. M. Pierce and R. E. Synovec, DOD Technology Program Review, ENSCO, Melbourne, FL, March 7, 2006.

355. "Correcting Retention Time Shifts in Chromatography for Improved Data Analysis," K. M. Pierce, R. E. Synovec, B. W. Wright and S. Ramos, PittCon 2006, Orlando, FL March 13, 2006.

356.* "Recent Advances in GC × GC – TOFMS and Chemometrics with Application to Metabolomics," R. E. Synovec, J. C. Hoggard, K. M. Pierce and R. E. Mohler, PittCon 2006, Orlando, FL, March 16, 2006.
(Keynote Lecture – Session of Discovery Through GC × GC Separations)

357.* "Analytical Adventures with Gas Chromatography," R. E. Synovec, Florida State University, Tallahassee, FL, April 6, 2006.

358.* "Analytical Adventures with Gas Chromatography and Chemometrics," R. E. Synovec, ExxonMobil, Corporate Strategic Research Laboratory, Clinton, NJ, April 24, 2006.

359.* "Analytical Adventures with Gas Chromatography," R. E. Synovec, Minnesota Chromatography Forum, Nye's Polonaise, Minneapolis, MN, April 25, 2006.

360. "Correcting Retention Time Shifts in Chromatography for Improved Data Analysis," K. M. Pierce, R. E. Synovec, B. W. Wright and S. Ramos, Eigenvector University, Seattle, WA, April 24 and 26, 2006.

361. "Metabolite Analysis of Fermenting and Respiring Yeast Cells using GC × GC – TOFMS and Chemometrics," R. E. Mohler, K. M. Dombek, J. C. Hoggard, E. T. Young and R. E. Synovec, Eigenvector University, Seattle, WA, April 24 and 26, 2006.

362. "Process LC and Microfabricated Liquid Analyzers," A. D. McBrady and R. E. Synovec, CPAC Meeting, Seattle, WA, May 9, 2006.

363. "Process GC with Chemometrics," V. R. Reid, K. M. Pierce and R. E. Synovec, CPAC Meeting, Seattle, WA, May 9, 2006.

364. "A Fisher Ratio Algorithm for Third Order Separation Instrumentation Data to Identify

Significant Chemical Components when Differentiating Complex Samples," K. M. Pierce, J. C. Hoggard, J. L. Hope, P. M. Rainey, A. N. Hoofnagle, R. M. Jack, B. W. Wright and R. E. Synovec, 54th ASMS Conference, Seattle, WA, May 31, 2006.

365. "Metabolite Analysis of Fermenting and Respiring Yeast Cells using GC × GC – TOFMS and Chemometrics," R. E. Mohler, K. M. Dombek, J. C. Hoggard, E. T. Young and R. E. Synovec, 54th ASMS Conference, Seattle, WA, June 1, 2006.

366. "High Speed and Multidimensional Gas Chromatography," R. E. Synovec, 11th CPAC Summer Institute, Seattle, WA, July 19, 2006.

367. "Analytical Advances with Gas Chromatography and Chemometrics," J. C. Hoggard, R. E. Mohler, J. S. Nadeau, K. M. Pierce, W. C. Siegler, N. E. Watson and R. E. Synovec, Pacific Northwest National Laboratory, Richland, WA, September 6, 2006.

368.* "Analytical Adventures with Gas Chromatography," R. E. Synovec, Fort Lewis College, Durango, CO, September 29, 2006.

369.* "Analytical Adventures with Gas Chromatography," R. E. Synovec, University of South Florida, Tampa, FL, October 26, 2006.

370. "Process LC and Microfabricated Liquid Analyzers," R. E. Synovec, CPAC Meeting, Seattle, WA, November 7, 2006.

371. "Process GC with Chemometrics," A. D. McBrady, K. M. Pierce and R. E. Synovec, CPAC Meeting, Seattle, WA, November 7, 2006.

372.* "Analytical Methodology for Metabolomics using GC × GC – TOFMS and Chemometrics," R. E. Synovec, 4th Int. Symp. Austrian Proteomics Platform, Seefeld, Austria, January 30, 2007. (**Keynote Lecture – Metabolomics and Proteomics Session)**

373.* "Analytical Methodology for Metabolomics using GC × GC – TOFMS and Chemometrics," R. E. Synovec, University of Regensburg Medical School, Regensburg, Germany, February 1, 2007.
(Keynote Lecture – Symposium on GC × GC – TOFMS in Biomedical Research)

374. "Gas Preconcentration, Separation and Detection with Carbon Nanotubes," M. Stadermann, A. D. McBrady, V. R. Reid, A. Noy, R. E. Synovec and O. Bakajin, 233rd ACS National Meeting, Chicago, IL, March 25-29, 2007, Presentation 1246.

375. "Comprehensive Three-Dimensional Gas Chromatography with Parallel Factor Analysis," N. E. Watson, W. C. Siegler, J. C. Hoggard and R. E. Synovec, Eigenvector University, Seattle, WA, May 1, 2007.

376. "Trilinearity Restoration in GC × GC – TOFMS," T. Skov, J. C. Hoggard, R. Bro and R. E.Synovec, Eigenvector University, Seattle, WA, May 1, 2007.

377. "Targeted PARAFAC Analysis with a Custom GUI," J. C. Hoggard and R. E.Synovec, Eigenvector University, Seattle, WA, May 1, 2007.

378. "Process LC and Microfabricated Liquid Analyzers," E. M. Humston and R. E. Synovec, CPAC Meeting, Seattle, WA, May 9, 2007.

379. "Process GC with Chemometrics," V. R. Reid, J. C. Hoggard and R. E. Synovec, CPAC Meeting, Seattle, WA, May 9, 2007.

380.* "Analytical Methodology using GC-TOFMS, GC × GC – TOFMS and Chemometric Data Analysis," R. E. Synovec, LECO Corporation, St. Joseph, MI, May 17, 2007.

381.* "Discovery-Based Metabolomics using GC × GC – TOFMS and Chemometrics," R. E. Synovec, E. T. Young, R. E. Mohler, K. M. Dombek, J. C. Hoggard, E. M. Humston and K. M. Pierce, Dalian International Symposia and Exhibition on Chromatography (DISEC), which included the 4th International GC × GC Symposium, Dalian, China, June 4, 2007. **Invited Keynote Lecture**

382.* "Analytical Adventures with Gas Chromatography: Recent Metabolomics Investigations," R. E. Synovec, University of Alberta, Edmonton, Alberta, Canada, June 25, 2007.

383. "Comparison of Wild Type and Mutant Yeast Metabolomes Using Comprehensive GC × GC – TOFMS Data," E. T. Young, R. E. Mohler, K. M. Dombek, E. M. Humston, J. C. Hoggard, K. M. Pierce, and R. E. Synovec, 23rd Int. Conf. on Yeast Genetics and Molecular Biology, Melbourne, Australia, July 1-6, 2007. Poster #13-35.

384.* "Discovery-Based Metabolomics using GC × GC – TOFMS and Chemometrics," R. E. Synovec, 12th CPAC Summer Institute, Seattle, WA, July 18, 2007.

385.* "Pattern Recognition and Classification of Fuels using GC Data," J. C. Hoggard, J. S. Nadeau and R. E. Synovec, Pacific Northwest National Laboratory, Richland, WA, September 11, 2007.

386. "CPAC Vision and Update," R. E. Synovec, CPAC Meeting, Seattle, WA, November 6, 2007.

387. "Chemometrics for High-Throughput Processing of GC Data," J. C. Hoggard, J. S. Nadeau and R. E. Synovec, CPAC Meeting, Seattle, WA, November 6, 2007.

388. "Process GC Technology," V. R. Reid, W. C. Siegler and R. E. Synovec, CPAC Meeting, Seattle, WA, November 7, 2007.

389. "Process LC and Related Technologies," E. M. Humston, K. Ahn, L. W. Burgess and R. E. Synovec, CPAC Meeting, Seattle, WA, November 7, 2007.

390.* "Recent Advances in GC × GC – TOFMS and GC × GC × GC with Chemometric Data Analysis," R. E. Synovec, 31st ISCC, Albuquerque, New Mexico, November 28, 2007. **(Keynote Lecture – Session on New Dimensions in GC × GC; Session Organizer and Chair)**

391.* "Biojet Fuel Analysis using GC × GC – TOFMS," R. E. Synovec, W. C. Siegler and J. C. Hoggard, Boeing Co., Seattle, WA, January 18, 2008

392.* "Discovery-Based Metabolomics using GC × GC – TOFMS and Chemometrics," R. E. Synovec, 10th International Symposium on Hyphenated Techniques in Chromatography and Hyphenated Chromatographic Analyzers (HTC-10), Bruges, Belgium, January 31, 2008. **(Keynote Lecture - Plenary Session)**

393. "An Instrument for Three-Dimensional Gas Chromatography (GC × GC × GC)," R. E. Synovec, HTC-10, Bruges, Belgium, January 30 – February 1, 2008. **Poster.**

394.* "Discovery-Based Metabolomics using GC × GC – TOFMS and Chemometrics," R. E. Synovec, PittCon 2008, New Orleans, LA, March 5, 2008. **(Keynote Lecture – Session on GC × GC)**

395.* "Discovery-Based Metabolomics using GC × GC – TOFMS and Chemometric Data Analysis," R. E. Synovec, Purdue University, Bindley Bioscience Center, West Lafayette, IN, March 18, 2008.

396.* "GC × GC – TOFMS and Data Analysis," R. E. Synovec, LECO Corporation, St. Joseph, MI, March 19, 2008.

397. "Biojet Fuel Analysis using GC × GC – TOFMS," R. E. Synovec, W. C. Siegler, J. C. Hoggard and O. J. Hadaller, CRC Aviation Meeting, Alexandria, VA, April 30, 2008.

398. "Overview of CPAC Program," R. E. Synovec, CPAC Meeting, Seattle, WA, May 5, 2008.

399. "Process GC and Chemometrics," V. R. Reid, J. C. Hoggard, J. S. Nadaeu, D. J. Veltkamp and R. E. Synovec, CPAC Meeting, Seattle, WA, May 6, 2008.

400. "Process LC and NeSSI," S. E. Gilbert, L. W. Burgess, D. J. Veltkamp, T. I. Dearing and R. E. Synovec, CPAC Meeting, Seattle, WA, May 6, 2008.

401.* "Chemometric Data Analysis for Two-Dimensional Separations," R. E. Synovec, 32nd International Symposium on High Performance Liquid Phase Separations and Related Techniques (HPLC 2008), Baltimore, MD, May 13, 2008. **(Keynote Lecture – 2D Separations Session)**

402.* "Recent Advances in GC × GC – TOFMS with Multivariate Data Analysis," R.E. Synovec, Symposium on New Frontiers of Bio-Imaging and Microseparation, honoring Ed Yeung, sponsored by Iowa State University and Ames Laboratory, Gateway Hotel, Ames, IA, May 24, 2008.

403.* "Comprehensive Three-Dimensional Gas Chromatography (GC × GC × GC): Fundamentals and Opportunities," R. E. Synovec, 5th GC × GC and 32nd ISCC, Riva del, Garda, Italy, May 27, 2008. **Invited Plenary Lecture.**

404. "Implementation of Advanced Gas Chromatography: From the Discovery Stage to Real-Time On-Line Analysis," R. E. Synovec, 13th CPAC Summer Institute, July 16, 2008, Seattle, WA

405.* "Pattern Recognition and Classification of Fuels using Gas Chromatography," J. C. Hoggard, E. M. Humston, W. C. Siegler, J. S. Nadeau and R. E. Synovec, Pacific Northwest National Laboratory, Richland, WA, Jul 24, 2008.

406. "Phased Heater Array for Enhanced Detection (PHASED): Realizing a Robust Micro-Gas Analyzer," A. D. McBrady, M. L. Rhodes, F. Nusseibeh, R. Higashi, T. M. Marta, K. M. Newstrom-Peitso, L. Forner, V. R. Reid, K. M. Pierce, J. C. Hoggard, J. S. Nadeau and R. E. Synovec, 236th ACS National Meeting, Philidelphia, PA, August 17-21, 2008.

407. "Metabolite Profiling Analysis of *Methylobacterium extorquens* AM1 by a Comprehensive Metabolomic Approach," S. Yang, M. Sadilek, R. E. Synovec and M. E. Lidstrom, Metabolomics Society 4th Annual International Conference, Boston, MA, Sept. 4, 2008, P014.

408. "Two-Dimensional Gas Chromatography / Time-of-Flight Mass Spectrometry with Chemometric Data Analysis," J. C. Hoggard and R. E. Synovec, FACSS, Reno, NV, October 2, 2008.

409.* "Implementation of Advanced Gas Chromatography: From the Discovery Stage to Real-Time On-Line Analysis," R. E. Synovec, Siena Conference on Product and Process Optimization, Certosa di Pontignano, Siena, Italy, October, 7, 2008.

410.* "Advances in Analytical Chemistry: from GC-on-a-chip, to Multidimensional GC for Metabolomics, to Dynamic Surface Tension Detection," R. E. Synovec, Instituto per i Processi Chimico-Fisici, Pisa, Italy, October 9, 2008.

411. "Process GC with Alignment and Chemometrics," J. C. Hoggard, J. S. Nadaeu, T.I. Dearing, E. M. Humson and R. E. Synovec, CPAC Meeting, Seattle, WA, November 3 (workshop) and 4 (talk), 2008.

412. "Process LC and NeSSI," M. S. Al-Shaer S. E. Gilbert, L. W. Burgess, and R. E. Synovec, CPAC Meeting, Seattle, WA, November 4, 2008.

413.* "Analytical Adventures with GG: from GC-on-a-chip to Multidimensional GC for Metabolomics," R. E. Synovec, Bethel University, Arden Hills, MN, November 21, 2008.

414.* "Analytical Adventures with GC: from GC-on-a-chip to Multidimensional GC for Metabolomics," R. E. Synovec,University of St. Thomas, St. Paul, MN, Nov. 22, 2008

415. "Optimized Target Selection for Real Time Alignment and Chemometric Analysis of Chromatographic Data," T. I. Dearing, J. S. Nadeau, L. S. Ramos, B. G. Rohrback and R. E. Synovec, 23rd International Forum for Process Analytical Chemistry (IFPAC), Baltimore, MD, January 27, 2009.

416. "Automated Parameter Selection for Real-Time Alignment in Gas Chromatography," J. S. Nadeau, T. I. Dearing, L. S. Ramos, B. G. Rohrback and R. E. Synovec, 23rd IFPAC, Baltimore, MD, January 27, 2009.

417.* "Discovery-Based Metabolomics using GC × GC – TOFMS and Chemometric Data Analysis," R. E. Synovec, E. T. Young, E. M. Humston, J. C. Hoggard, R. E. Mohler and K. M. Dombek, Association for Lab Automation (ALA09), Palm Springs, CA, January 27, 2009.

418. "Broader Impacts of Recent Technical Developments," M. V. Koch, M. McCarthy, B. J. Marquardt and R. E. Synovec, CPAC Webinar, February 18, 2009.

419.* "Using GC × GC – TOFMS and Chemometrics to Explore Diesel Fuel Alteration," R. E. Synovec, W. C. Siegler, J. C. Hoggard, and B. W. Wright, PittCon 2009, Chicago, IL, March 10, 2009.

420.* "Using GC × GC – TOFMS and Chemometrics to Understand the Chemical Composition of Complex Samples," R. E. Synovec, Weyerhaueser Technology Center, Federal Way, WA, March 19, 2009.

421. "Metabolomics, Fuel Characterization, Micro-GC, Micro-LC, Real-Time Retention Alignment, and Chemometrics," R. E. Synovec, CPAC Sponsor Meeting, Seattle, WA, May 4, 2009.

422. "Process GC with Alignment and Chemometrics," J. S. Nadaeu, E. M. Humson and R. E. Synovec, CPAC Sponsor Meeting, Seattle, WA, May 5, 2009

423. "Process LC: Engineering of a NeSSI Sampling Platform for Fast On-Line HPLC Process Monitoring," S. E. Gilbert, M. S. Al-Shaer, L. W. Burgess, and R. E. Synovec, CPAC Sponsor Meeting, Seattle, WA, May 5, 2009.

424. "Process Monitoring with Microdialysis Extraction and Gas Chromatography," A. Borgerding and R. E. Synovec, CPAC Sponsor Meeting, Seattle, WA, May 5, 2009.

425.* "GC × GC Software Development: Basic Features and Advanced Chemometrics," R. E. Synovec, 6th GC × GC and 33rd ISCC, Portland, OR, May 17, 2009. **Short Course**.

426.* "Recent Advances in Quantitative Methodology for GC × GC – TOFMS and GC × GC × GC," R. E. Synovec, J. C. Hoggard, E. M. Humston, W. C. Siegler, 6th GC × GC and 33rd ISCC, Portland, OR, May 18, 2009. **Invited Plenary Lecture.**

427. "LC-MS/MS and GC × GC – TOFMS Measurement of Targeted Metabolites of Methylobacterium Extorquens AM1 Grown on Two Different Carbon Sources," S. Yang, M. Sadilek, R. E. Synovec, M. E. Lidstrom, 6th GC × GC and 33rd ISCC, Portland, OR, May 19, 2009, P-405-T.

428. "Extended Nontarget PARAFAC Applications to GC × GC – TOFMS Data," J. C. Hoggard, W. C. Siegler, R. E. Synovec, 6th GC × GC and 33rd ISCC, Portland, OR, May 18, 2009, P-114-M.

429. "GC × GC – TOFMS with Chemometric Data Analysis Techniques Applied to a Snf1 Deletion Mutant Metabolomic Study," E. M. Humston, K. M. Dombek, E. T. Young, R. E. Synovec, 6th GC × GC and 33rd ISCC, Portland, OR, May 18, 2009, P-115-M.

430. "Optimized On-Line Alignment of Gas Chromatograms for Real-Time Decision Making," J. S. Nadeau, T. I. Dearing, L. S. Ramos, B. G. Rohrack, R. E. Synovec, 6th GC × GC and 33rd ISCC, Portland, OR, May 18, 2009, P-206-M.

431. "Comprehensive Three-Dimensional Gas Chromatography: Instrument Design, Figures-of-Merit and Applications," W. C. Siegler, J. C. Hoggard, R. E. Synovec, 6th GC × GC and 33rd ISCC, Portland, OR, May 19, 2009, P-406-T.

432. "Development of a GC × GC – TOFMS Method using SPME to Determine Volatile Compounds in Cacao Beans," R. E. Synovec, E. M. Humston, Y. Zhang, G. F. Brabeck and A. McShea, 6th GC × GC and 33rd ISCC, Portland, OR, May 18, 2009, P-113-M.

433. "Optimized On-Line Alignment of Gas Chromatograms for Real-Time Decision Making," J. S. Nadeau, T. I. Dearing, B. G. Rohrback, L. S. Ramos and R. E. Synovec, Northwest Regional ACS Meeting, Tacoma, WA, June 30, 2009.

434. "Development of a GC × GC – TOFMS Method Using SPME to Determine Volatile Compounds in Cacao Beans," E.M. Humston, Y. Zhang, G.F. Brabeck, A. McShea and R.E. Synovec, Northwest Regional ACS Meeting, Tacoma, WA, June 30, 2009.

435. "Using GC × GC – TOFMS and Chemometrics for Discovery-Based Process Analysis,"

R. E. Synovec, Contribution to CPAC Program Overview Webinar, Merck and Schering Plough, July 9, 2009.

436.* "Gas Chromatographic Techniques for Bioprocess Analysis," R. E. Synovec, 14th CPAC Summer Institute, July 22, 2009, Seattle, WA

437.* "Gas Chromatography and Chemometric Capabilities for the PACT / ChemIST Program," R. E. Synovec, J. C. Hoggard, R. B. Wilson and J. S. Nadeau, SRI, International, Menlo Park, CA, August 12, 2009.

438.* "Metabolomics Platform: GC × GC – TOFMS and LC-MS/MS," R. E. Synovec, Kidney Research Institute, Seattle, WA, October 1, 2009.

439.* "Analytical Adventures with Gas Chromatography: From Ultra Fast GC Sensors to Metabolomics," R. E. Synovec, Idaho State University, Pocatello, ID, October 9, 2009.

440.* "Analytical Adventures with Gas Chromatography: From Metabolomics to Ultra Fast GC Sensors," R. E. Synovec, Oregon State University, Corvallis, ID, October 19, 2009.

441. "Process Gas Chromatography with Real-Time Alignment and Chemometrics," R. E. Synovec, 2009 International NeSSI Forum, Seattle, WA, November 4, 2009.

442.* "Recent Advances in Gas Chromatographic Technology and Methods for Fuel Analysis," W. C. Siegler, J. S. Nadeau, J. C. Hoggard, R. B. Wilson and R. E. Synovec, Pacific Northwest National Laboratory, Richland, WA, November 12, 2009.

443.* "Development of Multidimensional Gas Chromatography – Mass Spectrometry Methods for Metabolomics," R. E. Synovec, Metabolomics User Group (MUG), Seattle, WA, November 17, 2009.

444.* "Selected Analytical Characterization Tools for the Biofuels Industry," R. E. Synovec, Association for Lab Automation (ALA10), Palm Springs, CA, January 25, 2010.

445.* "Recent Advances using GC × GC – TOFMS and Chemometrics to Food Quality and Metabolomics," J. C. Hoggard, E. M. Humston, W. C. Siegler and R. E. Synovec, 11th International Symposium on Hyphenated Techniques in Chromatography and Hyphenated Chromatographic Analyzers (HTC-11), Bruges, Belgium, January 29, 2010. **(Keynote Lecture)**

446.* "Real-Time Chemometric Alignment for Process Gas Chromatography," R. E. Synovec, J. S. Nadeau, T. I. Dearing, L. S. Ramos and B. G. Rohrback, 24th Int. Forum for Process Analytical Chemistry, Baltimore, MD, February 2, 2010.

447.* "Fundamental Advances for Process Gas Chromatography Instrumentation," R. E. Synovec, J. C. Hoggard, R. B. Wilson and W. C. Siegler, 24th Int. Forum for Process Analytical Chemistry, Baltimore, MD, February 3, 2010.

448. "Discovery-Based Analytics for Biofuel Characterization and Food Quality Assessment," E. M. Humston, J. C. Hoggard and R. E. Synovec, Center for Process Analytical Chemistry Satellite Workshop, Rome, Italy, March 25, 2010.

449. "Optimizing Peak Capacity Production and Chemometric Data Analysis for Hyphenated ' Gas Chromatographic Techniques," W. C. Siegler, R. B. Wilson, J. C. Hoggard and R. E. Synovec, 10th Annual Csaba Horváth Medal Award Symposium, Hartford, CT, April 15, 2010, Presentation #24.

450. "Chemometrics Workshop: Fundamental and Applications" T. I. Dearing. J. S. Nadeau, E. M. Humston and R. E. Synovec, CPAC Sponser Meeting, Seattle, WA, May 2, 2010.

451. "Discovery-Based Analytics for Biofuel Characterization and Food Quality Assessment," R. E. Synovec, CPAC Sponser Meeting, Seattle, WA, May 3, 2010.

452. "Process Gas Chromatography and Chemometrics," E. M. Humston, J. S. Nadeau, W. C. Siegler and R. E. Synovec, CPAC Sponser Meeting, Seattle, WA, May 4, 2010.

453. "Process Liquid Chromatography – Implementing Fast On-Line HPLC Process Monitoring with the NeSSI Sampling Platform," S. Gilbert and R. E. Synovec, CPAC Sponser Meeting, Seattle, WA, May 4, 2010.

454. "GC × GC – TOFMS with Chemometric Data Analysis Techniques Applied to a snf1Δ Mutant Metabolomics Study," E.M. Humston, K.M. Dombek, E.T. Young and R.E. Synovec, CPAC Sponser Meeting,Seattle, WA, May 4, 2010. (Poster)

455.* "Development of an Advanced Test Method for Jet Fuel Identification, Qualification, and Quality Control," J. C. Hoggard and R. E. Synovec, Aviation Technical Meeting of the Coordinating Research Council, Alexandria, VA, May 6, 2010.

456. "Extended Nontarget PARAFAC Applications to GC × GC – TOFMS Data," J. C. Hoggard, W. C. Siegler and R. E. Synovec, Eigenvector University, Seattle, WA, May 18, 2010. (poster)

457. "A New GUI for Alignment of GC and GC-MS Data using Piecewise Alignment," J. S. Nadeau and R. E. Synovec, Eigenvector University, Seattle, WA, May 18, 2010. (poster)

458. "Metabolomics Can Identify Biomarkers of Perinatal Asphyxia," A. Beckstrom, E. Humston, L. Snyder, R. Synovec and S. Juul, Pediatric Academic Society Conference, May, 2010. (poster)

459.* "Optimizing Peak Capacity Production in GC, 2D-GC, and 3D-GC," R. E. Synovec, 7th GC × GC & 34th ISCC, Riva del Garda, Italy, May 31, 2010. **Invited Plenary Lecture**

460. "Optimizing Peak Capacity with Quantitative Valve-Based Comprehensive Gas Chromatographic Instrumentation," W. C. Siegler, J. C. Hoggard, R. B. Wilson, and R. E. Synovec, 34th ISCC & 7th GC × GC Symposium, Riva del Garda, Italy, May 31,

2010, Keynote Lecture #03.

461. "High Peak Capacity Production for 1D, 2D and 3D Gas ChromatographyVia Reduction of Extra-Column Band Broadening," W. C. Siegler, J. C. Hoggard, R. B. Wilson, J. S. Nadeau and R. E. Synovec, 34th ISCC & 7th GC × GC Symposium, Riva del Garda, Italy, May-June, 2010. (poster)

462.* "Development and Implementation of Discovery-Based Metabolomics Technology," R. E. Synovec, U.S. Army Research Laboratory (ARL), Adelphi, MD, June 18, 2010.

463.* "Fundamental Advances for High Speed GC: Modeling, Instrumentation, and Data Analysis," R. E. Synovec, W. C. Siegler, R. B. Wilson, J. C. Hoggard and J. S. Nadeau, Sandia National Laboratories, Albuquerque, NM, July 13, 2010.

464.* "Discovery and Target-Based Metabolomics using Chromatographi Technologies," R. E. Synovec, 15th CPAC Summer Institute, July 21, 2010, Seattle, WA

465.* "Developments with Micro Gas Chromatography," R. E. Synovec, 15th CPAC Summer Institute, July 22, 2010, Seattle, WA

466.* "Recent Advances in GC Technology and Methods for Fuel Analysis," W. C. Siegler, J. S. Nadeau, L. C. Marney and R. E. Synovec, PNNL, Richland, WA, September 27, 2010.

467. "Improving GC Instrumentation for High Throughput Chemical Sensing," R. B. Wilson, J. C. Hoggard, W. C. Siegler, B. D. Fitz, J. S. Nadeau and R. E. Synovec, CPAC Sponser Meeting, Seattle, WA, November 2, 2010.

468. "Optimizing Peak Capacity with Valve-based GC × GC," W. C. Siegler, J. C. Hoggard, B. D. Fitz, J. Chen and R. E. Synovec, CPAC Sponser Meeting, Seattle, WA, November 2, 2010.

469. "Applications of GC × GC – TOFMS with Discovery-Based Data Analysis Software," L. R. Snyder, T. J. Montine, E. M. Humston-Fulmer, E. A. Viglino, R. E. Synovec, A. C. Beckstrom, S. E. Juul and A. McShea, CPAC Sponser Meeting, Seattle, WA, November 2, 2010.

470. "A Piecewise Alignment Algorithm GUI for Correcting Time Shifting to Facilitate Chemometric Analysis," J. S. Nadeau, W. C. Siegler, J. C. Hoggard, B. Kehimkar, L. C. Marney and R. E. Synovec, CPAC Sponser Meeting, Seattle, WA, November 2, 2010.

471* "Development and Application of GC × GC – TOFMS Methods for Discovery-Based Analysis," R. E. Synovec, J. C. Hoggard, E. M. Humston and W. C. Siegler, Int. Chemical Congress of the Pacific Basin Societies, Honolulu, Hawaii, December 15-20, 2010.

472. "Integrated Gas Chromatography – Chemometric Platform Suitable for Field Testing of Food Quality," K. J. Skogerboe, E. M. Humston, J. Cao, J. C. Hoggard, R. E. Synovec, Int. Chemical Congress of the Pacific Basin Societies, Honolulu, Hawaii, December

15-20, 2010. (poster)

473.* "Fundamental Instrumental Advances for Process GC," R. B. Wilson, R. E. Synovec, J. C. Hoggard, W. C. Siegler and B. D. Fitz, 25th Int. Forum for Process Analytical Chemistry, Baltimore, MD, January 20, 2011.

474.* "Real-Time Alignment and Chemometrics for Process GC," J. S. Nadeau, R. E. Synovec, R. B. Wilson and B. D. Fitz, 25th Int. Forum for Process Analytical Chemistry, Baltimore, MD, January 21, 2011.

475.* "GC × GC Software Development: Basic Features and Advanced Chemometrics," R. E. Synovec, 8th GC × GC and 35th ISCC, San Diego CA, May 3, 2011. **Short Course**.

476.* "Optimizing Peak Capacity Production in GC, 2D-GC and 3D-GC," R. E. Synovec, R. B. Wilson, W. C. Siegler and J. C. Hoggard, 8th GC × GC and 35th ISCC, San Diego, May 4, 2011. **Invited Plenary Lecture.**

477. "Process GC and Chemometrics," R. B. Wilson, J. C. Hoggard, W. C. Siegler, B. D. Fitz, J. S. Nadeau and R. E. Synovec, CPAC Sponser Meeting, Seattle, WA, May 5, 2011.

478. "Modernizing Isothermal GC for Process Analysis," R. B. Wilson, J. C. Hoggard, B. D. Fitz, J. S. Nadeau and R. E. Synovec, CPAC Summer Institute, Seattle, WA, July 21, 2011.

479.* "Fundamental Advances for High Speed Process GC," R. E. Synovec, J. C. Hoggard, R. B. Wilson and B. D. Fitz, Siemens Industry, Seattle, WA, August 11, 2011.

480.* "Recent Advances in GC Technology and Methods for Fuel Analysis," B. A. Parsons, L. C. Marney, B. D. Fitz, R. B. Wilson, J. C. Hoggard and R. E. Synovec, PNNL, Richland, WA, August 17, 2011.

481.* "Application of GC × GC – TOFMS with Chemometrics to Address Emerging Challenges in Metabolomics," R. E. Synovec, ASMS Asilomar Conference on Mass Spectrometry, Pacific Grove, CA, October 1, 2011.

482.* "Development of Multidimensional GC – Mass Spectrometry Methods for Metabolomics," R. E. Synovec, Eli Lilly and Company, Global External Research and Development, Indianapolis, IN, October 7, 2011.

483. "Process GC and Chemometrics," R. B. Wilson, J. C. Hoggard, B. D. Fitz, and R. E. Synovec, CPAC Sponser Meeting, Seattle, WA, November 9, 2011.

484.* "Development of Chemical Analysis Tools to Assess Compositional Variation in RP-1 and RP-2," R. E. Synovec, J. C. Hoggard, L. C. Marney, C. G. Fraga, M. C. Billingsley, T. J. Bruno, JANNAF, Hunstville, AL, December 7, 2011.

485.* "Overview of UW Chemistry Graduate Program," R. E. Synovec, University of British

Columbia, Vancouver, BC, CANADA, February 17, 2012.

486.* "Biomarker Discovery for Assessing Moisture Damage in Cacao Beans," R. E. Synovec, University of Montana, Missoula, MT, April 25, 2012.

487.* "Cacao Bean Quality Assessment using Two-Dimensional Gas Chromatography Combined with Time-of-Flight Mass Spectrometry and Chemometrics," R. E. Synovec, E. M. Humston, K. J. Skogerboe and J. C. Hoggard, 243rd National ACS Meeting, San Diego, CA, March 27, 2012.

488. "Process GC and Chemometrics: Advances in Instrumentation," R. B. Wilson, J. C. Hoggard, B. D. Fitz, and R. E. Synovec, CPAC Sponser Meeting, Seattle, WA, May 8, 2012.

489.* "Increasing the Speed and Peak Capacity of GC – TOFMS and GC × GC – TOFMS Separations, R. E. Synovec , 9th GC × GC and 36th ISCC, Riva del Garda, Italy, May 31, 2012.

490.* "GC × GC Software Development: Basic Features and Advanced Chemometrics," R. E. Synovec, 9th GC × GC and 36th ISCC, Riva del Garda, Italy, May 30, 2012. **Short Course**

491. "Process Gas Chromatography with Chemometrics," R. E. Synovec, CPAC Summer Institute, Seattle, WA, July 23, 2012.

492.* "Using GC × GC – TOFMS for Metabolomics," R. E. Synovec, 2012 NWMRC Metabolomics Symposium, Seattle, WA, September 14, 2012.

493.* "Application of GC × GC – TOFMS with Chemometrics to Address Emerging Chemical Analysis Challenges," R. E. Synovec, National Institute of Standards and Technology (NIST), Boulder, CO, October 17, 2012.

494. "Fast, High Peak Capacity Separations with GC – TOFMS and GC × GC – TOFMS for Metabolomics and VOC Analyses," R. E. Synovec, ACS Rocky Mountain Regional Meeting, Denver, CO, October 18, 2012.

495.* "Biomarker Discovery for Cacao Bean Quality Assessment using GC × GC – TOFMS," R. E. Synovec, University of Puget Sound, Tacoma, WA, November 2, 2012.

496.* "Fast, High Peak Capacity Separations with GC – TOFMS and GC × GC – TOFMS, R. E. Synovec, PittCon 2013, Philadelphia, PA, March 21, 2013.

497.* "West by Northwest to Seattle," R. E. Synovec, Seattle Pacific University, Seattle, WA, April 29, 2013.

498.* "Recent Advances in the Development of Chemical Analysis Tools to Assess Compositional Variation in RP-1 and RP-2," B. Kehimkar, J. C. Hoggard, R. E. Synovec, M. C. Billingsley and T. J. Bruno, JANNAF, Colorado Springs, CO, April 25, 2013.

499. "Process GC and Chemometrics," R. E. Synovec, CPAC Sponser Meeting, Seattle, WA, May 6, 2013.

500.* GC × GC: In Hot Pursuit of More Chemical Information," R. E. Synovec, 10th GC × GC and 37th ISCC, Palm Springs, CA, May 13, 2013. **Award Lecture**

501.* "GC × GC Software Development: Basic Features and Advanced Chemometrics," R. E. Synovec, 10th GC × GC and 37th ISCC, Palm Springs, CA, May 12, 2013. **Short Course**

502.* "Increasing Peak Capacity Production for GC × GC – TOFMS," R. E. Synovec, LECO eSeminar, July 18, 2013.

503. "Process Gas Chromatography with Chemometrics," R. E. Synovec, CPAC Summer Institute, Seattle, WA, July 23, 2013.

504.* "Recent Advances in GC Instrumentation, Software, and Methods for Fuel Analysis," B. A Parsons, B. D. Fitz, B. C. Reaser, D. K. Pinkerton, J. C. Hoggard and R. E. Synovec, PNNL, Richland, WA, August 14, 2013.

505.* Invited "Development of Chemical Analysis Tools to Assess Compositional Variation in RP-1 and RP-2 (Rocket Fuel)," R. E. Synovec, AFRL/DLA Kickoff Meeting, Fort Belvoir, VA, August 28, 2013.

506.* "Forensic Analysis of Diesel using GC × GC – TOFMS," B. A. Parsons, Luke C. Marney, J. C. Hoggard, R. E. Synovec and B. W. Wright, 246th National ACS Meeting, Indianapolis, IN, September 9, 2013.

507.* "Biomarker Discovery for Cacao Bean Quality Assessment using GC × GC – TOFMS with Chemometric Data Analysis," R. E. Synovec, Pacific University, Forest Grove, OR, October 29, 2013.

508.* "Application of GC × GC – TOFMS and Chemometrics to Study Rocket Fuel," R. E. Synovec, U. of Puget Sound, Tacoma, WA, November 21, 2013.

509.* "Recent Developments in Fisher Ratio Analysis Software for GC × GC – TOFMS," B. A. Parsons, L. C. Marney, J. C. Hoggard and R. E. Synovec, 5th Multidimensional Chromatography Workshop, January 7, 2014, Toronto, ON.

510.* "Advances in Instrumentation and Data Analysis Methods to Improve Peak Capacity in GC – TOFMS and GC × GC – TOFMS, R. E. Synovec, PittCon 2014, Chicago, IL, March 3, 2014.

511.* "Development of Discovery-Based Techniques for the Comprehensive Analysis of Complex Samples with GC × GC – TOFMS: Biomarker Discovery for Food Products," B. A. Parsons, B. C. Reaser, D. K. Pinkerton, R. E. Synovec; 247th ACS National Meeting, March 17, 2014, Dallas, TX.

512. "Advances in Process Gas Chromatography and Chemometrics," B. A. Parsons, B. D. Fitz and R. E. Synovec, CPAC Sponsor Meeting, May 13, 2014, Seattle, WA.

513. "Advances in Instrumentation and Data Analysis Methods to Improve Peak Capacity in GC–TOFMS and GC × GC – TOFMS," B. D. Fitz and R. E. Synovec, Canadian Research Conference (CSC 2014), Vancouver, BC, June 4, 2014.

514.* "Chemometric Approaches to Maximixe Interpretation of GC – TOFMS and GC × GC – TOFMS Data," R. E. Synovec, Chemometrics in Analytical Chemistry (CAC2014 International Conference), Richmond, VA, June 11, 2014.

515.* "Advances in Instrumentation and Data Analysis Methods to Improve Peak Capacity in GC – TOFMS and GC × GC – TOFMS," R. E. Synovec, ACS Northwest Regional Meeting (NORM 2014), Missoula, MT, June 24, 2014.

516. "Improving GC – TOFMS Data Interpretation Using 2D Mass Cluster Plots," B. D. Fitz and R. E. Synovec, CPAC Summer Institute, July 22, 2014, Seattle, WA.

517. "Advances in Supervised Analysis of GC × GC – TOFMS Data Using Tile-Based Fisher Ratio Software," B. A. Parsons and R. E. Synovec, CPAC Summer Institute, July 22, 2014, Seattle, WA.

518.* "Analysis of Complex Samples using GC × GC – TOFMS with Chemometrics," R. E. Synovec, AMGEN, Thousand Oaks, CA, October 27, 2014.

519.* "Analysis of Complex Samples using GC × GC – TOFMS with Chemometrics," R. E. Synovec, Gonzaga University, Spokane, WA, Novemeber 7, 2014.

520.* "Analysis of Complex Samples using GC × GC – TOFMS with Chemometrics," R. E. Synovec, U. of Puget Sound, Tacoma, WA, November 21, 2014.

521. "Ultra-Fast High Peak Capacity Separations using Low Thermal Mass Gas Chromatography (LTM-GC) and Chemometrics," B. D. Fitz and R. E. Synovec, CPAC Sponsor Meeting, May 12, 2015, Seattle, WA.

522. "Rapid Discovery-Based Analysis with the GC×GC–TOFMS Platform to Facilitate Molecular Management," B. A. Parsons and R. E. Synovec, CPAC Sponsor Meeting, May 12, 2015, Seattle, WA.

523.* "Chemometric Approaches to Maximize Interpretation of GC×GC–TOFMS Data," R. E. Synovec, 12th GC × GC and 39th ISCC, Arlington, TX, May 17, 2015.

524.* "Chemometric Analysis of GC × GC Data," R. E. Synovec, 12th GC × GC and 39th ISCC, Arlington, TX, May 16, 2015. **Short Course**

525.* "Development of Chemical Analysis Tools to Relate Compositional Variation to Thermal Integrity Data for RP-1, RP-2 and Related Fuels," R. E. Synovec, C. E. Freye, M. C. Billingsley and N. S. Keim, JANNAF, Nashville, TN, June 2, 2015.

526.* "Chemometric Approaches to Maximize Interpretation of GC×GC–TOFMS Data,"

R. E. Synovec, ACS Northwest Regional Meeting (NORM 2015), Pocatello, ID, June 22, 2015.

527. "Finding Trace Chemical Marker Compounds in Complex Samples by GC×GC–TOFMS and Tile-based Fisher Ratio Analysis," B. A. Parsons and R. E. Synovec, CPAC Summer Institute, July 22, 2015, Seattle, WA.

528. "Novel Analytical Workflow for Comprehensive ^{13}C-Metabolite Flux Analysis using GC-TOFMS and Chemometrics," B. C. Reaser and R. E. Synovec, CPAC Summer Institute, July 22, 2015, Seattle, WA.

529.* "Chemometric Approaches to Maximize Interpretation of GC × GC – TOFMS Data: Data Processing and Alignment for Discovery-Based Analysis," R. E. Synovec, LECO, St. Joseph, MI, September 1, 2015.

530.* "Chemometric Approaches to Maximize Interpretation of GC – TOFMS Data: 2D Mass Cluster Plots and ^{13}C Fluxomic Analysis of Metabolites," R. E. Synovec, LECO, St. Joseph, MI, September 1, 2015.

531.* "Diaphragm Valve-based GC × GC: Robust, Low Cost, with High Chromatographic Efficiency," R. E. Synovec, LECO, St. Joseph, MI, September 1, 2015.

532.* "Chemometric Approaches to Maximize Interpretation of GC × GC – TOFMS Data for Discovery-Based Analysis," R. E. Synovec, PittCon 2016, Atlanta, GA, March 8, 2016.

533.* "Discovery-Based Analysis of GC × GC – TOFMS Data using Tile-Based Fisher Ratio Software and Combinatorial Threshold Detemination," R. E. Synovec, ACS National Meeting, San Diego, CA, March 16, 2016.

534.* "Expanding the Scope of Chromatography through Chemometrics," R. E. Synovec, CPAC Sponsor Meeting, Seattle, WA, May 2, 2016.

535. "Multidimensional GC with Chemometrics for Process Optimization," B. C. Reaser and R. E. Synovec, CPAC Sponsor Meeting, May 3, 2016, Seattle, WA.

536. "Recent Advances in Valve-Based GC × GC," C. E. Freye and R. E. Synovec, CPAC Sponsor Meeting, May 3, 2016, Seattle, WA.

537.* "Chemometric Analysis of GC × GC Data," R. E. Synovec, 13th GC × GC and 40th ISCC, Riva del Garda, Italy, May 29, 2016. **Short Course**

538.* "Multidimensional GC with Chemometrics: Distilling Information from Complex Samples," R. E. Synovec, 13th GC × GC and 40th ISCC, Riva del Garda, Italy, May 31, 2016. **Golay Award Lecture**

539.* "Expanding the Scope of Chromatography through Chemometrics," R. E. Synovec, CPAC Summer Institute, Lake Kachess Clubhouse, July 21, 2016.

540.* "Recent Advances in GC Instrumentation, Software, and Methods for Diesel Fuel Analysis," B. C. Reaser, D. K. Pinkerton, N. E. Watson and Robert E. Synovec, PNNL, Richland, WA, September 7, 2016.

541.* "Discovery-Based Metabolomics Studies using GC × GC – TOFMS with Fisher Ratio Analysis," R. E. Synovec, Applied Technology Center, Food and Drug Administration, Bothell, WA, September 9, 2016.

542.* "Fisher Ratio Analysis of GC × GC – TOFMS Data for Relevant Analyte Discovery," R. E. Synovec, SciX 2016, Minneapolis, MN, September 21, 2016.

543.* "Discovery-Based Studies using GC × GC – TOFMS with Fisher Ratio Analysis," R. E. Synovec, MARKES International, Sacramento, CA, October 18, 2016.

544.* "Recent Advances in Gas Chromatographic Instrumentation and Chemometrics: In Hot Pursuit of More Chemical Information," R. E. Synovec, Iowa State University, Ames, IA, October 21, 2016.

545.* "Basic Principles of GC × GC – TOFMS with Applications to Metabolomics and Forensics," R. E. Synovec, University of Puget Sound, Tacoma, WA, November 10, 2016.

546.* "Recent Advances in the Development of Chemical Analysis Tools to Relate Compositional Variation to Thermal Integrity Data for RP-1, RP-2, and Related Fuels," R. E. Synovec, C. E. Freye, M. C. Billingsley, N. Keim and B. Hill-Lam, JANNAF, Phoenix, AZ, December 8, 2016.

547.* "Forensic Analysis of Diesel using GC×GC–TOFMS with Fisher Ratio Software," B. A. Parsons, D. K. Pinkerton, B. C. Reaser, B. W. Wright and R. E. Synovec, 253rd National ACS Meeting, San Francisco, CA, April 4, 2017.

548. "Development of Chemometric Tools for Discovery-Based Analysis of GC × GC – HRTOFMS Data," C. E. Freye, N. Moore and R. E. Synovec, CPAC Sponsor Meeting, May 2, 2017, Seattle, WA.

549. "Development, Evaluation, and Application of the 2D *m/z* Cluster Method for GC-TOFMS Analysis," K. L. Berrier, B. C. Reaser and R. E. Synovec, CPAC Sponsor Meeting, May 3, 2017, Seattle, WA.

550. "Impact of GC × GC – TOFMS Experimental Design on PARAFAC Deconvolution," S. E. Prebihalo, D. K. Pinkerton, A. Uppugonduri and R. E. Synovec, CPAC Sponsor Meeting, May 3, 2017, Seattle, WA.

551.* "Chemometric Analysis of GC × GC Data," R. E. Synovec, 14th GC × GC and 41st ISCC, Arlington, TX, May 14, 2017. **Short Course**

552.* "Understanding and Extending the Effective Peak Capacity in GC–TOFMS," R. E. Synovec, 14th GC × GC and 41st ISCC, Arlington, TX, May 15, 2017.

553. "Impact of GC × GC – TOFMS Experimental Design on Data Trilinearity for PARAFAC Deconvolution," S.E. Prebihalo, D.K. Pinkerton, A. Uppugonduri and R.E. Synovec, 14th GC×GC, Arlington, TX, May 16, 2017.

554. "Optimization of Chromatographic Conditions using Flow Modulated GC×GC-TI-TOFMS," C.E. Freye, N. R. Moore and R.E. Synovec, 14th GC×GC, Arlington, TX, May 16, 2017.

555. "Determination of Components in Simulated GC-TOFMS Chromatograms by the 2D *m/z* Cluster Method," K.L. Berrier, B.C. Reaser and R.E. Synovec, 14th GC×GC, Arlington, TX, May 16, 2017.

556.* "Analysis of Complex Samples using GC × GC – TOFMS with Chemometrics," R.E. Synovec, ExxonMobil Research and Engineering, Paulsboro, NJ, July 13, 2017.

557. "Data Analysis Strategies for GC-TOFMS and GC × GC – TOFMS with Tandem Ionization," K.L. Berrier, N.R. Moore and R. E. Synovec, CPAC Summer Institute, July 18, 2017, Seattle, WA.

558. "Recent Advances in GC × GC Instrumentation Development," C.E. Freye, H.D. Bahaghighat and R. E. Synovec, CPAC Summer Institute, July 19, 2017, Seattle, WA.

559.* "Gaining a Fundamental Understanding of Fuel Performance through Advanced Chemical Composition Measurements," R.E. Synovec, C.E. Freye and M.C. Billingsley, 15th International Symposium on Stability, Handling and Use of Liquid Fuels (IASH 2017), Rome, Italy, September 14, 2017.

560.* "Recent Advances in Gas Chromatographic Instrumentation, Software, and Methods for Diesel Fuel Analysis," C.E. Freye, N.R. Moore, H.D. Bahaghighat and R.E. Synovec, PNNL, Richland, WA, September 21, 2017.

561.* "Analysis of Complex Samples using GC×GC-TOFMS with Chemometrics," R.E. Synovec, Los Alamos National Laboratory (LANL), Los Alamos, NM, October 23, 2017.

562.* "Basic Principles of GC×GC-TOFMS with Applications to Metabolomics and Forensics," R.E. Synovec, University of Puget Sound, Department of Chemistry, Tacoma, WA, November 17, 2017.

563. "Development of Ultrafast Separations (<75 ms) for Multidimensional GC and Continuous GC-Sensing," R.E. Synovec, SWAP, UW, Seattle, WA, January 26, 2018.

564.* "Enhancing the Peak Capacity in Multidimensional Gas Chromatography through Advances in Instrumentation and Chemometrics," R.E. Synovec, PittCon 2018, Orlando, Fl, March 1, 2018.

565. "Recent Advances in Valve-Based GC×GC and GC Sensing," C.E. Freye, H.D. Bahaghighat, R. E. Synovec, CPAC Rome Meeting, Rome, Italy, March 21, 2018.

566. "Impact of GC×GC-TOFMS Experimental Design on Data Structure Trilinearity for Optimal PARAFAC Performance," S.E. Prebihalo, D. K. Pinkerton, R.E. Synovec, CPAC Sponsor Meeting, Seattle, WA, May 1, 2018.

567. "Development, Evaluation, and Application of the 2D *m/z* Cluster Method for GC-TOFMS Analysis," K.L. Berrier, R.E. Synovec, CPAC Sponsor Meeting, Seattle, WA, May 1, 2018.

568. "Development of Pulse Flow Valve Modulation for Multidimensional GC and GC Sensing," H. D. Bahaghighat, R.E. Synovec, CPAC Sponsor Meeting, Seattle, WA, May 1, 2018.

569.* "Chemometric Analysis of GC × GC Data," R. E. Synovec, 15th GC × GC and 42nd ISCC, Riva del Garda, Italy, May 13, 2018. **Short Course**

570.* "Development of Ultrafast Separations Enabling Efficiency Optimized Multidimensional Gas Chromatography," R.E. Synovec, H.D. Bahaghighat and C.E. Freye, 15th GC × GC and 42nd ISCC, Riva del Garda, Italy, May 14, 2018.

571.* "Recent Advances in Relating the Chemical Compositional Variation in RP-1, RP-2, and Similar Fuels to Thermal Integrity Data," R.E. Synovec, C.E. Freye, M.C. Billingsley, N. Keim, B. Hill-Lam and A. Bishop, JANNAF, Long Beach, CA, May 24, 2018.

572. "Discovery Based Determination of Metabolomic Biomarkers Using GC×GC-TOFMS and Fisher-ratio (F-Ratio)," S.E. Prebihalo, N.E. Watson and R.E. Synovec, Metabolomics 2018, Seattle, WA, June 2018.

573. "Optimization of Separation Conditions for Multidimensional Gas Chromatography," D.V. Gough, S.E. Prebihalo, R.E. Synovec, CPAC Summer Institute, Seattle, WA, July 18, 2018.

574. "Implementing GC with Chemometrics for Real Time Process Analysis," P.E. Sudol, D. Song, D.V. Gough, R.E. Synovec, CPAC Summer Institute, Seattle, WA, July 19, 2018.

575.* "Recent Advances in Gas Chromatographic Instrumentation, Software, and Methods for Diesel Fuel Analysis," S.E. Prebihalo, D.V. Gough, P.E. Sudol, K.L. Berrier, W.P. Sadler and Robert E. Synovec, PNNL, Richland, WA, September 24, 2018.

576. "Impact of GC × GC – TOFMS Experimental Design on Data Structure Trilinearity for Optimal PARAFAC Performance," S.E. Prebihalo, D.K. Pinkerton and R.E. Synovec, SciX 2018, Atlanta, GA, October 2018.

577.* "Basic Principles of GC × GC – TOFMS with Application to Biomarker Discovery," R.E. Synovec, University of Puget Sound, Department of Chemistry, Tacoma, WA, November 16, 2018.

578. "Recent Advances and Applications of Tile-based Fisher Ratio Analysis for Discovery-based GC×GC–TOFMS Studies," S.E. Prebihalo and R.E. Synovec, 10th Multidimensional Chromatography Workshop, Liège, Belgium, January 2019.

579.* "Opportunities and Outcomes in Graduate Chemistry at the University of Washington," R.E. Synovec, Dept. of Chemistry, Gonzaga University, Spokane, WA, February 1, 2019.

580. "Recent Advances in Valve-Based GC×GC and GC Sensing," D.V. Gough, R.E. Synovec, CPAC Rome Meeting, Rome, Italy, March 27, 2019.

581. "Defining the Optimum Pressure Ratio in Comprehensive Two-Dimensional Gas Chromatography with Partial Modulation", T.J. Trinklein, R.E. Synovec, CPAC Sponsor Meeting, Seattle, WA, May 6, 2019.

582. "Impact of Data Bin Size using PCA to Distinguish GC×GC Chromatograms of Diesel Fuels," P.E. Sudol, D.V. Gough, S.E. Prebihalo, R.E. Synovec, CPAC Sponsor Meeting, Seattle, WA, May 6, 2019.

583. "Automated Concentration Ratio Determination using Fisher Ratio Assisted Mass Spectral Selectivity," S.E. Prebihalo, B.C. Reaser, W.P. Sadler, R.E. Synovec, CPAC Sponsor Meeting, Seattle, WA, May 7, 2019.

584. "Gaining a Fundamental Understanding of Fuel Performance through Advanced Composition Measurements," K.L. Berrier, R.E. Synovec, CPAC Sponsor Meeting, Seattle, WA, May 7, 2019.

585. "Advancing Pulse Flow Valve Injection for Ultrfast Separations in GC," D.V. Gough, R.E. Synovec, CPAC Sponsor Meeting, Seattle, WA, May 7, 2019.

586. "High Speed GC×GC-TOFMS with Pulse Valve Modulation and Chemometric Deconvolution," S. Schöneich, D.V. Gough, S.E. Prebihalo, R.E. Synovec, CPAC Sponsor Meeting, Seattle, WA, May 7, 2019.

587.* "Chemometric Analysis of GC × GC Data," R. E. Synovec, 16th GC × GC and 43rd ISCC, Arlington, TX, May 13, 2019. Short Course

588.* "Development of Ultrafast Separations to Enable High Peak Capacity Multidimensional Gas Chromatography," R. E. Synovec, D.V. Gough, D.H. Song, S. Schöneich, T.J. Trinklein, G.S. Ochoa, P.E. Sudol and S.E. Prebihalo, 16th GC × GC and 43rd ISCC, Arlington, TX, May 15, 2019.

589. "Impact of GC×GC-TOFMS Experimental Design on Data Structure Trilinearity for Optimal PARAFAC Performance," S.E. Prebihalo, D.K. Pinkerton, R.E. Synovec, 43rd ISCC and 16th GC×GC, Fort Worth, TX, May 13, 2019.

590. "Advancing Partial Modulation Methods for Ultrafast Separations in GC," D.V. Gough, D.H. Song, R.E. Synovec, 43rd ISCC and 16th GC×GC, Fort Worth, TX, May 13, 2019.

591.* "Gaining a Fundamental Understanding of Fuel Performance through Advanced Chemical Composition Measurements," R.E. Synovec, K.L. Berrier, C.E. Freye, S.E. Prebihalo, M.C. Billingsley, N. Keim, B. Hill-Lam, A. Bishop, 66th JANNAF Propulsion Meeting, Dayton, OH, June 4, 2019.

592. "Impact of Data Bin Size on PCA to Distinguish Diesel Fuels using GC×GC Data," P.E. Sudol, D.V. Gough, S.E. Prebihalo, R.E. Synovec, 74th Northwest Regional ACS Meeting (NORM), Portland, OR, June 16, 2019.

593. "Ultrafast GC×GC via Pulse Valve Injection in the Negative Mode," T.J. Trinklein, D. Song, D.V. Gough, R.E. Synovec, 74th Northwest Regional ACS Meeting (NORM), Portland, OR, June 16, 2019.

594. "Recent Advances in Software Development and Application of GC×GC," S.E. Prebihalo, K.L. Berrier, R.E. Synovec, CPAC Summer Institute, Seattle, WA, July 24, 2019.

595. "Implementing GC for Real Time Process Analysis," T.J. Trinklein, P.E. Sudol, D.V. Gough, R.E. Synovec, CPAC Summer Institute, Seattle, WA, July 25, 2019.

596.* "Recent Advances in Gas Chromatographic Instrumentation, Software, and Methods for Diesel Fuel Analysis," G.S. Ochoa, T.J. Trinklein, S. Schöneich, P.E. Sudol, W.P. Sadler, K.L. Berrier, S.E. Prebihalo, R.E. Synovec, PNNL, Richland WA, September 24, 2019.

597. "Dynamic Pressure Gradient Modulation for Comprehensive Two-Dimensional Gas Chromatography," S. Schöneich, T.J. Trinklein, R.E. Synovec, PNNL, Richland, WA, September 24, 2019.

598.* "Multi-Dimensional Gas Chromatography for Hydrocarbon Characterization," R.E. Synovec, Honeywell UOP, Chicago, IL, November 12, 2019.

599.* "Basic Principles of GC×GC-TOFMS with Application to Biomarker Discovery," R.E. Synovec, University of Puget Sound, Department of Chemistry, Tacoma, WA, November 22, 2019.

600.* "Improvements to GC×GC-TOFMS Composition-Based Models for Hydrocarbon Fuel Thermal Integrity," R.E. Synovec, K.L. Berrier, C.E. Freye, M.C. Billingsley, N. Keim, B. Hill-Lam and A. Bishop, 67th JANNAF Propulsion Meeting, Tampa, FL, December 9, 2019.

601. "Metabolomics Study Associated with ACL Injury: Biomarker Discovery of Post Traumatic Osteoarthritis using GC×GC-TOFMS and Chemometrics," S.E. Prebihalo and R.E. Synovec, 11th Multidimensional Chromatography Workshop, Honolulu, Hawaii, January 2020.

602.* "Advances in Multidimensional Gas Chromatography Instrumentation and Chemometric Data Analysis," T.J. Trinklein, S. Schöneich, P.E. Sudol, D.V. Gough, C.G. Warren, G.S. Ochoa, R.E. Synovec, PittCon 2020, Chicago, IL, March 2, 2020.

603. "Dynamic Pressure Gradient Modulation for Multidimensional Gas Ghromatography: Instrumentation and Chemometrics," T.J. Trinklein, R.E. Synovec, R.E. PittCon 2020, Chicago, IL, March 1, 2020.

604.* "Discovery-Based Analysis of GC×GC–TOFMS Data using Tile-Based Fisher Ratio Analysis," R.E. Synovec, S.E. Prebihalo, G.S. Ochoa, P. E. Sudol, S. Schöneich, 68th American Society of Mass Spectrometry (ASMS) Conference on Mass Spectrometry and Allied Topics – LECO Symposium, June 3, 2020.

605. "Implementation of Fisher Ratio Analysis to Improve Classification of Sulfur-Contaminated Jet Fuels using GC×GC-TOFMS data," P.E. Sudol, G.S. Ochoa, R.E. Synovec, 68th ASMS, June 4, 2020.

606. "Implementation of Fisher Ratio Analysis for Metabolite Discovery in Pacu Fish using GC×GC-TOFMS," S. Schöneich, S.E. Prebihalo, C.M. Monzòn, R.E. Synovec, American Society for Mass Spectrometry (ASMS), June 2020.

607. "Implementation of Fisher Ratio Analysis to Improve Classification of Sulfur-Contaminated Jet Fuels using GC×GC-TOFMS data," P.E. Sudol, G.S. Ochoa, R.E. Synovec, CPAC Summer Institute, July 21, 2020.

608.* Discovery-Based Analysis of GC×GC-TOFMS Data using Tile-Based Fisher Ratio Software," R.E. Synovec, LECO GC×GC Syposium, September 14, 2020.

609.* "Application of GC-MS and GC×GC-TOFMS to Biomarker Discovery," R.E. Synovec, University of Puget Sound, November 17, 2020.

610. "Development of a Tandem Total-Transfer Modulation Comprehensive Three-Dimensional Gas Chromatography (GC^3) Time-of-Flight Mass Spectrometry Instrument," T.J. Trinklein, S. Schöneich, P.E. Sudol, C.G. Warren, D.V. Gough, R.E. Synovec, 12th International Multidimensional Chromatography Workshop, February 1, 2021.

611. "Development of an Enhanced Total Ion Current Chromatogram Algorithm to Improve Untargeted Peak Detection," C.N. Cain, S. Schöneich, R.E. Synovec, 12th International Multidimensional Chromatography Workshop, February 2, 2021.

612. "Investigation of the Limit of Discovery using Tile-based Fisher Ratio Analysis with GC×GC-TOFMS," P.E. Sudol, G.S. Ochoa, R.E. Synovec, PittCon 2021, March 10, 2021.

613. "Gas Chromatography with Chemometrics for Discovery and Process Analysis," T.J. Trinklein, C.N. Cain, S. Schöneich, L. Mikaliunaite, P.E. Sudol, G.S. Ochoa, R.E. Synovec, CPAC Rome Workshop, March 24, 2021.

614. "Gas Chromatography with Chemometrics for Discovery and Process Analysis," C.N. Cain, S. Schöneich, P.E. Sudol, R.E. Synovec, CPAC Sponsor Meeting, May 3, 2021.

615.* "Class Comparison Enabled Mass Spectrum Purification (CCE-MSP) with GC×GC-TOFMS and Tile-Based F-ratio Analysis," R.E. Synovec, LECO, June 1, 2021.

616. "Development of an Enhanced Total Ion Current Chromatogram Algorithm to Improve Untargeted Peak Detection," C.N. Cain, S. Schöneich, R.E. Synovec, 18th International GC×GC Symposium, June 9, 2021.

617. "Minimum Variance Optimized Fisher Ratio Analysis of GC×GC-TOFMS Data for the Discovery of Metabolites in Farmed Pacu Fish," S. Schöneich, G.S. Ochoa, C.M. Monzón, R.E. Synovec, 18th International GC×GC Symposium, June 9, 2021.

618. "Exploring Total-Transfer Comprehensive Three-Dimensional Gas Chromatography," T.J. Trinklein, R.E. Synovec, 18th International GC×GC Symposium, June 9, 2021.

619. "Class Comparison Enabled Methodologies for Improving Quantitation and Identification of Complex Samples with GC×GC-TOFMS," G.S. Ochoa, P.E. Sudol, S. Prebihalo, R.E. Synovec, 18th International GC×GC Symposium, June 9, 2021.

620. "Investigation of the Limit of Discovery using Tile-Based Fisher Ratio Analysis with GC×GC-TOFMS," P.E. Sudol, G.S. Ochoa, R.E. Synovec, 18th International GC×GC Symposium, June 9, 2021.

621. "Untargeted Profiling and Differentiation of Geographical Variants of Wine Samples Using Headspace SPME-GC×GC-TOFMS Coupled with Tile-based Fisher Ratio Analysis," M. Zoccali, P.E. Sudol, M. Galletta, P.Q. Tranchida, L. Mondello, R. E. Synovec, 18th International GC×GC Symposium, June 9, 2021.

622.* "Kerosene Fuel Evaluation using GC×GC-TOFMS and Chemometric Data Analysis," R.E. Synovec, G.S. Ochoa, P.E. Sudol, M.C. Billingsley, 68th JANNAF Propulsion Meeting, June 8, 2021.

623.* "Class Comparison Enabled Data Analysis for GC×GC-TOFMS," R. E. Synovec, 18th International GC×GC Symposium, June 11, 2021.

624. "Gas Chromatography with Chemometrics for Discovery and Process Analysis," T.J Trinklein, S. Schöneich, C.N. Cain, L. Mikaliunaite, P.E. Sudol, G.S. Ochoa, R.E. Synovec, CPAC Summer Institute, July 2021.

625.* "Overview of GC × GC - TOFMS coupled with Chemometric Data Analysis Capabilities at the University of Washington," R.E. Synovec, G.S. Ochoa, P.E. Sudol, T.J. Trinklein, AFRL Kickoff Meeting, August 18, 2021

626.* "Gaining an In-depth Chemical Compositional Understanding of Fuels by GC×GC-TOFMS coupled with Chemometric Data Analysis," R.E. Synovec, P.E. Sudol, G.S. Ochoa, ACS Fall 2021, Atlanta, GA, August 22, 2021.

627.* "Using Solid Phase Extraction to Facilitate a Focused Tile-based Fisher Ratio Analysis of Comprehensive Two-dimensional Gas Chromatography Time-of-Flight Mass Spectrometery Data," R.E. Synovec, G.S. Ochoa, 5th International Caparica Conference on Sample Treatment 2021, November 17, 2021.

628.* "Investigation of GC×GC–TOFMS Data using Tile-Based Fisher Ratio Analysis: From Biomarker Discovery to Uncovering Hidden Impurities," R.E. Synovec, XI Congreso Argentino, Quimica Analytica, December 3, 2021. **Plenary**

629.* "New Directions in the Complete Analysis of GC×GC-TOFMS Datasets for Class-Comparison Experimental Designs," Robert E. Synovec, PACIFICHEM, December 19, 2021.

630.* "Implementation of Tile-based Fisher Ratio Analysis to GC×GC–TOFMS Datasets: Current Status and Future Prospects," Robert E. Synovec, 13th Multidimensional Chromatography Workshop, January 31, 2022. **Keynote**

631. "Principal Component Analysis with GC^3-TOFMS data," P.E. Sudol, S. Schöneich, R.E. Synovec, 13th Multidimensional Chromatography Workshop, January 31, 2022.

632. "Novel Comparative Analysis Methods for GC×GC-TOFMS Data," C.N Cain, G.S. Ochoa, T.J. Trinklein, R.E. Synovec, 13th Multidimensional Chromatography Workshop, January 31, 2022.

633. "Non-targeted Chemometric Analysis of Pacu Fish Metabolome by GC×GC-TOFMS," S. Schöneich, G.S. Ochoa, C.M. Monzón, R.E. Synovec, 13th Multidimensional Chromatography Workshop, January 31, 2022.

634. "Using Solid Phase Extraction to Facilitate a Focused Tile-Based Fisher Ratio Analysis of GC×GC-TOFMS Data," G.S. Ochoa, R.E. Synovec, 13th Multidimensional Chromatography Workshop, February 1, 2022.

635. "GC×GC-FID using Dynamic Pressure Gradient Modulation and Porous Layer Open Tubular Columns," L. Mikaliunaite, P.E. Sudol, C.N. Cain, R.E. Synovec, 13th Multidimensional Chromatography Workshop, February 2, 2022.

636. "A Simulation-Based Evaluation of the Robustness of Tile-Based Fisher-Ratio Analysis to Retention Time Shifting in GC×GC-TOFMS Data," T.J. Trinklein, R.E. Synovec, 13th Multidimensional Chromatography Workshop, February 2, 2022.

637. "Developing and Applying Gas Chromatography with Chemometrics to Enable Discovery-Based Chemical Analysis," C.N. Cain, R.E. Synovec, CPAC Rome Workshop, Rome, Italy, March 23, 2022.

638.* "Application of GC-MS and GC×GC-TOFMS for Biomarker Discovery," R.E. Synovec, Seattle University, Department of Chemistry, Seattle, WA, April 27, 2022.

639. "Development of a Chemical Analysis Platform to Understand the Farming Environment Impact on Raising Argentinian Pacu Fish: Implications for Food Quality and Safety," S. Schöneich, G.S. Ochoa, C.M. Monzón, R.E. Synovec, CPAC Spring Sponsor Meeting, Seattle, WA. May 2, 2022.

640. "Untargeted Determination of Cycling Yeast Metabolites using GC×GC-TOFMS and Tile-Based Fisher Ratio Analysis," L. Mikaliunaite, R.E. Synovec, CPAC Spring Sponsor Meeting, May 2, 2022.

641. "Profiling Olefins in Gasoline by Bromination using GC×GC-TOFMS followed by Discovery-Based Comparative Analysis," T.J. Trinklein, J. Jiang, R.E. Synovec, CPAC Spring Sponsor Meeting, May 2, 2022.

642. "Tile-based Pairwise Analysis of GC×GC-TOFMS Data for Improved Analyte Discovery: Assessment of Cacao Bean Moisture Damage," C.N. Cain, T.J. Trinklein, G.S. Ochoa, R.E. Synovec, CPAC Spring Meeting, Seattle, WA, May 2, 2022.

643. "Using Solid Phase Extraction to Facilitate a Focused Tile-Based Fisher Ratio Analysis of GC×GC-TOFMS Data to Study Polar Compounds in Fuel," G.S. Ochoa, R.E. Synovec, CPAC Spring Sponsor Meeting, Seattle WA, May 2, 2022.

644.* "Recent Advances in the Comparative Analysis of GC×GC–TOFMS Datasets," R.E. Synovec, 19th International GC×GC Symposium, May 30, 2022. **Keynote**

645. "Tile-Based Pairwise Analysis of GC×GC-TOFMS Data," C.N. Cain, T.J. Trinklein, G.S. Ochoa, R.E. Synovec, 19th Int. GC×GC Symp., May 31, 2022.

646. "Tile-Based Fisher Ratio Analysis of Comprehensive Three-Dimensional Gas Chromatography with Time-of-Flight Mass Spectrometry Data," S. Schöneich, P.E. Sudol, R.E. Synovec, 19th International GC×GC Symposium, May 29-June 2, 2022.

647. "Computational Method for Untargeted Determination of Cycling Yeast Metabolites using GC×GC-TOFMS," L. Mikaliunaite, R.E. Synovec, 19th International GC×GC Symposium, May 29, 2022.

648. "Characterizing the Olefin Content of Gasoline by Bromination followed by GC×GC-TOFMS," T.J. Trinklein, R.E. Synovec, 19th International GC×GC Symposium, June 2, 2022.

649. "Using Solid Phase Extraction to Facilitate a Focused Tile-Based Fisher Ratio Analysis of GC×GC-TOFMS Data," G.S. Ochoa, R.E. Synovec, 19th International GC×GC Symposium, June 1, 2022.

650.* "Sequential Analysis of Clay Treated Jet Fuel," G.S. Ochoa, R.E. Synovec, AFRL/UDRI, June 8, 2022.

651.* "Advanced Chemical Measurements using GC×GC-TOFMS and Chemometrics to Gain a Fundamental Understanding of Fuel Composition and Performance," R.E. Synovec, PNNL, Bioproducts Institute Seminar, June 14, 2022

652. "Comprehensive Discovery of Polar Compounds in Fuels using SPE-GC×GC-TOFMS and F-ratio Analysis," G.S. Ochoa, R.E. Synovec, CPAC Summer Institute, July 19, 2022.

653. "Characterizing the Olefin Content of Gasoline by Bromination followed by GC×GC-TOFMS," T.J. Trinklein, R.E. Synovec, CPAC Summer Institute, July 19, 2022.

654. "Development of a Valve-based GC×GC-quadMS Instrument for Highly Volatile Sample Analysis," L. Mikaliunaite, R.E. Synovec, CPAC Summer Institute, July 19, 2022.

655. "Development of a Chemical Analysis Platform to Understand the Farming Environment Impact on Raising Argentinian Pacu Fish: Implications for Forensics Analysis Applications," S. Schöneich, G.S. Ochoa, C.M. Monzón, R.E. Synovec, "ACS Fall 2022 Meeting. Chicago, IL, August 22, 2022.

656. "Tile-based Pairwise Analysis of GC×GC-TOFMS Data for Improved Analyte Discovery and Mass Spectrum Purification," C.N. Cain, T.J. Trinklein, G.S. Ochoa, R.E. Synovec, 264th National ACS Meeting, Chicago, IL, August 22, 2022.

657. "Computational Method for Untargeted Determination of Cycling Yeast Metabolites using GC×GC-TOFMS," L. Mikaliunaite, R.E. Synovec, 264th National ACS Meeting, Chicago, IL, August 24, 2022.

658. "Profiling Olefins in Gasoline by Bromination followed by GC×GC-TOFMS," T.J. Trinklein, R.E. Synovec, 264th National ACS Meeting, Division of Energy and Fuels, August 25, 2022.

659. "Using Solid Phase Extraction to Facilitate a Focused Tile-Based Fisher Ratio Analysis of GC×GC-TOFMS Data," G.S. Ochoa, R.E. Synovec, 264th National ACS Meeting, Division of Energy and Fuels, August 25, 2022.

660. "Gaining a Deeper Understanding of Fuel Chemical Composition in the Context of Polar Compound Extraction Processes," G.S. Ochoa, M.C. Billingsley, R.E. Synovec, 17th International Conference on Stability, Handling, and use of Liquid Fuels (IASH), Dresden, Germany, September 11, 2022.

661. "Computational Method for Untargeted Determination of Cycling Yeast Metabolites using Comprehensive Two-Dimensional Gas Chromatography Time-of-Flight Mass Spectrometry," L. Mikaliunaite, R.E. Synovec, GC meets NTS, AFIN-TS GmbH, Augsburg, Germany, November 8, 2022.

662.* "Application of GC-MS and GC×GC-TOFMS for Biomarker Discovery," R.E. Synovec, University of Puget Sound, Tacoma, WA, November 18, 2022.

663.* "GC×GC-TOFMS and Chemometric Data Analysis Applied to Aerospace Fuels: Modeling Thermal Stability of Complex Hydrocarbon Mixtures", G.S. Ochoa, C.N. Cain, R.E. Synovec, M.C. Billingsley, 70th JANNAF Propulsion Meeting, Huntsville, Alabama, December 5, 2022.

664. "Developing Advanced Chemometric Analysis Methods for GC×GC-TOFMS to Facilitate In-Depth Diesel, Jet, and Rocket Fuel Characterization," G.S. Ochoa, R.E. Synovec, 14th Multidimensional Chromatography Workshop, Liège, Belgium, January 30, 2023.

665. “Computational Method for Untargeted Determination of Cycling Yeast Metabolites using Comprehensive Two-Dimensional Gas Chromatography Time-of-Flight Mass Spectrometry,” L. Mikaliunaite, Lina, R.E. Synovec, 14th Multidimensional Chromatography Workshop, Liège, Belgium, January 30, 2023.

666. “Development of a Valve-based GC×GC-qMS Instrument for Highly Volatile Sample Analysis,” L. Mikaliunaite, T.J. Trinklein, G.S. Ochoa, P.E. Sudol, D.S. Bell, R.E. Synovec, 14th Multidimensional Chromatography Workshop, Liège, Belgium, January 31, 2023.

667. “Discovering Compositional Differences Between Aerospace Fuels Using Comprehensive Two-Dimensional Gas Chromatography with Time-of-Flight Mass Spectrometry and Chemometrics,” C.N. Cain, G.S. Ochoa, R.E. Synovec, 14th Multidimensional Chromatography Workshop, Liège, Belgium. January 31, 2023.

668. “Tile-based Fisher Ratio for Comprehensive Three-Dimensional Gas Chromatography with Mass Spectrometry Data,” S. Schöneich, P.E. Sudol, R.E. Synovec, 14th Multidimensional Chromatography Workshop, Liège, Belgium, January 31, 2023.

669. “Simulating GC×GC-TOFMS Data with Realistic Run-to-Run Shifting to Evaluate the Robustness of Chemometric Software,” T.J. Trinklein, R.E. Synovec, 14th Multidimensional Chromatography Workshop, Liège, Belgium, February 1, 2023.

670. “Discovering Compositional Differences Between Aerospace Fuels Using Comprehensive Two-Dimensional Gas Chromatography with Time- of-Flight Mass Spectrometry and Chemometrics,” C.N. Cain, G.S. Ochoa, R.E. Synovec, PittCon 2023, Philadelphia, PA. March 21, 2023.

671. “Computational Method for Untargeted Determination of Cycling Yeast Metabolites using Comprehensive Two-Dimensional Gas Chromatography Time-of-Flight Mass Spectrometry,” L. Mikaliunaite, R.E. Synovec, 265th National ACS Meeting, Indianapolis, IN, March 26, 2023.

III. Patents, Patent Applications, and Invention Disclosures:

1. Patent 4,875,169 (Oct. 17, 1989) "Improvement in a Chromatographic Signal by a Numerical Integration Method," R.E. Synovec and E. S. Yeung, Iowa State University, Invention Disclosure (1985).

2. OTL# 1404-10876DL “Simultaneous Light Scattering and Refractive Index Meassurement,” R. E. Synovec, U. Washington, Invention Disclosure (October 1, 1987).

3. OTL# 1006-069491DL "Parallel Chromatographic Column Two-dimensional High Speed Process Analyzer," B. R. Kowalski and R. E. Synovec, U. Washington, Invention Disclosure (June 13, 1994).

4. OTL# 1404-1008DL “Liquid Chromatography using Water as the Mobile Phase,” M. D. Foster annd R. E. Synovec, U. Washington, Invention Disclosure (September 13, 1995).

5. OTL# 1006-3198DL “Dynamic Surface Tension Calibration and Determination of Flowing Liquids Without Optical Imaging,” R. E. Synovec and K. E. Miller, U. Washington, Invention Disclosure (August 5, 1999).

6. OTL# 2647-3394DL “Sub-nanoliter Injections Achieved by Flow Programming in Microfabricated Channels,” R. E. Synovec and P. G. Vahey, U. Washington, Invention Disclosure (July 17, 2000).

7. OTL# 2800-3605DL “Laser-Based Refractive Index Gradient Detector for Microfluidic Systems with Merging Laminar Flow Streams,” R. E. Synovec and C. D. Costin, U. Washington, Invention Disclosure (October 3, 2001).

8. OTL# 2911-3765DL “Dual-Beam Laser-Based Refractive Index Gradient Detector for Microfluidic Systems with Merging Laminar Flow Streams,” R. E. Synovec and C. D. Costin, U. Washington, Invention Disclosure (June 20, 2002).

9. OTL# 2918-3770DL “Chromatographic Retention Alignment Algorithm for Chemometric Analysis,” K. J. Johnson and R. E. Synovec, U. Washington, B. W. Wright and K. H. Jarman, PNNL, Invention Disclosure (July 10, 2002).

10. OTL# 3131-4038DL “Monolayer Protected Gold Nanoparticles for use as a Gas Chromatographic Stationary Phase in Capillary and Microfabricated Chromatographic Systems,” R. E. Synovec and G. M. Gross, U. Washington, J. W. Grate, PNNL, Invention Disclosure (October 17, 2003).

11. OTL# 4079-4607PT “Theoretical Model and Experimental Evaluation of a Micro-Scale Molecular Mass Sensor,” R. E. Synovec and C. D. Costin, U. Washington, M. E. McDonnell, Honeywell, U.S. Provisional Patent Application (Filed Feb. 9, 2004).

12. The tile-based Fisher ratio software pioneered by the group to perform discovery-based analysis of GC×GC-TOFMS data was licensed by LECO corportation (2019), and now commercialized as ***ChromaTOF Tile*** (2021-present).