

# Rebecca Ward, PhD

née Mackenzie

## Contact Information

rward@chemistry.msstate.edu

## Education

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| <b>PhD in Chemistry</b> , University of Minnesota, Twin Cities, MN     | 2016 |
| <b>MS in Chemistry</b> , University of Minnesota, Twin Cities, MN      | 2013 |
| <b>BA with Honors in Chemistry</b> , Grinnell College, Grinnell, IA    | 2009 |
| <b>BA with Honors in Anthropology</b> , Grinnell College, Grinnell, IA | 2009 |

## Work Experience

**Lecturer** Aug 2020- Present  
Dept. Chemistry, Mississippi State University, Starkville, MS

**Script Writer & Content Creator** May 2019 - Present  
Mometrix Test Preparation, Beaumont, TX  
Wrote content for 30 educational videos on topics in chemistry, biology, and physics aimed at an undergraduate audience. Created supporting images for scripts and consulted on clarity and scientific accuracy of animations used in videos.

**Lead Education Facilitator** Aug 2017 – May 2018  
Spark-Y Youth Action Labs, Minneapolis, MN  
Managed 5 education staff to troubleshoot programming issues and strengthen school relationships. Hired and supervised 8 undergraduate and 3 high school interns. Analyzed student survey data to make informed decisions on adjusting programming. Oversaw 5 K-12 school programs, providing hands-on STEM activities to 350+ students in the Twin Cities. Developed and delivered curriculum on environmental sustainability with an emphasis on the theory and design of aquaponic systems.  
Website: [spark-y.org](http://spark-y.org)

**Postdoctoral Research Associate** Nov 2016 – July 2017  
University of Minnesota, Twin Cities, MN, Advisor: Dr. Ken Leopold  
Trained graduate students in microwave spectroscopy, computational chemistry, and several aspects of the scientific process including experimental design and presentation of data. Researched carboxylic sulfuric anhydrides and established a generalized mechanism for their gas phase formation. Wrote a program in R to remove spurious signals in the chirp spectrum to expedite the identification of spectral patterns.

**Graduate Research Assistant**

June 2013 - Oct 2016

University of Minnesota, Twin Cities, MN, Advisor: Dr. Ken Leopold

Researched the electronic structure and geometry of molecular clusters using microwave spectroscopy and computational chemistry. Discovered the gas phase formation of formic sulfuric anhydride, a chemical species with possible implications for atmospheric aerosol. Published the results in *Science*. Assisted in the design and construction of a novel tandem chirped pulse – cavity microwave spectrometer. Designed and 3D-printed unique nozzles to improve the molecular signal of the spectrometer.

**Associate Chemist**

Nov 2010 – Aug 2011

Medtronic, Rice Creek, Fridley, MN

Trained in dissolution apparatus II and VII and HPLC. Validated dissolution and HPLC methods for quality control of finished pharmaceutical products. Evaluated previous methods and made recommendations for their improvement. Followed cGMP procedures and wrote SOPs.

**Chemist I**

Sept 2009 – Oct 2010

Pace Analytical, Oakdale, MN

Worked in cGMP environment to test the quality and consistency of finished pharmaceutical products. Trained in dissolution, UV/Vis spectroscopy, and ICP spectroscopy. Prepared finished pharmaceutical products for HPLC and GC testing using diverse wet chemistry techniques.

**Teaching Experience****Teaching Assistant**

Department of Chemistry, University of Minnesota, Twin Cities, MN

Organic Chemistry Laboratory

Fall 2011 &amp; Spring 2012

Supervised 30 undergraduates in Organic Chemistry Laboratory, training students in experimental procedures, data analysis, and scientific writing.

Advanced Physical Chemistry Laboratory

Fall 2012

Supervised and coached 40 undergraduates in Advanced Physical Chemistry Laboratory, focusing on the development of scientific writing skills.

Quantum Mechanics Lecture

Spring 2013

Provided weekly recitation sessions for Quantum Mechanics Lecture. Worked one-on-one with students to enhance their critical thinking and quantitative skills.

**Mentorship Program for Aspiring Chemistry Teachers (MPACT)**

Department of Chemistry, University of Minnesota, Twin Cities, MN

General Chemistry

Spring 2017

Faculty Mentor: Dr. Ken Leopold

Provided weekly recitation sessions and wrote practice exams.

Quantum Mechanics

Spring 2014 &amp; 2015

Faculty Mentor: Dr. Doreen Leopold

Provided weekly recitation sessions and wrote practice exams.

Guest lectured on rotational and vibrational spectroscopy.

Advanced Physical Chemistry Laboratory

Fall 2013

Faculty Mentor: Dr. James Johns

Guest lectured on current research topics in microwave spectroscopy.

**Refereed Journal Publications**

17. Huff, A.K.; **Ward, R.M.**; Leopold, K.R. Microwave spectrum and structure of the SO<sub>3</sub>-SO<sub>2</sub> weakly bound complex. In press at *J. Mol. Spec.* **2020**, DOI [10.1016/j.jms.2020.111327](https://doi.org/10.1016/j.jms.2020.111327)
16. Smith, C.J.; Huff, A.K.; **Ward, R.M.**; Leopold, K.R. Carboxylic Sulfuric Anhydrides. *J. Phys. Chem. A*, **2020**, 124, 601.
15. Boley, S.P.; **Mackenzie, R.B.**; Leroy, J.M.; Engebretsen, K.M.; Stellpflug, S.J.; Development and Feasibility of a Porcine Model of Amlodipine Toxicity. *J. Med. Tox.* **2020**, 16, 61
14. Huff, A.K.; **Mackenzie, R.B.**; Smith, C.J.; Leopold, K.R. A Perfluorinated Carboxylic Sulfuric Anhydride: Microwave and Computational Studies of CF<sub>3</sub>COOSO<sub>2</sub>OH. *J. Phys. Chem. A* **2019**, 123, 2237.
13. Smith, C.J.; Huff, A.K.; **Mackenzie, R.B.**; Leopold, K.R. Hydration of an Acid Anhydride: The Water Complex of Acetic Sulfuric Anhydride. *J. Phys. Chem. A* **2018**, 122, 4549.
12. Smith, C.J.; Huff, A.K.; **Mackenzie, R.B.**; Leopold, K.R. Observation of Two Conformers of Acrylic Sulfuric Anhydride by Microwave Spectroscopy. *J. Phys. Chem. A* **2017**, 121, 9074.
11. Huff, A.K.; **Mackenzie, R.B.**; Smith, C.J.; Leopold, K.R. Facile Formation of Acetic Sulfuric Anhydride: Microwave Spectrum, Internal Rotation, and Theoretical Calculations. *J. Phys. Chem. A* **2017**, 121, 5659.
10. Dewberry, C.T.; Mueller, J.L.; **Mackenzie, R.B.**; Timp, B.A.; Marshall, M.D.; Leung, H.O.; and Leopold, K.R. The effect of ortho-fluorination on intermolecular interactions of pyridine: Microwave spectrum and structure of the CO<sub>2</sub> – 2,6-difluoropyridine weakly bound complex. *J. Mol. Spec.* **2017**, 1146, 373.
9. **Mackenzie, R.B.**; Dewberry, C.T.; Cornelius, R.D.; Smith, C.J.; and Leopold, K.R. Multidimensional Large Amplitude Dynamics in the Pyridine-Water Complex. *J. Phys. Chem. A* **2017**, 121, 855.
8. Dewberry, C.T.; Cornelius, R.D.; **Mackenzie, R.B.**; Smith, C.J.; Dvorak, M.A.; Leopold, K.R. Microwave Spectrum and Structure of the 3,5-difluoropyridine-CO<sub>2</sub> van der Waals Complex. *J. Mol. Spec.* **2016**, 328, 67.

7. **Mackenzie, R.B.**; Dewberry, C.T.; Leopold, K.R. The Trimethylamine-Formic Acid Complex: Microwave Characterization of a Prototype for Potential Precursors to Atmospheric Aerosol. *J. Phys. Chem. A* **2016**, 120, 2268.
6. **Mackenzie, R.B.**; Dewberry, C.T.; Coulston, E.; Cole, G.C.; Legon, A.C.; Tew, D.P.; Leopold, K.R. Intramolecular Competition Between n-pair and  $\pi$ -pair Hydrogen Bonding: Microwave Spectrum and Internal Dynamics of the Pyridine-Acetylene Hydrogen-Bonded Complex. *J. Chem. Phys.* **2015**, 143, 104309.
5. Dewberry, C.T.; **Mackenzie, R.B.**; Green, S.; Leopold, K.R. 3D-printed Slit Nozzles for Fourier Transform Microwave Spectroscopy. *Rev. Sci. Instrum.* **2015**, 86, 065107.
4. **Mackenzie, R.B.**; Dewberry, C.T.; Leopold, K.R. Gas phase observation and microwave spectroscopic characterization of formic sulfuric anhydride. *Science* **2015**, 349, 6243.
3. **Mackenzie, R.B.**; Dewberry, C.T.; Leopold, K.R. The Formic Acid – Nitric Acid Complex: Microwave Spectrum, Structure, and Proton Transfer. *J. Phys. Chem. A* **2014**, 118, 7975.
2. Dewberry, C.T.; Huff, A.K.; **Mackenzie, R.B.**; Leopold, K.R. Microwave spectrum, van der Waals bond length and  $^{131}\text{Xe}$  quadrupole coupling constant of  $\text{Xe-SO}_3$ . *J. Mol. Spec.* **2014**, 304, 43.
1. **Mackenzie, R.B.**; Timp, B.A.; Mo, Y.; Leopold, K.R. Effects of a remote binding partner on the electric field and electric field gradient at an atom in a weakly bound trimer. *J. Chem. Phys.* **2013**, 139, 034320.

## Presentations

13. **Ward, R.M.** “From Industry to Grad School to a Non-Profit” MicrobeTech Seminar Series, BioTechnology Institute, University of Minnesota, Twin Cities, MN April 2018.
12. **Mackenzie, R.B.**; Dewberry, C.T.; Huff, A.K.; Smith, C.J.; Leopold, K.R. “Facile Formation of Carboxylic Sulfuric Anhydrides: Microwave and Computational Characterization of Potential Aerosol Precursors” Towards a Molecular Level Understanding of Atmospheric Aerosols, Santa Cruz, CA Aug 2016.
11. **Mackenzie, R.B.**; Dewberry, C.T.; Cornelius, R.D.; Smith, C.J.; Leopold, K.R. “The Curious Case of Pyridine Water” 71<sup>st</sup> International Symposium on Molecular Spectroscopy, Urbana-Champaign, IL June 2016.
10. **Mackenzie, R.B.**; Leopold K.R. “Understanding Intermolecular Attraction: Fundamental Science and Environmental Application” Annual research showcase for recipients of the Doctoral Dissertation Fellowship, University of Minnesota, Twin Cities April 2016.
9. **Mackenzie, R.B.**; Dewberry, C.T.; Leopold, K.R. “Formic Sulfuric Anhydride: A new chemical species with possible implications for atmospheric aerosol” 70<sup>th</sup> International Symposium on Molecular Spectroscopy, Urbana-Champaign, IL June 2015.
8. **Mackenzie, R.B.**; Dewberry, C.T.; Leopold, K.R. “Chirped Pulse and Cavity FT Microwave Spectroscopy of the Formic Acid – Trimethylamine Weakly Bound Complex” 70<sup>th</sup> International Symposium on Molecular Spectroscopy, Urbana Champaign, IL June

2015.

7. **Mackenzie, R.B.;** Dewberry, C.T.; Leopold, K.R. "Formic Sulfuric Anhydride: A new atmospheric molecule?" 62<sup>nd</sup> Pacific Conference on Spectroscopy and Dynamics, Monterey, CA Jan 2015.
6. **Mackenzie, R.B.;** Dewberry, C.T.; Leopold, K.R. "The Microwave Spectrum, Structure, and Double Proton Exchange of Formic Acid – Nitric Acid" 69<sup>th</sup> International Symposium on Molecular Spectroscopy, Urbana-Champaign, IL June 2014.
5. **Mackenzie, R.B.;** Dewberry, C.T.; Coulston, E.; Cole, G.C.; Legon, A.C.; Tew, D.P.; Leopold, K.R. "Pyridine-Acetylene: Microwave Spectrum, Structure, and Internal Dynamics" 69<sup>th</sup> International Symposium on Molecular Spectroscopy, Urbana Champaign, IL June 2014.
4. **Mackenzie, R.B.;** Leopold, K.R. "Probing Large Amplitude Motion in Weakly Bound Complexes Using Microwave Spectroscopy" 13<sup>th</sup> Annual Graduate Student Research Symposium, Department of Chemistry, University of Minnesota, Twin Cities, MN June 2014.
3. **Mackenzie, R.B.;** Dewberry, C.T.; Leopold, K.R. "Formic Acid – Nitric Acid Complex: Microwave Spectrum, Structure, and Proton Tunneling" SciMix Session, 247<sup>th</sup> ACS National Meeting, Dallas, TX March 2014.
2. **Mackenzie, R.B.;** Dewberry, C.T.; Leopold, K.R. "Formic Acid – Nitric Acid Complex: Microwave Spectrum, Structure, and Proton Tunneling" PHYS Session, 247<sup>th</sup> ACS National Meeting, Dallas, TX March 2014.
1. **Mackenzie, R.B.;** Timp, B.A.; Mo, Y.; Leopold, K.R. "Effects of a Remote Binding Partner on the Electric Field and Electric Field Gradient at an Atom in a Weakly Bound Trimer" 68<sup>th</sup> Ohio State University International Symposium on Molecular Spectroscopy, Columbus OH June 2013.

## Outreach

### Co-Founder of Science For All!

May 2014 – May 2016

University of Minnesota, Twin Cities, MN

Science for All! is a UMN student group with the goal of bringing hands-on science experiments to underserved students in the Twin Cities. Along with co-founding the group, I served as the outreach coordinator for our events at the KIPP charter school in the 2015-2016 academic year. Our group developed experiments and demonstrations on the properties of sound, light, and heat.

Website: [sfa.cems.umn.edu](http://sfa.cems.umn.edu)

## Awards and Honors

### Doctoral Dissertation Fellowship

Apr 2015

University of Minnesota

From the University of Minnesota website:

"The Doctoral Dissertation Fellowship (DDF) gives the University's most accomplished Ph.D. candidates an opportunity to devote full-time effort to an outstanding research project by providing time to finalize and write a dissertation during the fellowship year." Awarded with a \$25,000 stipend.

### Overend Award

Apr 2015

Department of Chemistry, University of Minnesota

Awarded for outstanding research in experimental physical chemistry.

### Bunsen and Beaker Award

June 2014

Department of Chemistry, University of Minnesota

Awarded for best presentation in the physical chemistry session at the 13<sup>th</sup> Annual Graduate Student Research Symposium.

### Honorable Mention for Excellence in Teaching

Aug 2013

Department of Chemistry, University of Minnesota

### Lester C. and Joan M. Krogh Endowed Fellowship

Aug 2013

Department of Chemistry, University of Minnesota

Awarded for excellent progress in graduate studies with \$25,000 stipend.

### Grinnell College Chemistry Alumni Prize

May 2009

Department of Chemistry, Grinnell College

Awarded for earning the highest GPA in chemistry courses.

### Grace McIlrath Parker Memorial Award

May 2009

Grinnell College

Awarded to an outstanding senior female athlete in a team sport.

### POLYED Undergraduate Award

May 2007

Department of Chemistry, Grinnell College

Awarded for outstanding achievement in organic chemistry.