

# Herbert Tobias

## Web Bio

### Information

#### Biography

##### Biographical Statement

As an instrumental analytical chemist, Dr. Tobias' research experience includes the development and application of advance analytical techniques to such areas as biomedical analysis for molecular and isotopic compositions of lipids, such as steroids of interest in sport doping, and the characterization and study of atmospheric and biological aerosols. More recently, Dr. Tobias has developed a comprehensive two-dimensional gas chromatography separation techniques coupled to Isotope Ratio Mass Spectrometry for the measurement of the stable isotopic composition of individual components in complex samples as applied synthetic steroid detection in sport doping. Currently in development are Instrumentation and methods for unique internal carbon position specific isotopic measurements for metabolic applications. External collaborations included microfabrication of on-line chemical micro-reactors for Cavity Ring-Down Spectroscopy and in-situ imaging of single particles using the SLAC Linear Coherent Light Source, which generates the world's most intense and short wavelength x-rays.

Before his position at Cornell University, Dr. Tobias was part of a dynamic group at Lawrence Livermore National Laboratory that developed Bioaerosol Mass Spectrometry for the detection of single airborne microorganisms and environmental airborne particulates. An R&D 100 award was given for this work in 2005. As a postdoctoral researcher at the University of California at Riverside, Dr. Tobias helped develop and apply thermal desorption particle beam mass spectrometry to the study of the chemical formation of organic aerosols that contribute to air pollution (known as smog) and the characterization of diesel exhaust particulates.

##### Department Website Summary

As an instrumental analytical chemist, Dr. Tobias' research experience includes the development and application of advance analytical techniques to such areas as biomedical analysis for molecular and isotopic compositions of lipids, such as steroids of interest in sport doping, and the characterization and study of atmospheric and biological aerosols. Currently, Dr. Tobias is developing comprehensive two-dimensional gas chromatography separation techniques coupled to Isotope Ratio Mass Spectrometry for the measurement of the stable isotopic composition of individual compounds in complex samples as applied to lipid metabolism. Also in current development are Instrumentation and methods for unique internal carbon position specific isotopic measurements. External collaborations include microfabrication of on-line chemical micro-reactors for Cavity Ring-Down Spectroscopy and in-situ imaging of single particles using the SLAC Linear Coherent Light Source, which generates the world's most intense and short wavelength x-rays.

Before his position at Cornell University, Dr. Tobias was part of a dynamic group at Lawrence Livermore National Laboratory that developed Bioaerosol Mass Spectrometry for the detection of single airborne microorganisms and environmental airborne particulates. An R&D 100 award was given for this work in 2005. As a postdoctoral researcher at the University of California at Riverside, Dr. Tobias helped develop and apply thermal desorption particle beam mass spectrometry to the study of the chemical formation of organic aerosols that contribute to air pollution (known as smog) and the characterization of diesel exhaust particulates.

## **Teaching**

### **Teaching and Advising Statement**

I teach advance instrumental analytical methods development, use, and applications in a world class laboratory setting and advise graduate students, undergraduates, and postdocs in this research area. I have also taught microfabrication methods to undergraduate students.

## **Professional**

### **Current Professional Activities**

Peer review manuscripts for scientific journals and panel review of proposals submitted to NASA.

Member of Professional Societies:

American Chemical Society

American Society for Mass Spectrometry

Alpha Chi Sigma: Professional Chemistry Society

## **Research**

### **Current Research Activities**

Advanced separations coupled to isotope ratio mass spectrometry for compound-specific sourcing studies and intramolecular carbon position specific isotope measurements.

Generation of stable isotopic calibration standards and development of instrumental methods for advanced synthetic steroid detection applied to anti-doping in sport.

Microfabrication of novel micro-reactors for on-line chemistries for stable isotope measurements and other applications.

## **Extension**

## **Education**

### **Education**

08/1994-03/1997, Cornell University, NY, Ph.D. (Analytical Chemistry)

07/1992-07/1994, Cornell University, NY, M.S. (Analytical Chemistry)

08/1988-05/1992, College of William & Mary, VA, B.S. (Chemistry)

## Courses

### Courses Taught

CHEM 6280 / NS 6900

### Websites

### Related Websites

<http://www.youtube.com/watch?v=waG9G-INUYY>

<https://news.slac.stanford.edu/press-release/x-ray-vision-exposes-aerosol-structures>

<https://str.llnl.gov/str/October05/Riot.html#sthash.PSGz7FQ7.dpuf>

## Administration

## Publications

### Selected Publications

Nisbet, M.; Tobias, H.J.; Brenna, J.T.; Sacks, G.; Mansfield, A.K. "Quantifying the Contribution of Grape Hexoses to Wine Volatiles by High Precision [ $U^{13}C$ ]-glucose Tracer Studies." *Journal of Agricultural and Food Chemistry*, 2014, 62, 6820-6827.

Park, H.J.; et. al. "Toward Unsupervised Single-Shot Diffractive Imaging of Heterogeneous Particles using X-ray Free-Electron Lasers." *Optics express*, 2013 21, 28729.

Pedersoli, E.; et. al. "Mesoscale Morphology of Airborne Core-shell Nanoparticle Clusters: X-ray Laser Coherent Diffraction Imaging." *Journal of Physics B: Atomic, Molecular & Optical Physics*, 2013, 46, 164033.

Loh, D.; et. al. "Sensing the Wavefront of X-ray Free-electron Lasers using Aerosol Spheres." *Optics Express*, 2013, 21, 12385.

Zhang, Y.; Tobias, H.J.; Sacks, G.L.; Brenna, J.T. "Calibration and Data Processing in Gas Chromatography Isotope Ratio Mass Spectrometry." *Drug Testing and Analysis*, 2012, 4, 912-922.

Loh, N.D.; et. al. "Fractal Morphology, Imaging and Spectrometry of Single Aerosol Particles in Flight." *Nature*, 2012, 486, 513-517.

Zhang, Y.; Tobias, H.J.; Brenna, J.T. "Highly Sensitive and Selective Analysis of Urinary Steroids by Comprehensive Two-Dimensional Gas Chromatography Combined with Positive Chemical Ionization Quadrupole Mass Spectrometry." *Analyst*, 2012, 137, 3102-3110.

Zhang, Y.; Tobias, H.J.; Auchus, R.J.; Brenna, J.T. "Comprehensive Two Dimensional Gas Chromatography Fast Quadrupole Mass Spectrometry (GC×GC-qMS) for Urinary Steroid Profiling. Mass Spectral Characteristics with Chemical Ionization." *Drug Testing and*

*Analysis*, 2011, 3, 857-867.

Tobias, H.J.; Zhang, Y.; Auchus, R.; Brenna, J.T. "Detection of Synthetic Testosterone Use by Novel Comprehensive Two-Dimensional Gas Chromatography Combustion Isotope Ratio Mass Spectrometry (GC×GCC-IRMS)," *Analytical Chemistry*, 2011, 83, 7158–7165.

Frank, M.; Gard, E.; J. Tobias, H.J.; Adams, K.L.; Bogan, M.J.; Coffee, K.R.; Farquar, G.R.; Fergenson, D.P.; Martin, S.; Pitesky, M.; Riot, V.J.; Srivastava, A.; Steele, P.; Williams, A.M. "Single-Particle Aerosol Mass Spectrometry (SPAMS) for High-Throughput and Rapid Analysis of Biological Aerosols and Single Cells," in *Rapid Characterization of Microorganisms by Mass Spectrometry*, Fenselau, C. (ed), ACS Symposium Series Vol. 1065; American Chemical Society: Washington, DC, 2011, Chapter 10, pp. 161-196. (Peer Reviewed Chapter).

Martin, A.V.; et.al. "Single Particle Imaging with Soft X-Rays at the Linac Coherent Light Source." *Proceedings of SPIE, International Society for Optics and Photonics*, 2011, 8078, Advances in X-ray Free-Electron Lasers, 807809, 1-9. doi: 10.1117/12.886754

Tobias, H.J.; Brenna, J.T. "Microfabrication of Micro-Reactors for Isotope Ratio Mass Spectrometry," *Microfluidics and Nanofluidics*, 2010, 9, 461-470.

Zhang, Y; Tobias, H.J.; Brenna, J.T. "Uniform Steroid Isotopic Standards for Gas Chromatography Combustion Isotope Ratio Mass Spectrometry," *Steroids*, 2009, 74, 369-378.

Tobias, H.J.; Sacks, G.L.; Zhang, Y.; Brenna, J.T. "Comprehensive Two-Dimensional Gas Chromatography Combustion Isotope Ratio Mass Spectrometry," *Analytical Chemistry*, 2008, 80, 8613-8621.

Zhang, Y; Tobias, H.J.; Brenna, J.T. "Uniform Isotopic Standards for Gas Chromatography Combustion Isotope Ratio Mass Spectrometry of Steroids," *Recent Advances in Doping Analysis*, 2008, 16, 171-180.

Tobias, H.J.; Sacks, G.L.; Zhang, Y.; Brenna, J.T. "Progress Towards Comprehensive 2D Gas Chromatography Combustion Isotope Ratio Mass Spectrometry (GC×GC)," *Recent Advances in Doping Analysis*, 2008, 16, 153-162.

McJimpsey, E.L.; Jackson, W.M.; Lebrilla, C.B.; Tobias, H.J.; Bogan, M.J.; Gard, E.E.; Frank, M.; Steele, P.T. "Parameters Contributing to Efficient Ion Generation in Aerosol MALDI Mass Spectrometry," *Journal of the American Society for Mass Spectrometry*, 2008, 19, 315-324.

Farquar, G.R.; Steele, P.T.; McJimpsey, E.L.; Lebrilla, C.B.; Tobias, H.J.; Gard, E.E.; Frank, M.; Coffee, K.; Riot, V.; Fergenson, D.P. "Supramicrometer particle shadowgraph imaging in the ionization region of a single particle aerosol mass spectrometer." *Journal of Aerosol Science*, 2008, 39, 10-18.

Bogan, M.J.; Patton, E.; Srivastava, A.; Martin, S.; Fergenson, D.P.; Steele, P.T.; Tobias, H.J.; Gard, E.E.; Frank, M. "Online aerosol mass spectrometry of single micrometer-sized particles containing poly(ethylene glycol)." *Rapid Communications in Mass Spectrometry*, 2007, 21, 1214-1220.

Tobias, H.J., Pitesky, M.; Fergenson, D.P.; Steele, P.T.; Horn, J.; Frank, M.; Gard, E.E. "Following the biochemical and morphological changes of *Bacillus atrophaeus* cells during the sporulation process using Bioaerosol Mass Spectrometry." *Journal of Microbiological Methods*, 2006, 67, 56-63.

Ferge, T.; Karg, E.; Schroppel, A.; Coffee, K.R.; Tobias, H.J.; Frank, M.; Gard, E.E.; Zimmerman, R. "Fast Determination of the Relative Elemental and Organic Carbon Content of Aerosol Samples by Single-Particle Aerosol Time-of-Flight Mass Spectrometry." *Environmental Science and Technology*, 2005, 40, 3327-3335.

Steele, P.T.; Srivastava, A.; Pitesky, M.E.; Fergenson, D.P.; Tobias, H.J.; Gard, E.E.; Frank, M. "Desorption/Ionization Fluence Thresholds and Improved Mass Spectral Consistency Measured Using a Flat-top Laser Profile in the Bioaerosol Mass Spectrometry of Single *Bacillus* Endospores." *Analytical Chemistry*, 2005, 77, 7448-7454.

Tobias, H.J., Schafer, M.P., Pitesky, M., Fergenson, D.P., Horn, J., Frank, M., Gard, E.E. "Bioaerosol Mass Spectrometry (BAMS) for the Rapid Detection of Individual Airborne *Mycobacterium tuberculosis* H37Ra Particles." *Applied and Environmental Microbiology*, 2005, 71, 6086-6095.

Srivastava, A., Pitesky, M., Steele, P.T., Tobias, H.J., Fergenson, D.P., Horn, J.M., Russell, S.C., Czerwieniec, G.A., Lebrilla, C.B., Gard, E.E. and Frank, M. "Comprehensive Assignment of Mass Spectral Signatures from Individual *Bacillus atrophaeus* Spores in Matrix-free Laser Desorption/Ionization Bioaerosol Mass Spectrometry." *Analytical Chemistry*, 2005, 77, 3315-3323.

Czerwieniec, G., Russell, S., Tobias, H.J., Pitesky, M., Fergenson, D., Steele, P.T., Srivastava, A., Horn, J., Frank, M., Gard, E.E. Lebrilla, C. "Stable Isotope Labeling of Entire *Bacillus atrophaeus* Spores and Vegetative Cells Using Bioaerosol Mass Spectrometry." *Analytical Chemistry*, 2005, 77, 1081-1087.

Russell, S., Czerwieniec, G., Tobias, H.J., Fergenson, D., Steele, P.T., Pitesky, M., Horn, J., Srivastava, A., Frank, M., Gard, E.E. Lebrilla, C. "Toward Understanding the Ionization of Biomarkers from Micrometer Particles by Bio-Aerosol Mass Spectrometry." *Journal of the American Society for Mass Spectrometry*, 2004, 15, 900-909.

Fergenson, D., Pitesky, M., Tobias, H.J., Steele, P.T., et. al., E.E. "Detection and Classification of Individual Bioaerosol Particles." *Analytical Chemistry*, 2004, 76, 373-378.

Sakurai, H., Tobias, H.J., Park, K., M., Zarling, D., Docherty, K.S., Kittelson, D.B., McMurry, P.H.,

Ziemann, P.J. "On-Line Measurements of Diesel Nanoparticle Composition, Volatility, and Hydroscopicity." *Atmospheric Environment*, 2003, 37, 1199-1210.

Steele, P.T., Tobias, H.J., Fergenson, D.P., Pitesky, M., Horn, J., Czerwieniec, G., Russell, S., Lebrilla, C., Frank, M., Gard, E.E. "Laser Power Dependence of Mass Signatures from Individual Bacterial Spores in Bioaerosol Mass Spectrometry." *Analytical Chemistry*, 2003, 75, 2480-2487.

Chattopadhyay, S.; Tobias, H.J.; Ziemann, P.J. "A Method for Measuring Vapor Pressures of Low-Volatility Organic Aerosol Compounds Using a Thermal Desorption Particle Beam Mass Spectrometer." *Analytical Chemistry*. 2001, 73, 3797-3803.

Tobias, H.J.; Ziemann, P.J. "Kinetics of the Gas-Phase Reactions of Alcohols, Aldehydes, Carboxylic Acids, and Water with the C13 Stabilized Criegee Intermediate formed from Ozonolysis of 1-Tetradecene." *Journal of Physical Chemistry A*, 2001, 105, 6129-6135.

Tobias, H.J., Beving, D.E., Ziemann, P.J., Sakurai, H., Zuk, M., McMurry, P.H., Zarling, D., Waytulonis, R., Kittelson, D.B. "Chemical Analysis of Diesel Engine Nanoparticles Using a Nano-DMA/Thermal Desorption Particle Beam Mass Spectrometer." *Environmental Science and Technology*, 2001, 35, 2233-2243.

Tobias, H.J.; Docherty, K.S.; Beving, D.E.; Ziemann, P.J. "Effect of Relative Humidity on the Chemical Composition of Secondary Organic Aerosol Formed from Reactions of 1-Tetradecene and Ozone." *Environmental Science and Technology*, 2000, 34, 2116-2125.

Tobias, H.J.; Ziemann, P.J. "Thermal Desorption Mass Spectrometric Analysis of Organic Aerosol Formed from Reactions of 1-Tetradecene and Ozone in the Presence of Alcohols and Carboxylic Acids." *Environmental Science and Technology*, 2000, 34, 2105-2115.

Tobias, H.J.; Kooiman, P.M.; Docherty, K.S.; Ziemann, P.J. "Real-Time Chemical Analysis of Organic Aerosols Using a Thermal Desorption Particle Beam Mass Spectrometer." *Aerosol Science and Technology*, 2000, 33, 170-190.

Tobias, H.J.; Ziemann, P.J. "Compound Identification in Organic Aerosols Using Temperature-Programmed Thermal Desorption Particle Beam Mass Spectrometry." *Analytical Chemistry*, 1999, 71, 3428-3435.

Brenna, J.T.; Corso, T.N.; Tobias, H.J.; Caimi, R.J. "High-Precision Continuous-Flow Isotope Ratio Mass Spectrometry." *Mass Spectrometry Reviews*, 1997, 16, 227-258.

Tobias, H.J.; Brenna, J.T. "On-Line Pyrolysis as a Limitless Reduction Source for Isotopic Analysis of Organic Derived Hydrogen." *Analytical Chemistry*, 1997, 69, 3148-3152.

Tobias, H.J.; Brenna, J.T. "High-Precision D/H Measurement from Organic Mixtures by Gas Chromatography Continuous-Flow Isotope Ratio Mass Spectrometry Using a Palladium Filter." *Analytical Chemistry*, 1996, 68, 3002-3007.

Tobias, H.J.; Brenna, J.T. "Correction of Ion Source Nonlinearities over a Wide Signal Range in Continuous-Flow Isotope Ratio Mass Spectrometry of Water Derived Hydrogen." *Analytical Chemistry*, 1996, 68, 2281-2286.

Tobias, H.J.; Goodman, K.J.; Blacken, C.E.; Brenna, J.T. "High-Precision D/H Measurement from Hydrogen Gas and Water by Continuous-Flow Isotope Mass Spectrometry" *Analytical Chemistry*, 1995, 67, 2486-2492.