

## CV: Professor Avram Gold

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### Education and Training

Harvard Univ., Cambridge, MA	B.A.	Chemistry	1963
Harvard Univ., Cambridge, MA	Ph.D.	Chemistry	1969
Harvard School of Public Health, Boston, MA	M.S.	Air Pollution	1973
Massachusetts Inst. Tech., Cambridge, MA	Post-Doc	Chemistry	1969 – 1970
Harvard Univ., Cambridge, MA	Post-Doc	Chemistry	1970 - 1972

### Appointments

Professor, Department of Environmental Sciences and Engineering, School of Public Health, University of North Carolina-Chapel Hill.	1986-
Associate Professor, Department of Environmental Sciences and Engineering, School of Public Health, University of North Carolina-Chapel Hill.	1982-86
Assistant Professor, Department of Environmental Sciences and Engineering, School of Public Health, University of North Carolina-Chapel Hill.	1979-82
Research Associate, Harvard School of Public Health, Boston, MA.	1973-79
EPA Fellowship, towards MS in Air Pollution, Harvard School of Public Health	1972-73

### Awards and Honors

1986 - 1987	Fogarty International Fellowship, Université Louis Pasteur, Strasbourg, FR.
1972 – 1973	EPA Fellowship, towards MS in Air Pollution, Harvard School of Public Health

### Publications from 2012

+Committee chair, \*Committee member

1. Lin, Ying-Hsuan\*; Zhang, Zhenfa; Docherty, Kenneth; Zhang, Haofei; Budisulistiorini, Sri\*; Rubitschun, Caitlin; Shaw, Stephanie; Knipping, Eladio; Edgerton, Eric; Kleindienst, Tadeusz E. ; Gold, Avram; Surratt, Jason, "Isoprene Epoxydiols as Precursors to Secondary Organic Aerosol Formation: Acid-Catalyzed Reactive Uptake Studies with Authentic Standards", *Environ. Sci. Technol.* **2012**, *46*, pp 250–258 (e-pub 11/21/11; doi.org/10.1021/es202554c).
2. Haofei Zhang, Ying-Hsuan Lin\*, Zhenfa Zhang, Xiaolu Zhang, Stephanie L. Shaw, Eladio M. Knipping, Rodney J. Weber, Avram Gold, Richard M. Kamens, and Jason D. Surratt, "Secondary Organic Aerosol Formation from Methacrolein Photooxidation: Roles of NO<sub>x</sub> Level, Relative Humidity, and Aerosol Acidity", *Environ. Chem.* **2012**, *9*, 247 - 262 (e-pub 02/10/12).
3. Z. Zhang, Y.-H. Lin\*, H. Zhang, J. D. Surratt, L. M. Ball, and A. Gold, "Technical Note: Synthesis of isoprene atmospheric oxidation products: isomeric epoxydiols and the rearrangement products *cis*- and *trans*-3-methyl-3,4-dihydroxytetrahydrofuran", *Atmos. Chem. Phys.* **2012**, *12*, 8529 - 8535; doi:10.5194/acp-12-8529-2012.

4. Zhang, Haofei; Worton, David; Lewandowski, Michael; Ortega, John; Rubitschun, Caitlin; Park, Jeong-Hoo; Kristensen, Kasper; Campuzano-Jost, Pedro; Day, Doug; Jimenez, Jose; Mohammed, Jaoui ; Offenberg, John; Kleindienst, Tadeusz E. ; Gilman, Jessica; Kuster, William; de Gouw, Joost; Park, Changhyoun; Schade, Gunnar; Frossard, Amanda; Russell, Lynn; Kaser, Lisa; Jud, Werner; Hansel, Armin; Cappellin, Luca; Karl, Thomas; Glasius, Marianne; Guenther, Alex; Goldstein, Allen; Seinfeld, John; Gold, Avram; Kamens, Richard; Surratt, Jason, "Organosulfates as Tracers for Secondary Organic Aerosol (SOA) Formation from 2-Methyl-3-Buten-2-ol (MBO) in the Atmosphere", *Environ. Sci. Technol.* **2012** (e-pub 08/02/12).
5. Ying-Hsuan Lin\*, Haofei Zhanga, Havala O. T. Pye, Zhenfa Zhang, Wendy J. Marth\*, Sarah Park, Maiko Arashiro, Tianqu Cui\*, Sri Hapsari Budisulistiorini\*, Kenneth G. Sexton, William Vizuete, Ying Xie, Deborah J. Luecken, Ivan R. Piletic, Edward O. Edney, Libero J. Bartolotti, Avram Gold, Jason D. Surratt, "Epoxide as a Precursor to Secondary Organic Aerosol Formation from Isoprene Photooxidation in the Presence of Nitrogen Oxides", *Proc. Natl. Acad. Sci. USA* **2013**, *110*, 6718 – 6723 (e-pub 04/03/13; DOI:10.1073/pnas.1221150110).
6. Sri Hapsari Budisulistiorini\*, Manjula R. Canagaratna, Philip L. Croteau, Wendy J. Marth\*, Karsten Baumann, Eric S. Edgerton, Stephanie L. Shaw, Eladio M. Knipping, Douglas R. Worsnop, John T. Jayne, Avram Gold and Jason D. Surratt, "Real-time Continuous Characterization of Secondary Organic Aerosol Derived from Isoprene Epoxydiols (IEPOX) in Downtown Atlanta, Georgia, using the Aerodyne Aerosol Chemical Speciation Monitor (ACSM)", *Environ. Sci. Technol.* **2013**, *47*, 5686–5694 (e-pub 05/02/13; DOI: 10.1021/es400023n).
7. Havala Olson Taylor Pye, Robert William Pinder, Ivan Piletic, Ying Xie, Shannon L. Capps, Ying-Hsuan Lin\*, Jason Douglas Surratt, Zhenfa Zhang, Avram Gold, Deborah J Luecken, William T. Hutzell, Mohammed Jaoui, John H. Offenberg, Tadeusz Edward Kleindienst, Michael Lewandowski, and Edward O. Edney, "Epoxide pathways improve model predictions of isoprene markers and reveal key role of acidity in aerosol formation", *Environ. Sci. Technol.* **2013**, *47*, 11056 – 11064 (e-pub 08/26/13; DOI: 10.1021/es402106h).
8. Haofei Zhang , Zhenfa Zhang , Tianqu Cui\* , Ying-Hsuan Lin\* , Neil A. Bathela, John Ortega , David RobertWorton , Allen H. Goldstein , Alex Guenter , Jose Luis Jimenez , Avram Gold , Jason Douglas Surratt, "Secondary Organic Aerosol Formation from 2-Methyl-3-Buten-2-ol (MBO) Photooxidation: Evidence for Acid-Catalyzed Reactive Uptake of Epoxides", *Environ. Sci. Technol. Lett.* **2014** *1*, 242 – 247 (e-pub. 03/18/14; DOI: 10.1021/ez500055f).
9. K. Kristensen, T. Cui, H. Zhang, A. Gold, M. Glasius, J. D. Surratt, "Dimers in  $\alpha$ -pinene secondary organic aerosol: effect of hydroxyl radical, ozone, relative humidity and aerosol acidity", *Atmos. Chem. Phys.* **2014**, *14*, 4201–4218.
10. Hong Sik Yoo, Blair U. Bradford, Oksana Kosyk, Takeki Uehara, Svitlana Shymonyak, Leonard B. Collins, Wanda M. Bodnar, Louise M. Ball, Avram Gold, Ivan Rusyn, "Comparative Analysis of the Relationship between Trichloroethylene Metabolism and Tissue-Specific Toxicity among Inbred Mouse Strains: Kidney Effects *J. Toxicol. Env. Health Part A* **2015**, *78*, 15 – 31 (DOI: 10.1080/15287394.2015.958417).
11. Hong Sik Yoo, Blair U. Bradford, Oksana Kosyk, Svitlana Shymonyak, Takeki Uehara, Leonard B. Collins, Wanda M. Bodnar, Louise M. Ball, Avram Gold, Ivan Rusyn, "Comparative Analysis of the Relationship between Trichloroethylene Metabolism and Tissue-Specific Toxicity among Inbred Mouse Strains: Liver Effects", *J. Toxicol. Env. Health Part A* **2015**, *78*, 15 – 31 (DOI: 10.1080/15287394.2015.958417).
12. Gaston, Cassandra; Riedel, Theran; Zhang, Zhenfa; Gold, Avram; Surratt, Jason; Thornton, Joel, "Reactive Uptake of an Isoprene-derived Epoxydiol to Submicron Aerosol Particles", *Environ. Sci. Technol.* **2014**, *48*, 11178–11186 (e-pub. 09/10/14; DOI: 10.1021/es5034266).
13. Lin, Ying-Hsuan\*; Budisulistiorini, Sri\*; Chu, Kevin; Siejack, Richard; Zhang, Haofei; Riva, Matthieu; Zhang, Zhenfa; Gold, Avram; Kautzman, Kathryn; Surratt, Jason, "Light-absorbing oligomer formation in secondary organic aerosol from reactive uptake of isoprene epoxydiols", *Environ. Sci. Technol.* **2014**, *48*, 12012–12021 (e-pub 09/16/14; DOI: 10.1021/es503142b).
14. Wenjie Ye\*, Debamita Paul, Lina Gao\*, Jolita Seckute, Ramiah Sangaiah, Karupiah Jayaraj, Zhenfa Zhang, P. Alexandre Kaminski, Steven E. Ealick, Avram Gold, Louise M. Ball, "Ethenoguanines undergo glycosylation by nucleoside 2'-deoxyribosyltransferases at non-natural sites", *PLOS ONE*, **2014** (e-pub 12/18/14; DOI: 0.1371/journal.pone.0115082).
15. Elyse Rodgers-Vieira, Zhenfa Zhang, Alden Adrion\*, Avram Gold, Michael Aitken," Identification of Anthraquinone-Degrading Bacteria in Soil Contaminated with Polycyclic Aromatic Hydrocarbons", *Appl. Environ. Microbiol.*, **2015**, *81*, 3775–3781 (doi:10.1128/AEM.00033-15).

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17. Matthieu Riva, Sri Hapsari Budisulistiorini\*, Zhenfa Zhang, Avram Gold, Jason D. Surratt, “Chemical Characterization of Secondary Organic Aerosol Constituents from Isoprene Ozonolysis in the Presence of Acidic Aerosol”, *Atmos. Environ.* **2016**, *130*, 5–13 (DOI: 10.1016/j.atmosenv.2015.06.027)
18. S. H. Budisulistiorini\*, X. Li, S. T. Bairai, J. Renfro, Y. Liu, Y. J. Liu, K. A. McKinney, S. T. Martin, V. F. McNeill, H. O. T. Pye, A. Nenes, M. E. Neff, E. A. Stone, S. Mueller, C. Knote, S. L. Shaw, Z. Zhang, A. Gold J. D. Surratt, “Examining the effects of anthropogenic emissions on isoprene-derived secondary organic aerosol formation during the 2013 Southern Oxidant and Aerosol Study (SOAS) at the Look Rock, Tennessee ground site”, *Atmos. Chem. Phys.* **2015**, *15*, 8871–8888 (doi:10.5194/acp-15-8871-2015).
19. Amanda J Kramer, Weruka Rattanavaraha\*, Zhenfa Zhang, Avram Gold, Jason Douglas Surratt, Ying-Hsuan Lin, “Assessing the Oxidative Potential of Isoprene-Derived Epoxides and Secondary Organic Aerosol”, *Atmos. Environ.* **2016**, *130*, 211–218 (e-pub 10/20/15; DOI: 10.1016/j.atmosenv.2015.10.018).
20. Riedel, T. P.; Lin\*, Y.-H.; Budisulistiorini\*, S. H.; Gaston, C. J.; Thornton, J. A.; Zhang, Z.; Vizuete, W. G.; Gold, A.; Surratt, J. D., “Heterogeneous Reactions of Isoprene-Derived Epoxides: Reaction Probabilities and Molar SOA Yield Estimates”, *Environ. Sci. Technol. Lett.*, **2015**, *2*, 38–42 (e-pub 01/14/15; DOI: 10.1021/ez500406f)..
21. Phillip A. Wages\*, Katelyn S. Lavrich+, Zhenfa Zhang, Wan-Yun Cheng, Elizabeth Corteselli\*, Avram Gold, Philip Bromberg, Steven O. Simmons, and James M. Samet, “Protein Sulfenylation: A Novel Readout of Environmental Oxidant Stress”, *Chem. Res. Toxicol.*, **2015**, *28*, 2411–2418 (e-pub. 12/25/15; DOI: 10.1021/acs.chemrestox.5b00424).
22. F. D. Lopez-Hilfiker, C. Mohr1, E. L. D’Ambro, A. Lutz, T. P. Riedel, C. J. Gaston, S. Iyer, Z. Zhang, A. Gold, J. D. Surratt, B. H. Lee, T. Kurten, W.W. Hu, J. Jimenez, M. Hallquist, J. A. Thornton,” Molecular composition and volatility of organic aerosol in the Southeastern U.S.: implications for IEPOX derived SOA”, *Environ. Sci. Technol.* **2016**, *50*, 2200 – 2209 (e-pub 01/26/16; DOI: 10.1021/acs.est.5b04769).
23. W. Rattanavaraha\*, K. Chu, S. H. Budisulistiorini\*, M. Riva, Y.-H. Lin, E. S. Edgerton, K. Baumann, S. L. Shaw, H. Guo, L. King, R. J. Weber, E. A. Stone, M. E. Neff, J. H. Offenberg, Z. Zhang, A. Gold, J. D. Surratt, “Assessing the impact of anthropogenic pollution on isoprene-derived secondary organic aerosol formation in PM<sub>2.5</sub> collected from the Birmingham, Alabama ground site during the 2013 Southern Oxidant and Aerosol Study”, *Atmos. Chem. Phys.* **2016**, *16*, 4897 – 4914 (accepted for publication 03/06/16; doi: 10.5194/acp-16-4897-2016).
24. S. H. Budisulistiorini\*, K. Baumann, E. S. Edgerton, S. T. Bairai, S. Mueller, S. L. Shaw, E. M. Knipping, A. Gold, and J. D. Surratt, “Seasonal Characterization of Submicron Aerosol Chemical Composition and Organic Aerosol Sources in the Southeastern United States: Atlanta, Georgia and Look Rock, Tennessee”, *Atmos. Chem. Phys.* **2016**, *16*, 5171–5189 (doi:10.5194/acp-16-5171-2016).
25. Matthieu Riva, David M. Bell, Anne-Maria Kaldal Hansen, Greg T. Drozd, Zhenfa Zhang, Avram Gold, Dan Imre, Jason D. Surratt, Marianne Glasius, Alla Zelenyuk, “Effect of Organic Coatings, Humidity and Aerosol Acidity on Multiphase Chemistry of Isoprene Epoxydiols”, *Environ. Sci. Technol.*, **2016**, *50*, 5580–5588 (doi: 10.1021/acs.est.5b06050).
26. Riedel, T. P.; Lin, Y.-H. \*; Zhang, Z.; Chu, K.; Thornton, J. A.; Vizuete, W.; Gold, A.; Surratt, J. D. “Constraining Condensed-Phase Formation Kinetics of Secondary Organic Aerosol Components from Isoprene Epoxydiols”, *Atmospheric Chemistry & Physics*, **2016**, *16*, 1245–1254.
27. Jiumeng Liu, Emma L. D’Ambro, Ben H. Lee, Felipe Lopez-Hilfiker, Rahul A. Zaveri, Jean C. Rivera-Rios, Frank N. Keutsch, Siddharth Iyer, Theo Kurten, Zhenfa Zhang, Avram Gold, Jason D. Surratt, John E. Shilling, Joel A. Thornton, “Efficient organic aerosol formation from isoprene photooxidation in pristine conditions”, *Environ. Sci. Technol.* **2016**, *50*, 9872–9880; DOI: 10.1021/acs.est.6b01872 (e-pub 08/22/16)..
28. Ying-Hsuan Lin\*, Maiko Arashiro, Elizabeth Martin, Yuzhi Chen, Zhenfa Zhang, Kenneth G. Sexton, Avram Gold, Ilona Jaspers, Rebecca C. Fry, Jason D. Surratt, “Isoprene-Derived Secondary Organic Aerosol Induces the Expression of Oxidative Stress Response Genes in Human Lung Cells”, *Environ. Sci. Technol. Lett.* **2016**, *3*, 250 – 254; doi: 10.1021/acs.estlett.6b00151.
29. Maiko Arashiro, Ying-Hsuan Lin\*, Kenneth G. Sexton, Zhenfa Zhang, Ilona Jaspers, Rebecca C. Fry, William G. Vizuete, Avram Gold, Jason D. Surratt, “In Vitro Exposure to Isoprene-Derived Secondary Organic Aerosol by Direct Deposition 2 and its Effects on COX-2 and IL-8 Gene Expression”, *Atmos. Chem. Phys. D*, 05/13/16.

30. Matthieu Riva, Sri H. Budisulistiorini\*, Yuzhi Chen, Zhenfa Zhang, Emma D'Ambro, Xuan Zhang, Avram Gold, Barbara J. Turpin, Joel A. Thornton, Manjula R. Canagaratna, Jason D. Surratt, "Chemical Characterization of Secondary Organic Aerosol from Oxidation of Isoprene Hydroxyhydroperoxides", *Environ. Sci. Technol.* **2016**, *50*, 9889–9899; DOI: 10.1021/acs.est.6b02511 (e-pub 07/28/16).
31. Esra Mutlu, Lina Gao\*, Leonard B. Collins, Nigel J. Walker, James R. Olson, Wei Sun, Avram Gold, Louise M. Ball, James A. Swenberg, "Polychlorinated Biphenyls (PCBs) Induce Oxidative DNA Adducts In Female Sprague-Dawley Rats", *Chem. Res. Toxicol.*, **2016**, *29*, 1335–1344; DOI: 10.1021/acs.chemrestox.6b00146 (e-pub 07/20/16).
32. M. Riva, T. Da Silva Barbosa, Y.-H. Lin\*, E. A. Stone, A. Gold, and J. D. Surratt, "Characterization of Organosulfates in Secondary Organic Aerosol Derived from the Photooxidation of Long-Chain Alkanes", *Atmos. Chem. Phys.*, **2016**, *16*, 11001–11018; accepted for publication 08/10/16, doi:10.5194/acp-2016-20, 2016.
33. Maiko Arashiro, Ying-Hsuan Lin, Kenneth G. Sexton, Zhenfa Zhang, Ilona Jaspers, Rebecca C. Fry, William G. Vizuete, Avram Gold, Jason D. Surratt, "In Vitro Exposures to Isoprene-Derived Secondary Organic Aerosol: Assessing the Effects on Inflammation-Associated Gene Expression in Human Bronchial Epithelial Cells using a Direct Deposition Approach", *Environ. Sci. Technol.* **2016**, *50* (accepted 10/17/16).
34. Neha Sareen, Annmarie G. Carlton, Jason D. Surratt, Avram Gold, Ben Lee, Felipe D. Lopez-Hilfiker, Claudia Mohr, Joel A. Thornton, Zhenfa Zhang, Yong B. Lim, Barbara J. Turpin, "Identifying precursors and aqueous organic aerosol formation pathways during the SOAS campaign", *Atmos. Chem. Phys.* **2016**, *16*, 14409–14420; accepted 10/24/16; doi:10.5194/acp-16-14409-2016.
35. Matthieu Riva, Sri H. Budisulistiorini\*, Zhenfa Zhang, Avram Gold, Joel A. Thornton, Barbara J. Turpin, Jason D. Surratt, "Multiphase Reactivity of Gaseous Hydroperoxide Oligomers Produced from Isoprene Ozonolysis in the Presence of Acidified Aerosols", *Atmos. Environ.* **2017**, *152*, 314–32; accepted 12/20/16.; doi.org/10.1016/j.atmosenv.2016.12.040.
36. Emma L. D'Ambro, Ben H. Lee, Jiumeng Liu, John E. Shilling, Cassandra J. Gaston, Felipe D. Lopez-Hilfiker, Siegfried Schobesberger, Rahul A. Zaveri, Claudia Mohr, Anna Lutz, Zhenfa Zhang, Avram Gold, Jason D. Surratt, Jean C. Rivera-Rios, Frank N. Keutsch, Joel A. Thornton, "Molecular composition and volatility of isoprene photochemical oxidation secondary organic aerosol under low- and high-NO<sub>x</sub> conditions", *Atmos. Chem. Phys.*, **2017**, *17*, 159–174; doi:10.5194/acp-17-159-2017; accepted 05/12/16.
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38. A. Venkatratnam, S. Furuya, O. Kosyk, A. Gold, W. Bodnar, K. Konganti, D. W. Threadgill, K. M. Gillespie, D. L. Aylor, F. A. Wright, W. A. Chiu<sup>1</sup>, I. Rusyn, "Collaborative Cross mouse population enables refinements to characterization of the variability in toxicokinetics of trichloroethylene and provides genetic evidence for the role of PPAR pathway in its oxidative metabolism", *Tox. Sci.* **2017**, *158*, 48–62; doi.org/10.1093/toxsci/kfx065 (e-pub 03/27/17).
39. W. Rattanavaraha, M. R. Canagaratna, S. H. Budisulistiorini, P. L. Croteau, K. Baumann, F. Canonaco, E. S. Edgerton, Z. Zhenfa, J. T. Jayne, D. R. Worsnop, A. Gold, S. L. Shaw J. D. Surratt "Source Apportionment of Submicron Organic Aerosol Collected from Atlanta, Georgia, During 2014-2015 Using the Aerosol Chemical Speciation Monitor (ACSM)", *Atmos. Environ.* **2017**
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42. Zhenyu Tian, Avram Gold, Jun Nakamura, Zhenfa Zhang, Joaquim Vila, David R. Singleton, Leonard Bruce Collins, Michael D. Aitken, "Non-target analysis reveals a bacterial metabolite of pyrene implicated in the genotoxicity of contaminated soil after bioremediation," *Environ. Sci. Technol.* **2017**, *51*, 7091–7100; DOI: 10.1021/acs.est.7b01172 (e-pub 05/16/17).

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- M. Riva, Y. Chen, Y. Zhang, Z. Lei, N. E. Olson, H. C. Boyer Chelmo, S. Narayan, L.D. Yee, H. S. Green, T. Cui, Z. Zhang, K. Baumann, M. Fort, E. Edgerton, S.H. Budisulistiorini, C. A. Rose, I. O. Ribeiro, R. L. e Oliveira, E. O. dos Santos, C. M. D. Machado, S. Szopa, Y. Zhao, E. G. Alves, S. S. de Sá, W. Hu, E. M. Knipping, S. L. Shaw, S. Duvoisin Junior, R. A. F. de Souza, B.B. Palm, T. P. Riedel, J. L. Jimenez, M. Glasius, A. H. Goldstein, H. O. T. Pye, A. Gold, B. J. Turpin, W. Vizuete, S. T. Martin, J. A. Thornton, C. S. Dutcher, A. P. Ault, and J. D. Surratt, "Extensive Isoprene Epoxydiols Conversion of Inorganic to Organic Sulfur Alters Aerosol Properties", 11<sup>th</sup> Asian Aerosol Conference, Kowloon, Hong Kong during 27 – 30 May 2019.
- Yue Zhang, Yuzhi Chen, Ziyang Lei, Nicole E. Olson, Matthieu Riva, Abigail R. Koss, Zhenfa Zhang, Avram Gold, John T. Jayne, Douglas R. Worsnop, Timothy B. Onasch, Barbara J. Turpin, Jesse Kroll, Andrew P. Ault, Jason D. Surratt, "Combined Impacts of Acidity and Viscosity on the Formation of Inorganic-Organic Mixed Isoprene Epoxydiol (IEPOX)-Derived Aerosols", 37<sup>th</sup> AAAR Annual Conference, Oct 14 – 18, 2019, Portland, OR.
- Yue Zhang, Yuzhi Chen, Andrew T. Lambe, Nicole E. Olson, Ziyang Lei, Manjula Canagaratna, Jordan Krechmer, Rebecca L. Craig, Zhenfa Zhang, Avram Gold, John T. Jayne, Douglas R. Worsnop, Timothy B. Onasch, Cassandra J. Gaston, Joel A. Thornton, William Vizuete, Andrew P. Ault, Jason D. Surratt, "The Effects of Aerosol-Phase State and Chemical Composition on Multiphase Chemistry Leading to Isoprene-Derived Secondary Organic Aerosol Formation", 37<sup>th</sup> AAAR Annual Conference, Oct 14 – 18, 2019, Portland, OR.
- Yue Zhang, Yuzhi Chen, Manjula Canagaratna, Sri H. Budisulistiorini, Tianqu Cui, Zhenfa Zhang, Avram Gold, John T. Jayne, Douglas R. Worsnop, Barbara J. Turpin, Jason D. Surratt, "IEPOX-Derived Organosulfates Contribute a Significant Portion of the Aerosol Mass Spectral Tracer Ion of IEPOX-derived SOA and Its Implications, 37<sup>th</sup> AAAR Annual Conference, Oct 14 – 18, 2019, Portland, OR.
- Yuzhi Chen, Yue Zhang, Matthieu Riva, Theran P. Riedel, Havala O. T. Pye, Nicole E. Olson, Ziyang Lei, Zhenfa Zhang, Avram Gold, Barbara J. Turpin, Andrew P. Ault, Jason D. Surratt, "Application of a Reactive Uptake Parameterization Considering Non-Ideal Effects and Phase State in Simulating Secondary Organic Aerosols from Isoprene Epoxydiols Under Controlled Laboratory Measurements," 37<sup>th</sup> AAAR Annual Conference, Oct 14 – 18, 2019, Portland, OR.
- Yuzhi Chen, Yue Zhang, Andrew T. Lambe, Zhenfa Zhang, Avram Gold, Barbara J. Turpin, Andrew P. Ault, Jason D. Surratt, Man Nin Chan, "Heterogeneous OH oxidation of methyltetrol sulfates leads to formation of multifunctionalized organosulfates previously measured in ambient fine aerosols", AGU Fall Meeting, San Francisco, CA, 9 – 13 December.
- Yue Zhang, Martin J. Wolf, Abigail R. Koss, Xiaoli Shen, Leonid Nichman, Zhenfa Zhang, Avram Gold, John T. Jayne, Douglas R. Worsnop, Timothy B. Onasch, Paul Davidovits, Jason D. Surratt, Jesse H. Kroll, Daniel J. Cziczo, "Enhancement of the Heterogeneous Ice Nucleation by the Ch21anging Phase State of Secondary Organic Aerosols", 2020 American Meteorology Society Meeting, Boston, MA, Jan. 12 – 16, 2020.
- Edward Pennington, Syed Masood, Zhenfa Zhang, Avram Gold, Chapel Hill Weidong Wu, Xinxiang Medical University, "Monitoring Real Time Changes in Redox Status of Human Airway Epithelial Cells Exposed to Environmental Peroxides", Society for Redox Biology and Medicine, 27<sup>th</sup> Annual Conf. 11/18 - 11/20; virtual.
- Syed Masood, Zhenfa Zhang, Avram Gold, and James Samet, "Live Cell Imaging of Oxidative Stress in Human Airway Epithelial Cells Exposed to Environmental Peroxides" SfrBM 2021 - 27<sup>th</sup> Annual Conference of the Society for Redox Biology and Medicine, 11/18 - 11/20; virtual.
- Edward Pennington, Syed Masood, Zhenfa Zhang, Avram Gold, Chapel Hill Weidong Wu, Xinxiang Medical University, "Monitoring Real Time Changes in Redox Status of Human Airway Epithelial Cells Exposed to Environmental Peroxides", Society for Redox Biology and Medicine, 27<sup>th</sup> Annual Conf. 11/18 - 11/20; virtual
- Yuzhi Chen, Tracy Dombek, Jenny Hand, Zhenfa Zhang, Avram Gold, Andrew P. Ault, Keith E. Levine, Jason D. Surratt, "Seasonal Contribution of Organosulfates to Total Water-Soluble Fine Particulate Organic Sulfur in the United States", 21<sup>st</sup> AAAR Conference, 10/18 – 10/22, 2021, Virtual
- Alison M. Fankhauser, Ziyang Lei, Kimberly R. Daley, Yao Xiao, Zhenfa Zhang, Avram Gold, Bruce S. Ault, Jason D. Surratt, Andrew P. Ault, "Acidity-Dependent Atmospheric Organosulfate Structures and Spectra: Exploration of Protonation State Effects via Raman, Infrared, and Density Functional Theory," 11<sup>th</sup> International Aerosol Conference, Sept. 4-9, 2022, Athens, Greece.

- \*Molly P. Frauenheim, Melinda Beavers, John Offenberg, Zhefa Zhang, Jason D. Surratt, **Avram Gold**, “Insights into the Alkene Triol Conundrum” 40<sup>th</sup> annual conference, American Association for Aerosol Research, Raleigh, NC 11/03 – 07, 2022.
- Rebecca L. Rice, Jin Yan, Sebastian Gerber, Stephan Graf, Michael Z. Kamrath, Felipe Lopez-Hilfiker, Zhenfa Zhang, Jason D. Surratt, **Avram Gold**, “Identifying a missing link: confirmation of the structure and origin of 4-hydroperoxy-3-methylbut-2-enal (4-HPALD) with an authentic standard”, 40<sup>th</sup> annual conference, American Association for Aerosol Research, Raleigh, NC 11/03 – 07, 2022.
- Jin Yan, N. Cazimir Armstrong, Alison M. Fankhauser, Madeline Cooke, Nicolas Buchenau, Yao Xiao, Zhenfa Zhang, Andrew Lambe, **Avram Gold**, Andrew P. Ault, Jason D. Surratt “Effect of Aerosol Acidity on the Kinetics and Products of Heterogeneous Hydroxyl Radical Oxidation of Isoprene Epoxydiol-Derived Secondary Organic Aerosol”, 40<sup>th</sup> annual conference, American Association for Aerosol Research, Raleigh, NC 11/03 – 07, 2022.
- Madeline E. Cooke, Ziyang Lei, Yuzhi Chen, N. Cazimir Armstrong, Yue Zhang, Nicolas Buchenau, Isabel R. Ledsky, Jany Y. Lee, **Avram Gold**, Zhenfa Zhang, Jason D. Surratt, Andrew P. Ault, “Organosulfate Formation in Proxies for Aged Sea Spray Aerosol: Reactive Uptake of Isoprene Epoxydiols to Acidic Sodium Sulfate”, 40<sup>th</sup> annual conference, American Association for Aerosol Research, Raleigh, NC 11/03 – 07, 2022.
- N. Cazimir Armstrong, Yuzhi Chen, Tianqu Cui, Yue Zhang, Zhenfa Zhang, Barbara J. Turpin, Man Nin Chan, **Avram Gold**, Andrew P. Ault, Jason D. Surratt, “Isoprene Epoxydiol-Derived Sulfated and Non-Sulfated Oligomers Suppress Particulate Mass Loss During Oxidative Aging of Secondary Organic Aerosol”, 40<sup>th</sup> annual conference, American Association for Aerosol Research, Raleigh, NC 11/03 – 07, 2022.
- Jin Yan, N. Cazimir Armstrong, Alison M. Fankhauser, Madeline Cooke, Nicolas Buchenau\*, Yao Xiao, Zhenfa Zhang, Andrew Lambe, **Avram Gold**, Andrew P. Ault, Jason D. Surratt, “Effect of Aerosol Acidity on the Kinetics and Products of Heterogeneous Hydroxyl Radical Oxidation of Isoprene Epoxydiol-Derived Secondary Organic Aerosol”, 40<sup>th</sup> annual conference, American Association for Aerosol Research, Raleigh, NC 10/03 – 07, 2022.
- \*Rebecca L. Rice, Jin Yan, Sebastian Gerber, Stephan Graf, Michael Z. Kamrath, Felipe Lopez-Hilfiker, Zhenfa Zhang, Jason D. Surratt and Avram Gold, “Identifying a missing link: confirmation of the structure and origin of 4-hydroperoxy-3-methylbut-2-enal (4-HPALD) with an authentic standard”, 40<sup>th</sup> annual conference, American Association for Aerosol Research, Raleigh, NC 10/03 – 07, 2022.
- \*Rebecca Rice, ‡ Jason Surratt, Zhenfa Zhang, **Avram Gold**, HPALD2 is a Peroxyhemiacetal and a Source of SOA. *41st Meeting American Association of Aerosol Research*. 41st Meeting AAAR, 10/02 – 10/06, 2023, Portland, OR.
- Katherine Kolosvari, Cara Waters, Alison Fankhauser, N. Cazimir Armstrong, Jin Yan, Madeline Cooke, Yao Xiao, Rebecca Parham, Zhenfa Zhang, **Avram Gold**, Jason Surratt, Andrew Ault. (2023). Direct Determination of Melting Temperatures for Individual, Sub-Micron Isoprene Epoxydiol-Derived Secondary Organic Aerosol Particles. 41st Meeting AAAR, 10/02 – 10/06, 2023, Portland, OR.
- \*Molly Frauenheim, Jason Surratt, Zhenfa Zhang, **Avram Gold**. Chemical Composition of Secondary Organic Aerosol Formed from the Oxidation of Isoprene-Derived C<sub>5</sub>H<sub>10</sub>O<sub>3</sub> Reactive Uptake Products. 41st Meeting AAAR, 10/02 – 10/06, 2023, Portland, OR.
- Katherine Kolosvari, Yao Xiao, Alison Fankhauser, Jin Yan, Madeline Cooke, Cara Waters, Rebecca Parham, N. Cazimir Armstrong, Zhenfa Zhang, **Avram Gold**, Jason D. Surratt, Andrew P. Ault. Determining Glass Transition Temperatures of Individual Isoprene-Derived Secondary Organic Aerosol Particles at Different Relative Humidities. ACS Spring 2023 meeting, Indianapolis, IN, 03/26 – 03/30.
- N. Cazimir Armstrong, Madeline Cooke, Yuzhi Chen, \*Molly Frauenheim, Zhenfa Zhang, **Avram Gold**, Andrew Ault, Jason Surratt. Formation Kinetics of Isoprene Epoxydiol-Derived Secondary Organic Aerosol Are Altered Near the Sulfate/Bisulfate pKa. 41st Meeting AAAR, 10/02 – 10/06, 2023, Portland, OR.
- Rebecca L. Parham, Alison M. Fankhauser, Jia Shi, Madeline E. Cooke, Jin Yan Cara Waters, Yao Xiao, Katherine Kolosvari, N. Cazimir Armstrong, Zhenfa Zhang, **Avram Gold**, Jason D. Surratt, Andrew P. Ault. Development of a Single-Particle Technique to Study Insoluble Residues from Isoprene-Derived Secondary Organic Aerosol in Droplets ACS Spring 2023 meeting, Indianapolis, IN, 03/26 – 03/30.
- Cara Waters, Katherine Kolosvari, Jin Yan, Madeline Cooke, Alison Fankhauser, N. Cazimir Armstrong, Rebecca Parham, Yao Xiao, Carlie Poworoznek, Zhenfa Zhang, **Avram Gold**, Jason Surratt, Andrew Ault. Investigating the Heterogeneous Formation and Degradation of Oligomers in Isoprene Epoxydiol-Derived Secondary Organic Aerosol. 41st Meeting AAAR, 10/02 – 10/06, 2023, Portland, OR.

Jin Yan, N. Cazimir, Alison Fankhauser, Katherine Rebecca Anne Kolozsvari, Madeline Cooke, Nicolas Aliaga Buchenau, Yao Xiao, Cara Waters, Rebecca Parham, Zhenfa Zhang, Andrew Lambe, **Avram Gold**, Andrew P Ault, Jason Surratt. Effect of aerosol acidity on the kinetics and products of heterogeneous hydroxyl radical oxidation of isoprene epoxydiol-derived secondary organic aerosol. ACS Spring 2023 meeting, Indianapolis, IN, 03/26 – 03/30.

Matthieu Riva, Sebastian Gerber, Megan Claflin, Peter Mettke, \*Molly Frauenheim, \*Rebecca Rice, **Avram Gold**, Jason Surratt, Vasyl Yatsyna, Stephan Graf, Manjula Canagaratna, Hartmut Herrmann, Urs Rohner, Michael Kamrath, and Felipe Lopez-Hilfiker. Real-time monitoring of dynamic isomer populations with CI-SLIM IMS-MS, EGU General Assembly 2024, Vienna, Austria, 04/14 – 04/19, 2024.

Madeline E. Cooke, N. Cazimir Armstrong, Alison M. Fankhauser, Yuzhi Chen, Ziyang Lei, Yue Zhang, Isabel R. Ledsky, Barbara J. Turpin, Zhenfa Zhang, **Avram Gold**, V. Faye McNeill, Jason D. Surratt, Andrew P. Ault, “Decreases in Epoxide-Driven Secondary Organic Aerosol Production Under Highly Acidic Conditions: The Importance of Acid-Base Equilibria” Tampere, Finland, European Aerosol Conference, 08/25 – 08/30 2024.

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\*Selected for oral presentation.

‡Session Chair

### Students advised (date of degree)

#### *PhD*

Masood, Syed\* (Committee Chair, starting Fall 2020)

Rebecca Rice (Committee Chair, starting Fall 2020)

Molly Frauenheim (Committee Chair, starting Fall 2020)

Carolyn Nichols (Co-Chair, starting Fall 2020)

Marc Webb (2023)

Alma Beciragic (2022)

Yuzhi Chen (2020)

Zachary Robbins (2020)

Elizabeth Corteselli (2019)

Virginia Bass (committee chair, 2019)

Sean Watford (2019)

Katelyn Laverich\* (2018)

Zhenyu Tian (2018)

Abhishek Venkatratnam (2018)

Tianqu Cui (2017)

Weruka Rattanavaraha (2016)

Arial Atkinson (2016)

Philip Wages\* (2015)

Sri Budisulistiorini (2014)

Nour Abdo (2014)

Ying-Hsuan Lin (2014)

Alex Carll (committee chair, 2012)

Wen-Yun Cheng (committee chair, 2012)

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\*Curriculum in Toxicology

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#### *MS*

Caitlin Rose (current)

Yuzhi Chen (current)

Zachary Robbins (2012)

Xinxin Li (2014)

Wendy Marth (2013)

Zhexi Zheng (2018)

#### *BSPH*

Stephanie Yu (2017)

Neil Bhethela (2013)

**MPH practicum preceptor**

Rachael Cogbill (2023)

Amanda Coleman (2023)

**Current grant support (2019 – current)**

**AGS-2304669** NSF Atmospheric Chemistry (Lead PI: A. Gold)

Total award \$667,687 (06/01/2023 – (05/31/2026)

*Early-Generation Photochemical Oxidation Products of Isoprene Under Low-NO Conditions: Aerosol Formation Potential and Structural Assignments by Ion Mobility Mass Spectral Analysis*

Structures of many early generation gas-phase isoprene oxidation products are not definitively confirmed. Prediction of subsequent gas- and multi-phase chemical transformations and analysis of SOA composition are therefore based largely on tentative structural assignments. This proposal will expand the number of definitive structural assignments of early-generation isoprene oxidation products and products of subsequent multiphase chemical transformations. By synthesis of tentatively assigned structures for use as authentic standards.

**AGS – 2001027** NSF Atmospheric Chemistry (PI: A. Gold)

Total award \$596,470 (02/15/2020 – 02/14/2023)

*Comparison of thermal and non-thermal protocols for analysis of isoprene SOA generated under low-Nox conditions. Assessment of artifacts and detection of highly oxidized products*

Critical gaps exist in understanding isoprene low-Nox chemistry. Lack of authentic standards for key low-Nox isoprene SOA markers leads to ambiguity in quantitating SOA components and poor performance of predictive models. Some markers may actually be artifacts of widely used thermal analytical protocols, while multifunctional hydroperoxides may degrade. Of particular concern are methyl tetrols, IEPOX oligomers, C<sub>5</sub>H<sub>10</sub>O<sub>3</sub> isobars (C<sub>5</sub>-alkene triols), and the multifunctional hydroperoxides. This proposal addresses gap

**Professional Service (2019 – current)**

Guest Editor with Jason Surratt, Atmosphere Special Issue, “*The critical role of synthetic chemistry in elucidating mechanisms, product identification and quantitation in atmospheric gas-phase and multiphase chemistry of volatile organic emissions*”

Member, Editorial Board, Atmosphere (2019 - )

Proposal Review, NSF Atmospheric and Geospace Sciences-Atmospheric Chemistry Directorate (2023)

Proposal Review, Swiss NSF (2024, 2021, 2021)

Proposal Review, Southern California Environmental Health Sciences Center (2019)

Peer reviewer for the following Journals:

Journal

*Analytical Methods*

*Atmosphere*

*Atmospheric Chemistry and Physics*

*Atmospheric Pollution Research*

*Chemosphere*

*Ecotoxicology and Environmental Safety*

*Environmental Pollution*

*Experimental and Molecular Pathology*

*Environmental Science & Technology*  
*Journal of Inorganic Biochemistry*  
*Materials Sciences & Engineering C*  
*Microchemical Journal*  
*Natural Products Reports*  
*Science*  
*Science of the Total Environment*  
*Sustainability*  
*Symmetry*  
*Toxicology Reports*  
*Toxics*

**Committees (2019 – current)**

School/University Committees

Admissions Committee, Environmental Climate and Health MPH

UNC Hospitals Personnel and Environmental Safety Subcommittee 08/2000 – present

Department Committees

Kun Lu Promotion Committee, 2024

Jill Stewart 2024 Post Tenure Review (Chair)

Jason Surratt 2024 Post Tenure Review

Jason West 2024 Post Tenure Review

ESE Space Committee

Working Group On the Water MPH, 2021