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**Zahilyn Roche Allred, Ph.D.**

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Nova Southeastern University • Department of Chemistry and Physics

Fort Lauderdale, FL 33314

## **EDUCATION**

### **Doctor of Philosophy in Chemistry**

Advisor: Dr. Stacey Lowery Bretz

Miami University, Oxford, OH; Department of Chemistry and Biochemistry, Spring 2019

Specialization in Chemistry Education Research; Cognate area in Biochemistry

Dissertation: Investigating Students' Understandings about the Electronic Structure of the Atom with Regards to Energy Quantization and Probability

### **Bachelor of Arts in Chemistry**

Advisor: Dr. Joong-ho Moon

Florida International University, Miami, FL; Department of Chemistry and Biochemistry, Fall 2012

Specialization in Biochemistry; Minor in Biology

Undergraduate Research: Fabrication of conjugated nanoparticles for biomedical applications

### **Associates of Arts in Biology**

Miami Dade College, Miami, FL; Department of Biology and Health & Wellness; Fall 2009

## **ACADEMIC APPOINTMENTS**

### **Assistant Professor of Chemistry**

Nova Southeastern University, Fort Lauderdale, FL

Fall 2022 – Present

Department of Chemistry & Physics

### **Distinguished Postdoctoral Scholar – Chemistry Education**

Florida International University, Miami, FL

Fall 2021 – Summer 2022

Department of Chemistry and Biochemistry & STEM Transformation Institute.

### **Post-Doctoral Associate – Chemistry Education**

Florida International University, Miami, FL

Spring 2019 – Summer 2021

Department of Chemistry and Biochemistry & STEM Transformation Institute.

## **RESEARCH EXPERIENCES**

### **Post-Doctoral Associate – Chemistry Education**

Florida International University, Miami, FL

Spring 2019 – Summer 2022

Department of Chemistry and Biochemistry & STEM Transformation Institute

Supervisor: Dr. Sonia Underwood

- Assist in the establishment of an evidence-based curriculum for introductory chemistry and the expansion of the curriculum to higher level courses (e.g., organic chemistry).
- Develop, implement, and evaluate instructional materials, including in-class activities, homework assignments, and instruction slides for lecture and student-centered settings.
- Direct the creation of professional development materials, such as videos, workshop materials, and podcasts, to support instructors' use of Scientific Practices in the classroom.
- Assist in the establishment of the Chemistry Education Research program in the Department of Chemistry and Biochemistry by mentoring eight undergraduate research assistants and two graduate students with diverse backgrounds on their individual education research projects.
- Coordinate and manage multiple research projects, which have yielded to a total of four first author manuscripts.
- Maintain all the documents associated with the projects in a secure and organized manner.
- Organize and coordinate research meetings for the STEM Transformation Institute.
- Write chemistry education grant proposals in collaboration with faculty and administrators.

### **Graduate Research Assistant – Chemistry Education**

Miami University, Department of Chemistry & Biochemistry, Oxford, OH Fall 2014 – Spring 2019

Advisor: Dr. Stacey Lowery Bretz

- Developed, implemented, and evaluated instructional materials (e.g., diagnostic assessments, laboratory activities, and homework assessments).
- Designed and conducted a qualitative research study to investigate chemistry students' interpretations of multiple representations.
- Performed quantitative analyses to investigate students' use and understanding of chemistry concepts to interpret multiple representations.
- Created monthly data analysis reports and presented results to colleagues and mentors.
- Mentored six undergraduate students on individual qualitative and/or quantitative research projects.
- Attended and presented at local and national research meetings, as a published peer-reviewed author.

### **Undergraduate Researcher**

Florida International University, Miami, FL; Department of Chemistry and Biochemistry, Spring 2010 – Fall 2012

Advisor: Dr. Joong-ho Moon

- Fabricated conjugated nanoparticles for biomedical applications.
- Mentored undergraduate researchers.
- Coordinated group research meetings, laboratory maintenance, and special events.

### **Chemistry Research Experience for Undergraduate Program**

Miami University, Oxford, OH; Department of Chemistry and Biochemistry, Summer 2012

Sponsored by National Science Foundation

Advisor: Dr. Michael Crowder

- Performed kinetic and mechanistic studies on antibiotic-resistant enzymes.
- Assisted in the development of novel techniques to identify enzymatic activity.

## **TEACHING EXPERIENCES**

### **Chemistry Guest Instructor**

Florida International University, Miami, FL

Fall 2021

Miami University, Oxford, OH

Fall 2016 – Fall 2018

- Facilitated the instruction of lectures and student-centered classes for several lower and upper-level chemistry courses, including General Chemistry I and II, and Chemical Misconceptions.
- Facilitated class discussions and assisted students with individual and group assignments in class sizes ranging from 20 - 200 students

### **Chemistry Teaching Assistant**

Florida International University, Miami, FL

Fall 2019 – Spring 2020

- Assisted instructor in implementing an evidence-based curriculum focused on supporting students' integration of disciplinary core ideas and use of scientific practices in a student-centered classroom.
- Facilitated instruction in both in-person and online environments by moderating discussions and student group activities.
- Assisted instructor in developing instructional materials and grading duties.

### **Organic Chemistry Laboratory Teaching Assistant**

Miami University, Oxford, OH

Fall 2014

- Tested and evaluated all experiments prior to implementation.
- Prepared demonstrations, setups, and materials for laboratory activities.
- Engaged and guided students through laboratory experiments.

## Middle School Science Teacher

Archimedean Middle Conservatory, Miami, FL

Fall 2013 – Spring 2014

- Taught a total of five sections with 20-30 students each.
- Developed lesson plans and instructional materials for the science curriculum.
- Utilized evidenced-based instructional practices to plan meaningful learning experiences.
- Supported the Science Chair with the coordination of the Science Fair Competition and
- assisted in the mentoring and training of students for Science Olympiad Competitions
- at the local and national levels.

## PEER REVIEWED PUBLICATIONS

10. Underwood, S. M.; **Roche Allred, Z.**; Parent, K. N.; Matz, R.L. Developing a Process to Design, Administer, and Refine Cross-Disciplinary Activities to Support Students' Connections of their Chemistry and Biology Courses, *Journal of Chemical Education* (in preparation).
9. **Roche Allred, Z.**; Martinez, B.L.; Green, A. G.; Farias, A.; Tomlinson, A.; Kararo, A.T.; Gonzalez, J.; Parent, K. N.; Matz, R. L.; Underwood, S.M. "Lessons Learned from the Administration, and Evaluation of Multidisciplinary Activities," *Chemistry Education Research and Practice* (in revision).
8. **Roche Allred, Z.**; Santiago Caobi, L.; Pardinias, B.; Kohn, K.P.; Kararo, A.T.; Cooper, M.M.; Underwood, S.M. "Big Ideas" of the Introductory Chemistry and Biology Courses and Connections Between Them," *CBE – Life Sciences Education*, 2022; <https://doi.org/10.1187/cbe.21-10-0301>.
7. **Roche Allred, Z.**; Shrode, A.D.; Gonzalez, J.; Rose, A.; Green, A.I.; Swamy, U.; Matz, R.L.; Underwood, S.M. "The Impact of Ocean Acidification on Shelled Organisms: Supporting the Integration of Chemistry and Biology Knowledge through Multidisciplinary Activities," *Journal of Chemical Education*, 2022; 10.1021/acs.jchemed.1c00981.
6. **Roche Allred, Z.**; Farias, A.J.; Kararo, A. T.; Parent, K. N.; Matz, R. L.; Underwood, S.M. "Students' Use of Chemistry Core Ideas to Explain the Structure and Stability of DNA," *Biochemistry and Molecular Biology Education*, 2021; 49: 55-68.
5. **Roche Allred, Z.**; Bretz, S.L. "Development of the Quantization and Probability Representations Inventory as a Measure of Students' Understanding of Particulate and Symbolic Representations," *Journal of Chemical Education*, 2019, 96, 8, 1558-1570.
4. **Roche Allred, Z.**; Bretz, S.L. "University Chemistry Students' Interpretations of Multiple Representations of the Helium Atom," *Chemistry Education Research and Practice*, 2019, 20, 358-368.
3. **Roche Allred, Z.**; Tai, H.; Bretz, S.L.; Page, R.C. "Using PyMOL to Explore the Effects of pH on Non-Covalent Interactions between Immunoglobulin G and Protein A: A Guided-Inquiry Biochemistry Activity," *Biochemistry and Molecular Biology Education*, 2017, 45, 528-536.
2. Aitha, M; Moritz, L.; Sahu, I.D.; Sanyurah, O.; **Roche, Z.**; McCarrick, R.; Lorigan, G. A.; Bennett, B.; Crowder, M.W. "Conformational dynamics of metallo- $\beta$ -lactamase CcrA during catalysis investigated by using DEER spectroscopy," *Journal of Biological Inorganic Chemistry*, 2015, 20(3), 585-594.
1. Twomey, M.; Na, Y.; **Roche, Z.**; Mendez, E.; Panday, N.; He, J.; Moon, J. H. "Fabrication of core-shell nanoparticles via controlled aggregation of semiflexible conjugated polymer and hyaluronic acid," *Macromolecules*, 2013, 46(15), 6374-6378.

## OTHER PUBLICATIONS

1. Roche Allred, Z. Editor: Gertz, E. "Improving Science Literacy is Key to Overcoming Medical and Misinformation – and it means changing science education," *The Conversation*, July 12<sup>th</sup>, 2022; <https://theconversation.com/improving-science-literacy-means-changing-science-education-178291>.

## PRESENTATIONS (Undergraduates underlined, \*Invited presentation)

27. \*"EXPAND: Adaptation of Evidence-Based Curricula in Chemistry Gateway Courses," 263<sup>rd</sup> American Chemical Society National Meeting, San Diego, CA; March 20<sup>th</sup>, 2022 (with Alex T. Kararo, and Sonia Underwood)
26. "Uncovering Students' Abilities to Use and Apply their Chemistry Knowledge Through Three-dimensional Learning Assessments," STEM Transformation Institute at Florida International University, Miami, FL; October 26, 2021 (with Alexandria Roach, Brianna Martinez, Elaine Arias, Kodi Nix, and Sonia Underwood).
25. \*"Developmental Process and Lessons Learned from Cross-Disciplinary Activities," Chemistry Education Research Seminar at Michigan State University; August 2, 2021 (with Kristin N. Parent, Rebecca L. Matz, and Sonia M. Underwood).
24. \*"Comparison of a Bottom-Up & a Top-Down Approach to the Development of Assessments," Chemistry Education Research Seminar at University of North Carolina – Greensboro; June 25, 2021.

23. "Lessons Learned from the Development, Administration, and Evaluation of Cross-Disciplinary Activities for Chemistry & Biology Students," 261<sup>st</sup> American Chemical Society National Meeting, Virtual Meeting: Live Presentation; April 13, 2021 (with Kristin N. Parent, Rebecca L. Matz, and Sonia M. Underwood).
22. \*"Lessons Learned from the Creation Administration, and Evaluation of Cross-Disciplinary Activities," STEM Transformation Institute at Florida International University, Miami, FL; February 23, 2021 (with Kristin N. Parent, Rebecca L. Matz, and Sonia M. Underwood).
21. \*"Investigating Students' Use of Chemistry Core Ideas to Explain Biological Phenomena," 259<sup>th</sup> American Chemical Society National Meeting, Philadelphia, PA; March 23, 2020 (with Anthony Farias, Alex T. Kararo, Rebecca Matz, Kristin Parent, and Sonia Underwood) Conference canceled due to COVID-19
20. "Development of Multiple Assessments to Investigate Students' Integration of Core Chemistry Ideas in Biology," Chemistry Education Research Graduate Student & Post-Doc Professional Development Conferences, Miami University, Oxford, OH (with Anthony Farias, Rebecca Matz, Kristin Parent, and Sonia Underwood)
19. "Characterizing Students' Prior Knowledge about the Electronic Structure of the Atom and their Interpretations of Carbon Atomic Orbital Representations," Gordon Research Conference on Chemistry Education Research and Practice, Bates College, Lewiston, ME; June 18, 2019 (with Timothy N. Abell and Stacey Lowery Bretz)
18. "Development of an Inventory to Measure Students' Understandings of Element and Compounds using Particulate Representations," 257<sup>th</sup> American Chemical Society National Meeting, Orlando, FL; March 31, 2019 (with Lillian Huff and Stacey Lowery Bretz)
17. "Administration of the Flame Test Concept Inventory with Confidence Scale to General Chemistry Students," 257<sup>th</sup> American Chemical Society National Meeting, Orlando, FL; March 31, 2019 (with Charles Speiser and Stacey Lowery Bretz)
16. "Implementation of the Quantization and Probability Representations Inventory across the United States," 257<sup>th</sup> American Chemical Society National Meeting, Orlando, FL; March 31, 2019 (with Stacey Lowery Bretz)
15. "Investigating General Chemistry and Physical Chemistry Students' Probabilistic Reasoning about the Electronic Structure of the Atom," Biennial Conference on Chemical Education, University of Notre Dame, August 1, 2018 (with Stacey Lowery Bretz)
14. "Measuring General Chemistry and Physical Chemistry Students' Ideas about the Electronic Structure of the Atom: The Quantization and Probability Representations Inventory," Biennial Conference on Chemical Education, University of Notre Dame, August 1, 2018 (with Stacey Lowery Bretz)
13. "Assessment of Students' Understandings of Quantization and Probability using Representations of the Electronic Structure of the Atom," 101<sup>st</sup> Canadian Chemistry Conference and Exhibition, Edmonton, Alberta; May 27, 2018 (with Stacey Lowery Bretz)
12. "A Cluster Analysis of Biochemistry Students' Misconceptions about Enzyme-Substrate Interactions," 255<sup>th</sup> American Chemical Society National Meeting, New Orleans, L.A; March 18, 2018 (with Mikayla DeLucas and Stacey Lowery Bretz)
11. "Students' Understanding of Particulate Representations of Elements and Compounds," 255<sup>th</sup> American Chemical Society National Meeting, New Orleans, L.A; March 19, 2018 (with Lillian Huff, and Stacey Lowery Bretz)
10. "Development of an Inventory to Measure Students' Understandings of Quantization and Probability Using Representations of the Electronic Structure of the Atom," 255<sup>th</sup> American Chemical Society National Meeting, New Orleans, L.A; March 18, 2018 (with Stacey Lowery Bretz)
9. "Exploring the Effect of pH on Non-Covalent Interactions in Proteins Using Molecular Visualization Software: A Guided Inquiry Biochemistry Activity," American Society for Biochemistry and Molecular Biochemistry Symposium: Transforming Undergraduate Education in Molecular Life Science, Tampa, FL; July 22, 2017 (with Heeyoung Tai, Stacey Lowery Bretz, and Richard C. Page)
8. "Students' Understandings of Probability in the Electronic Structure," Gordon Research Conference on Chemistry Education Research and Practice, Bates College, ME; June 21, 2017 (with Stacey Lowery Bretz)
7. "Students' Understandings of Atomic Orbital Representations for Carbon," 251<sup>st</sup> American Chemical Society National Meeting, San Francisco, CA; April 2, 2017 (with Stacey Lowery Bretz)
6. "Using PyMOL to explore the effects of pH on non-covalent interactions between Immunoglobulin G and Protein A: A guided-inquiry biochemistry activity," 24<sup>th</sup> Biennial Conference on Chemical Education, Greeley, CO; August 4, 2016 (with Stacey Lowery Bretz)
5. "General and physical chemistry students' ideas about electron structure," 24<sup>th</sup> Biennial Conference on Chemical Education, Greeley, CO; August 3, 2016 (with Stacey Lowery Bretz)
4. "An Analysis of Representations Used to Introduce the Atomic Model in a General Chemistry Textbook," Undergraduate Research Forum at Miami University, Oxford, OH; April 2016 (with Kevin Rarden, Timothy N. Abell, and Stacey Lowery Bretz)

3. "Analysis of General Chemistry Textbook Representations: Quantum Models of Atomic Structure," Undergraduate Research Forum at Miami University, Oxford, OH; April 2016 (with John A. Spear, Timothy N. Abell, and Stacey Lowery Bretz)
2. "Students' Ideas about Electron Structure with Regards to Probability and Energy Quantization," 251st American Chemical Society National Meeting, San Diego, CA; March 13, 2016 (with Stacey Lowery Bretz)
1. "Complexation of Conjugated Polymer Nanoparticles with Hyaluronic Acid for Cancer Cell Imaging," Annual Biomedical Research Conference for Minority Students, San Jose, CA; November 10, 2012 (with Joong-ho Moon)

#### **HONORS & AWARDS:**

- Distinguished Postdoctoral Scholar, 2021 – Present
- Recipient of the Gordon Research Conference on Chemistry Education Research Travel Award, 2019
- Top Presenter at Miami University Graduate Research Forum, Miami University, 2017
- Carl Storm Underrepresented Minority Fellowship, Summer 2017
- Diversity Enhancement Pathway Graduate Teaching Assistantship, Miami University, 2014-2019
- William H. Charch Scholarship, Miami University, 2014-2015
- Dedication to Students in Science, Archimedean Middle Conservatory, 2013-2014
- Minority Biomedical Research Support Rise Fellowship, Florida International University, 2011-2012
- Delta Epsilon Iota Academic Honor Society, Florida International University, 2010-2012
- Florida Bright Future Scholarship, 2008-2012
- Hispanic American Commitment to Educational Resources National Scholarship, 2008-2009

#### **PROFESSIONAL SERVICES:**

- **Expert Reviewer**, Chemistry Education Research and Practice, 2021- Current
- **Expert Reviewer**, International Journal of Science and Mathematics Education, 2020-Current
- **Expert Reviewer**, Journal of Chemical Education, 2019-Current
- **Team Member**, Three-Dimensional Learning for Undergraduate Science, 2020-2021
- **Co-organizer**, Developing Cross-disciplinary Assessments that Measure Three-Dimensional Learning, Workshop at 26<sup>th</sup> BCCE Conference, Corvallis, OR, July 2020 (Conference canceled due to COVID-19)
- **Branch Director**, Faith & Fitness, Non-profit Organization, Oxford, OH, 2018-2019
- **Event Coordinator**, Faith & Fitness, Non-profit Organization, Oxford, OH, 2017-2018
- **Marketing and Design Coordinator**, Faith & Fitness, Non-profit Organization, Oxford, OH, 2017-2018
- **Volunteer**, Science Week at Miami University, 2015-2019
- **Panel Reviewer**, The ACS Division of Chemical Education Central Region Award for Excellence in High School Teaching, 2016
- **Assistant Coach**, Science Olympiad at Archimedean Middle Conservatory, Miami, FL, 2013-2014
- **Volunteer**, Ventilation Assisted Children's Center Camp, Miami, FL 2012
- **Member**, Medically Engaged Diverse Students at Florida International University, Miami, FL, 2010-2012

#### **PROFESSIONAL SOCIETIES:**

- American Chemical Society, Division of Chemical Education (ACS)

#### **SKILLS:**

- Bilingual: Fluent in Spanish
- Certified in College Teaching
- Qualitative and Quantitative data collection and analysis skills.
- Computer skills: Microsoft Word, Excel, PowerPoint, NVivo, and SPSS
- Spectroscopy skills: UV-Vis, Proton Nuclear Magnetic Resonance, Fluorescence, IR spectroscopy, Dynamic light scattering, and Bio-layer Interferometry.
- Biochemistry skills: Solution, media and buffer preparation, cell culture preparation, cryopreservation of cells, cell microscope imaging, agarose gel electrophoresis, SDS-PAGE.