

Matthew P. Grindle, PhD

NMR Scientist | Enhanced Oil Recovery Researcher

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PROFESSIONAL SUMMARY

Physical chemist and nuclear magnetic resonance (NMR) specialist applying low-field NMR spectroscopy and magnetic resonance imaging to enhanced oil recovery (EOR) and subsurface fluid-rock interactions. As an ORISE postdoctoral fellow at the National Energy Technology Laboratory, develops experimental and analytical methods for high-pressure studies of CO₂, natural gas, water, and surfactant injection in unconventional reservoir rocks, including shales and caprocks. Experienced in quantifying multiphase fluid saturation, pore structure, wettability, and transport behavior, with a record of cross-disciplinary research, conference publication, mentoring, and laboratory instruction.

CORE EXPERTISE

Low-field NMR and MRI | T1/T2 relaxometry | CO₂ huff-and-puff EOR | Shale and caprock characterization | High-pressure core analysis | Multiphase fluid saturation | NMR/EPR spectroscopy | Python, MATLAB, Linux, and Bash

PROFESSIONAL EXPERIENCE

Postdoctoral Fellow (ORISE) | National Energy Technology Laboratory (NETL) | Pittsburgh, PA **Mar 2025-Present**

- Serve as the NMR subject-matter expert for petroleum, geologic materials, and subsurface-energy research.
- Develop low-field NMR and MRI methods to quantify porosity, pore-size distributions, fluid saturation, wettability, and multiphase fluid movement in unconventional reservoir samples.
- Design and conduct high-pressure enhanced oil recovery experiments using CO₂, natural gas, water, and surfactants, with emphasis on cyclic huff-and-puff recovery from shale and caprock.
- Create analysis workflows for relaxation and imaging data to track fluid redistribution, pore-scale transport, and oil recovery throughout injection experiments.
- Collaborate with NETL, university, and contractor researchers and communicate results through SPE and URTeC conference papers and presentations.

Graduate Research Assistant | Miami University | Oxford, OH **2019-2025**

- Investigated transition-metal complexes and biomolecular systems using NMR, EPR, UV-vis spectroscopy, ICP analysis, X-ray diffraction, and computational modeling.
- Integrated magnetic-resonance measurements with structural and molecular-dynamics methods to characterize electronic structure and molecular dynamics.
- Mentored 6 undergraduate and 2 graduate researchers in spectroscopy, physical chemistry, data analysis, and laboratory methods.
- Co-authored journal manuscripts and presented research at 7 scientific conferences.

Teaching Assistant, General Chemistry | Miami University | Oxford, OH **2019-2024**

- Prepared lectures and laboratory instruction for classes of 20-100 students across five academic years.
- Coordinated meetings and training for 20 teaching assistants as head teaching assistant to support consistent instruction and laboratory safety.

Fermentation Associate | DuPont Industrial Biosciences | Wilmington, DE **2017-2019**

- Operated and supported 24 pilot fermenters for 14 L scale-up experiments in a continuous research environment.
- Troubleshoot Python-based controls and in-house data-tracking systems and coordinated with polymerization and separations laboratories.

Analyst | Bioanalytical Systems, Inc. | West Lafayette, IN **2016-2017**

- Conducted GLP pharmaceutical analyses for quality control and stability studies; maintained and troubleshoot 15 Agilent HPLC systems.
- Developed five analytical standard operating procedures for future pharmaceutical studies.

Microbiologist | Tate & Lyle | West Lafayette, IN **2014-2016**

- Performed microbiological and environmental monitoring for a corn starch and syrup manufacturing facility, including Listeria surveillance.

Student Co-op Chemist | Chemtura Corporation | West Lafayette, IN **2014-2015**

- Characterized bromine-based flame-retardant materials using NMR, HPLC, GPC, Karl Fischer titration, and related analytical methods.
- Developed TEMPO-radical-based methods for preparing bisphenol-derived flame-retardant candidates.

Quality Management Intern | Cargill | Hammond, IN **2014**

- Conducted chemical quality testing and designed experiments evaluating corn-syrup storage facilities and ion-exchange materials.

EDUCATION

PhD, Chemistry | Miami University | Oxford, OH

2025

Dissertation: Structural Dynamics of Inorganic Complexes and Chaperone Proteins Investigated Through NMR Spectroscopy and Molecular Dynamics

BS, Chemistry | Purdue University | West Lafayette, IN

2016

PUBLICATIONS AND CONFERENCE PROCEEDINGS

- 2026** **Comparing Huff-N-Puff Oil Recovery in Unconventional Shale Cores with CO₂ Alone Against Low Concentration Solution of 2EH-PO5-EO10 in CO₂ Using NMR Spectroscopy.** M. P. Grindle, D. Tapriyal, L. C. Burrows, R. Enick, and A. Goodman. *SPE Improved Oil Recovery Conference, Tulsa, Oklahoma, April 2026*. SPE-231513-MS; doi:10.2118/231513-MS
- 2026** **Enhanced Oil Recovery Effects of Adding Non-Ionic Surfactants During CO₂ Huff-and-Puff.** M. P. Grindle, D. Tapriyal, L. Burrows, and A. Goodman. *Unconventional Resources Technology Conference (URTeC), Houston, Texas, June 2026*
- 2024** **NMR Observation of Three Interconverting Structures in TpPh₃Me Cobalt(II) Nitrate.** M. P. Grindle, V. Batra, and D. L. Tierney. *European Journal of Chemistry*. submitted November 2024
- 2023** **Field- and Temperature-Dependent Paramagnetic Relaxation Enhancements in Co(II) Trispyrazolylmethanes.** N. D. Kumarage, A. R. Marts, M. P. Grindle, J. C. Kaine, L. A. Crandall, W.-Y. Chen, C. J. Ziegler, and D. L. Tierney. *Inorganic Chemistry*
- 2021** **Structural Communication between the E. coli Chaperones DnaK and Hsp90.** M. P. Grindle, B. Carter, J. P. Alao, K. Connors, R. Tehver, and A. N. Kravats. *International Journal of Molecular Sciences*

SELECTED PRESENTATIONS

- Jun 2026** **Enhanced Oil Recovery Effects of Adding Non-Ionic Surfactants During CO₂ Huff-and-Puff** | Unconventional Resources Technology Conference (URTeC), Houston, TX
- Apr 2026** **Comparing Huff-N-Puff Oil Recovery in Unconventional Shale Cores with CO₂ Alone Against Low Concentration Solution of 2EH-PO5-EO10 in CO₂ Using NMR Spectroscopy** | SPE Improved Oil Recovery Conference, Tulsa, OK
- Nov 2023** **Solution NMR Magnetic Axis Direction of 4/5-Coordinate Co(II) Complexes** | Graduate Research Forum, Miami University, Oxford, OH
- Apr 2023** **NMR Relaxation Dynamics of 4/5-Coordinate Co(II) Complexes** | Experimental NMR Conference, Pacific Grove, CA
- Mar 2023** **Solution Dynamics of 4/5-Coordinate Cobalt Complexes** | American Chemical Society National Meeting, Indianapolis, IN
- Nov 2022** **Physical Electronic Dynamics in Five-Coordinate Cobalt(II)** | Ohio Inorganic Weekend, The Ohio State University, Columbus, OH
- Nov 2022** **Solution Dynamics of Co-Based Single-Ion Magnets** | Graduate Research Forum, Miami University, Oxford, OH
- Jan 2021** **Computational Modeling of the Modulation of Hsp70 by Hsp90** | Midwest Stress Response and Molecular Chaperones, Virtual
- Nov 2020** **Modeling the Modulation of Hsp90 by Hsp70** | Graduate Research Forum, Miami University, Oxford, OH

AWARDS AND LEADERSHIP

- Outstanding Teaching Assistant, Miami University Department of Chemistry, 2022-2023
- Three-Minute Thesis Finalist, Miami University, 2022
- Graduate Student Advocate, Miami University Department of Chemistry, 2023-2024 - organized six departmental events, represented graduate students in association meetings, and prepared monthly newsletters.

SCIENCE OUTREACH

- International Day of Light, Cincinnati Museum Center, 2024 - led paper-chromatography demonstrations for approximately 80 students and family members.
- Talawanda Science Week, Miami University, 2022-2023 - delivered hands-on laboratory demonstrations in 15 sessions for elementary-school students.

- Grandparents College, Miami University, 2023 - taught introductory forensic-science experiments to middle-school students and their grandparents.

TECHNICAL SKILLS

- Magnetic resonance: low-field NMR, MRI, NMR relaxometry, EPR spectroscopy, pulse-sequence and data-analysis method development.
- Analytical methods: UV-vis spectroscopy, ICP analysis, X-ray diffraction, HPLC, GPC, and Karl Fischer titration.
- Computational and data tools: Python, MATLAB, Linux, Bash, molecular dynamics, and electronic-structure calculations.