LAURA R. MCCUNN

Department of Chemistry
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EDUCATION

University of Chicago, Chicago, Illinois
Ph.D. in Chemistry, December 2005
M.S. in Chemistry, August 2002

Ohio Wesleyan University, Delaware, Ohio
B.A. in Biochemistry (ACS certified) with a minor in Mathematics*, summa cum laude* with University Honors, May 2001

PROFESSIONAL EXPERIENCE

Professor, Department of Chemistry, Marshall University, 2021-present
Associate Professor, Department of Chemistry, Marshall University, 2014-2021
Assistant Professor, Department of Chemistry, Marshall University, 2008-2014

Postdoctoral Associate, Department of Chemistry, Yale University, February 2006-May 2008 (Dr. Mark A. Johnson, advisor)

Research Assistant, Department of Chemistry and James Franck Institute, University of Chicago, 2001-2005 (Dr. Laurie J. Butler, advisor)
Dissertation: *Dissociation dynamics of radical intermediates in bimolecular reactions*

COURSES TAUGHT

CHM 211, Principles of Chemistry I	Fall 2008-10, 2015, 2022, 2023 Spring 2021-22
CHM 212, Principles of Chemistry II	Fall 2013-4, 2017, 2022; Spring 2017-18, 2023, 2024
CHM 217, Principles of Chemistry Lab I	Fall 2008-2009, 2013-16, 2018, 2020-21
CHM 218, Principles of Chemistry Lab II	Spring 2016-19, Fall 2022
CHM 307, Introductory Physical Chemistry	Spring 2009, 2011-13
CHM 357, Physical Chemistry I	Fall 2016-18, 2023
CHM 358, Physical Chemistry II	Fall 2011-12, Spring 2015-6, 2020-23
CHM 480/580, Atmospheric Chemistry	Fall 2010
CHM 480/580, Brownie, Beer, and Bacon Chem.	Spring 2019, 2024

CURRENT RESEARCH INTERESTS

- Matrix-isolation infrared spectroscopy of radicals that occur as intermediates in combustion processes and extraterrestrial environments.
- Identification of the products from gas-phase pyrolysis of organic molecules.
- Molecular photochemistry of matrix-isolated halogenated hydrocarbons.

PUBLICATIONS

27. K. El-Shazly, H. R. Legg, J. Wilkinson, D. Kapp, L. R. McCunn "Characterization of the pyrolysis products of 2-pyrone via matrix-isolation FTIR." *Journal of Molecular Spectroscopy,* **407**, 111981, (2025). DOI: 10.1016/j.jms.2024.111981

26. K. Narkin, H. R. Legg, G. J. Brown, K. El-Shazly, T. D. Martin, M. Jarrell, **L. R. McCunn**, Z. Chen, C. A. Parish "Thermal Decomposition of 2-Cyclopentenone." *Journal of Physical Chemistry A* **128**, 9226-9234 (2024). DOI: 10.1021/acs.jpca.4c05532

25. H. N. Legg, K. M. Narkin, **L. R. McCunn**, C. A. Parish, X. Song "Experimental and Theoretical Study of Oxolan-3-one Thermal Decomposition" *Journal of Physical Chemistry A*, **126**, 7084–7093 (2022) DOI: 10.1021/acs.jpca.2c03254

24. **L. R. McCunn**, A. Vasiliou, "Developing an Undergraduate Research Laboratory for Experimental Physical Chemistry" in *Physical Chemistry Research at Undergraduate Institutions,* ACS Symposium Series. (2022) DOI: 10.1021/bk-2022-1429.ch004

23. K. A. El-Shazly, E. Sparks, K. Narkin, H. Legg; J. Cardot, M. Hostetler, **L. R. McCunn**, C. Parish "The signature C=C=O stretch of propenylketenes and ketene clusters" in *Physical Chemistry Research at Undergraduate Institutions,* ACS Symposium Series. (2022) DOI: 10.1021/bk-2022-1428.ch004

22. G. J. Brown, M. J. Ellis, T.D. Martin, **L. R. McCunn** "Vibrational Bands of the 2-Butyn-1-yl Radical." *Journal of Physical Chemistry A* **124**, 4081–4086 (2020). DOI: 10.1021/acs.jpca.0c02218

21. E.R. Sias, S.L. Cole, B.J. Warner, E.M. Wright, **L.R. McCunn** "The effect of aldehyde structure on pyrolysis reactions." *Journal of Analytical and Applied Pyrolysis* **123**, 340-346 (2017). DOI: 10.1016/j.jaap.2016.11.009

20. E. M. Wright, B. J. Warner, H. E. Foreman, **L. R. McCunn**, K. N. Urness, "Pyrolysis Reactions of 3-Oxetanone." *Journal of Physical Chemistry A* **119**, 7966-7972 (2015). DOI: 10.1021/acs.jpca.5b04565

19. B. J. Warner, E. M. Wright, H. E. Foreman, C. D. Wellman, **L. R. McCunn**, "Products from Pyrolysis of Gas-Phase Propionaldehyde. *Journal of Physical Chemistry A* **119**, 14-23 (2015).

18. C. D. Hatten, K. R. Kaskey, B. J. Warner, E. M. Wright, and **L. R. McCunn**, "Thermal decomposition products of butyraldehyde." *Journal of Chemical Physics* **139**, 214303 (2013).

17. B. M. Elliott, **L. R. McCunn** and M. A. Johnson, "Photoelectron imaging study of vibrationally mediated electron autodetachment in the type I isomer of the water hexamer anion." *Chemical Physics Letters* **467,** 32-36 (2008).

16. **L. R. McCunn**, G. H. Gardenier, T. L. Guasco, B. M. Elliott, J. C. Bopp, R. A. Relph and M. A. Johnson, "Probing isomer interconversion in anionic water clusters using an Ar-mediated pump-probe approach: Combining vibrational predissociation and velocity-map photoelectron imaging spectroscopies." *Journal of Chemical Physics* **128**, 234311 (2008).

15. **L. R. McCunn**, J. R. Roscioli, B. M. Elliott, M. A. Johnson and A. B. McCoy, "Why does argon bind to deuterium? Isotope effects and structures of $Ar{\cdot}H_5O_2^+$ complexes." *Journal of Physical Chemistry A* **112**, 6074-6078 (2008).

14. **L. R. McCunn**, J. M. Headrick and M. A. Johnson, "Site-specific addition of D_2O to the $(H_2O)_6^-$ "hydrated electron" cluster: Isomer interconversion and substitution at the double H-bond acceptor (AA) electron-binding site." *Physical Chemistry Chemical Physics* **10**, 3118-3123 (2008).

13. **L. R. McCunn**, J. R. Roscioli, M. A. Johnson and A. B. McCoy, "An H/D isotopic substitution study of the $H_5O_2^+{\cdot}Ar$ vibrational predissociation spectra: Exploring the putative role of Fermi resonances in the bridging proton fundamentals." *Journal of Physical Chemistry B* **112**, 321-327 (2008).

12. K. R. Asmis, Y. Yang, G. Santambrogio, M. Brümmer, J. R. Roscioli, **L. R. McCunn**, M. A. Johnson and O. Kühn, "Gas-Phase Infrared Spectroscopy and Multidimensional Quantum Calculations of the Protonated Ammonia Dimer $N_2H_7^+$." *Angewandte Chemie International Edition* **46**, 8691-8694 (2007).

11. M. J. Krisch, M. J. Bell, B. L. FitzPatrick, **L. R. McCunn**, K.-C. Lau, Y. Liu and L. J. Butler, "Photodissociation Pathways of 1,1-Dichloroacetone." *Journal of Physical Chemistry A* **111**, 5968-5980 (2007).

10. J. R. Roscioli, **L. R. McCunn** and M. A. Johnson, "Quantum Structure of the Intermolecular Proton Bond." *Science* **316**, 249-254 (2007).

9. **L. R. McCunn**, B. L. Fitzpatrick, M. J. Krisch, L. J. Butler, C.-W. Liang and J. J. Lin, "Unimolecular dissociation of the propargyl radical intermediate of the CH + C_2H_2 and C + C_2H_3 reactions." *Journal of Chemical Physics* **125,** 133306 (2006).

8. **L. R. McCunn**, K.-C. Lau, M. J. Krisch, L. J. Butler, J.-W. Tsung and J. J. Lin, "Unimolecular Dissociation of the CH_3OCO Radical: An Intermediate in the CH_3O + CO Reaction." *Journal of Physical Chemistry A* **110**, 1625-1634 (2006).

7. **L. R. McCunn**, D. I. G. Bennett, L. J. Butler, H. Fan, F. Aguirre and S. T. Pratt, "Photodissociation of Propargyl Chloride at 193 nm." *Journal of Physical Chemistry A* **110**, 843-850 (2006).

6. **L. R. McCunn**, M. J. Krisch, Y. Liu, L. J. Butler, and J. Shu, "A Study of the Unimolecular Dissociation of the 2-Buten-2-yl Radical via the 193 nm Photodissociation of 2-Chloro-2-butene." *Journal of Physical Chemistry A* **109**, 6430-6439 (2005).

5. J. L. Miller, **L. R. McCunn**, M. J. Krisch, L. J. Butler, and J. Shu, "Dissociation of the ground state vinoxy radical and its photolytic precursor chloroacetaldehyde: electronic nonadiabaticity and the suppression of the H + ketene channel." *Journal of Chemical Physics* **121,** 1830-1838 (2004).

4. M. J. Krisch, M. C. Reid, **L. R. McCunn**, L. J. Butler, and J. Shu, "Photofragment translational spectroscopy of nitric acid at 248 nm with VUV photoionization detection of products." *Chemical Physics Letters* **397**, 21-25 (2004).

3. **L. R. McCunn**, M. J. Krisch, K. Takematsu, L. J. Butler, and J. Shu, "Competing Pathways in the 248 nm Photodissociation of Propionyl Chloride and the Barrier to Dissociation of the Propionyl Radical." *Journal of Physical Chemistry A* **108**, 7889-7894 (2004).

2. M. J. Krisch, **L. R. McCunn**, K. Takematsu, L. J. Butler, F. R. Blase, and J. Shu, "Photodissociation of CH_3OCl to CH_3O + Cl at 248 nm." *Journal of Physical Chemistry A* **108**, 1650-1656 (2004).

1. J. J. Gilligan, **L. R. McCunn**, B. D. Leskiw, Z. Herman, A. W. Castleman, Jr. "Associative ionization of excited sodium species with various ligands: assessing relative bonding strengths of ion-ligand interactions." *International Journal of Mass Spectrometry* **204,** 247-253 (2001).

PRESENTATIONS

June 18, 2024, International Symposium on Molecular Spectroscopy, contributed talk: "Matrix-isolation FTIR spectra of 2-pyrone pyrolysis products."

June 20, 2023, International Symposium on Molecular Spectroscopy, contributed talk: "Thermal decomposition of 2-(chloroethyl)benzene studied via matrix-isolation FTIR."

June 24, 2022, International Symposium on Molecular Spectroscopy, contributed talk: "Pyrolysis reactions of oxolan-3-one studied via matrix-isolation FTIR."

June 2, 2022, DOE Gas Phase Chemical Physics Principal Investigators Meeting, invited talk: "Thermal Decomposition of Cyclic, Oxygenated Hydrocarbons."

May 17, 2022, International Conference on Analytical and Applied Pyrolysis (PYRO 2022), contributed poster: "Pyrolysis mechanisms of cyclopentenones revealed via matrix-isolation FTIR and computations."

November 29, 2021, New College of Florida Natural Sciences Seminar, invited talk: "Vibrational fingerprints of substituted ketenes."

November 11, 2021, Southeastern Regional Meeting of the American Chemical Society, invited talk: "Vibrational fingerprints of substituted ketenes."

August 25, 2021, American Chemical Society Fall National Meeting, invited talk: "Experimental and theoretical study of cyclopentenone pyrolysis."

June 25, 2021, International Symposium on Molecular Spectroscopy, invited talk: “Research with undergraduates: Spectroscopy is just the beginning.”

May 29, 2019, DOE Gas Phase Chemical Physics Principal Investigators Meeting, invited talk: “Thermal Decomposition of Cyclic, Oxygenated Hydrocarbons.”

April 16, 2019, Argonne National Laboratory, Chemical Science and Engineering Seminar Series, invited talk: “Understanding the Thermal Decomposition of Oxygenated Hydrocarbons Via Pyrolysis and Matrix-Isolation FTIR.”

November 1, 2018, University of Georgia Physical Chemistry Group Meeting, invited talk: “Pyrolysis and Spectroscopy at a PUI.”

August 22, 2018, American Chemical Society Fall National Meeting, contributed talk: “Pyrolysis and matrix-isolation FTIR spectroscopy for characterization of astrochemically significant radicals.”

June 18, 2018, 73nd International Symposium on Molecular Spectroscopy, contributed talk: “Matrix-Isolation FTIR Spectroscopy of the 2-Butyn-1-yl Radical.”

June 21, 2017, 72nd International Symposium on Molecular Spectroscopy, contributed talk: “Pyrolysis and Matrix-Isolation FTIR of Acetoin.”

June 22, 2016, 71st International Symposium on Molecular Spectroscopy, contributed talk: “Molecular Structure and Reactivity in the Pyrolysis of Aldehydes.”

June 26, 2015, 70th International Symposium on Molecular Spectroscopy, contributed talk: “Reactions of 3-Oxetanone at High Temperatures.”

June 18, 2013, 68th International Symposium on Molecular Spectroscopy, contributed talk: “Thermal Decomposition Mechanism of Butyraldehyde.”

March 13, 2013, West Virginia University Department of Chemistry Seminar: “Unraveling the Mechanisms of Thermal Decomposition in Butyraldehyde.”

June 18, 2012, 67th International Symposium on Molecular Spectroscopy, contributed talk: “FTIR of Methyl Pyruvate Conformers in an Argon Matrix.”

March 29, 2012, meeting of the Central Ohio Valley Section of the American Chemical Society, invited talk: “Hot and Cold: Matrix-Isolation FTIR of Pyrolytic Products from Organic Compounds”

June 2011, 32nd Annual Combustion Research Meeting sponsored by the Department of Energy, poster: "Characterization of Combustion Radicals Via Matrix-Isolation FTIR"

March 3, 2011, Pat Logan Symposium of Scholars at Marshall University, invited talk: "Matrix-Isolation FTIR Spectroscopy for the Study of Combustion Radicals," and poster: "Photochemistry of Matrix-Isolated Halogenated Hydrocarbons"

March 31, 2009, meeting of the Central Ohio Valley Section of the American Chemical Society, invited talk: "Trapping Transients: Using Matrix-Isolation FTIR to Understand Chemical Processes"

Fall 2007 Science Lecture Series, Ohio Wesleyan University: "Picturing the Photoelectric Effect: Velocity-Map Imaging of Anionic Water Clusters"

2007 Physical Chemistry Student Lecture Series, Ohio State University: "Probing Binding Motifs: Velocity-Map Imaging of Anionic Water Clusters"

2007 Fall ACS Meeting in Boston, MA, contributed talk: "An H/D isotopic substitution study of $H_5O_2^+ \cdot Ar$: Exploring Fermi resonances in the bridging proton fundamentals"

2007 Dynamics of Molecular Collisions Meeting in Santa Fe, NM, poster presentation: "An H/D isotopic substitution study of $H_5O_2^+ \cdot Ar$: Exploring Fermi resonances in the bridging proton fundamentals"

2006 Fall ACS Meeting in San Francisco, CA, contributed talk: "Unimolecular Dissociation of the Propargyl Radical Intermediate of the CH + C_2H_2 and C + C_2H_3 Reactions"

2006 Gordon Research Conference on Atomic and Molecular Interactions in New London, NH, poster presentation: "Identification and Dynamics of the AA Binding Motif in Water Clusters"

2005 Dynamics of Molecular Collisions Meeting at Asilomar, CA, contributed talk: "Dissociation Dynamics of the Methoxycarbonyl Radical, An Intermediate in the CH_3O + CO Reaction"

2005 Gordon Research Conference on Molecular Energy Transfer in Santa Barbara, CA, poster presentation: "Dissociation Dynamics of the Methoxycarbonyl Radical, An Intermediate in the CH_3O + CO Reaction"

27th International Free Radical Symposium in Taipei, Taiwan, 2004, poster presentation: "Molecular Beam Studies of the Photolysis of 2-Chloro-2-butene and the subsequent dissociation of the 2-Buten-2-yl Radical"

2003 Dynamics of Molecular Collisions Meeting in Lake Tahoe, CA, poster presentation: "Photolysis Channels of Propionyl Chloride and the Barrier to Propionyl Dissociation"

RESEARCH FUNDING

- Department of Energy, 2019-2022
- NASA-WV Space Grant Consortium Research Initiation Grant, 2017-2018
- ACS Petroleum Research Fund Undergraduate Research Grants, 2013-2016, 2024-2027
- Research Corporation for Science Advancement Cottrell College Science Award, 2010-2012
- MU-ADVANCE Faculty Fellowship, 2009-2010

- Camille and Henry Dreyfus Foundation Faculty Start-up Award, 2008-2013
- West Virginia HEPC Mini-Grant, 2008

AWARDS

- Marshall University Advisor of the Year, 2025
- Marshall University Student Success Champion, 2024
- Marshall and Shirley Reynolds Outstanding Teacher Award, 2024
- Achoth Award, Delta Zeta Sorority, 2023
- Outstanding Faculty Advisor, Delta Zeta Sorority Region IV, 2013
- Marshall University Greek Life Faculty Member of the Year, 2010
- Outstanding Poster, Dynamics of Molecular Collisions XXI Conference, 2007
- Yang Prize for Outstanding Thesis in Physical Chemistry, University of Chicago Chemistry Department, 2006
- George Van Dyke Tiers Travel Award, University of Chicago Chemistry Department, 2004
- Sigma Xi Grant in Aid of Research, 2004
- Edith Barnard Award for Service to Others in Chemistry, University of Chicago, 2003
- U.S. Department of Education GAANN Fellowship, 2002-2004
- Nathan Sugarman Teaching Award in General Chemistry, University of Chicago, 2002
- Freud Scholarship, University of Chicago, 2001-2002
- National Science Foundation Graduate Research Fellowship Honorable Mention, 2001
- Hall Fellowship, Ohio Wesleyan University Chemistry Department, 2000-2001
- Ralph V. Sinnett Prize, Ohio Wesleyan University Chemistry Department, 2001
- Julian Higley Prize, Ohio Wesleyan University Chemistry Department, 2000
- Schafer Chemistry Scholarship, Ohio Wesleyan University Chemistry Department, 1999
- Florence Leas Prize in Mathematics, Ohio Wesleyan University Math Department, 1998
- Presidential Scholarship, Ohio Wesleyan University, 1997-2001
- National Merit Scholarship, 1997

AFFILIATIONS

- Alpha Chi Sigma Chemistry Professional Fraternity, 2012-present
- American Chemical Society, 2001-present (member of Division of Physical Chemistry and Subdivision of Astrochemistry)
- Phi Kappa Phi, 2025
- Phi Beta Kappa, 2001
- Sigma Xi, Ohio Wesleyan University, 2001
- Chi Gamma Nu Chemistry Honor Society, Ohio Wesleyan University, 2000
- Phi Society Sophomore Honor Society, Ohio Wesleyan University, 1999
- Pi Mu Epsilon Mathematics Honor Society, Ohio Wesleyan University, 1999
- Phi Sigma Biological Sciences Honor Society, Ohio Wesleyan University, 1999
- Phi Eta Sigma Freshman Honor Society, Ohio Wesleyan University, 1998

SERVICE

- *ad hoc* Shared Governance Committee, 2022-2024
- Chair, "Atmospheric Science" session at the 76th International Symposium on Molecular Spectroscopy, Urbana-Champaign, IL, June 2023
- College of Science Dean Search Committee, 2022-2023
- International Advisory Committee for the International Symposium on Molecular Spectroscopy, 2018-2022

- Budget and Academic Policy Committee, Marshall University, 2016-2025; Secretary, 2017-2018; Chair, 2020-2024.
- Chair, "Radicals" session at the 74th International Symposium on Molecular Spectroscopy, Urbana-Champaign, IL, June 2019
- College of Science Curriculum Committee, Marshall University, 2015-2018; Chair, 2017-18
- Chair, Travel Committee, Marshall University Chemistry Department, 2015-present
- Chair, "Infrared and Raman" session at the 68th International Symposium on Molecular Spectroscopy, Columbus, OH, June 2013
- Officer of the Central Ohio Valley Section of the American Chemical Society
  Secretary, 2009
  Chair-elect, 2010
  Chair, 2011, 2022
  Nominating Committee Chair, 2012, 2023
  Outreach coordinator, 2019-present
- Undergraduate Affairs Committee, Marshall University Chemistry Department, 2008-present
- Chemistry Summer Research Program Committee, Marshall University Chemistry Department, 2010-present
- Reynolds Teaching Award Selection Committee, Marshall University, 2010-2013
- *ad hoc* Budget Understanding Committee, Marshall University 2011-2012
- Chair, "Radicals and Ions" session at the 66th International Symposium on Molecular Spectroscopy, Columbus, OH, June 2011
- Chemistry Faculty Search Committee, 2009, 2011, 2012, 2013, 2015, 2016, 2018, 2022, 2023
- Manuscript Reviewer for *Journal of Physical Chemistry, Journal of Chemical Physics, Physical Chemistry Chemical Physics, Environmental Chemistry Letters, Journal of Molecular Spectroscopy*, *Journal of Molecular Structure, ChemistrySelect,* 2006-present
- Reviewer of chapters in 4 chemistry textbooks for Flat World Knowledge, Inc.; W.H. Freeman & Co.; W. W. Norton & Co. 2010-2013, and Oxford University Press, 2016
- Proposal Reviewer for National Science Foundation, U.S. Department of Energy, Research Corporation for Science Advancement, and ACS Petroleum Research Fund, 2011-present
- Virtual Review Panelist, National Science Foundation, 2021, 2022.
- Faculty Advisor, Delta Upsilon chapter of Delta Zeta at Marshall University, 2008-present