



WILLIAM & MARY

CHARTERED 1693

TYLER MELDRUM

Associate Professor of Chemistry
Curriculum Vitae, September 2021

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Education

- 2006–2011 *University of California, Berkeley*
Lawrence Berkeley National Laboratory, Materials Sciences Division;
Berkeley, California
Ph.D., Chemistry
Dissertation: *Xenon-based Molecular Sensors in Analytical Applications*
- 2004–2006 *Brigham Young University; Provo, Utah*
B.S., Biochemistry
- 1999–2001 *University of Colorado, Boulder*

Academic Positions

- 2020– Associate Professor, Department of Chemistry; *William & Mary*
- 2013–2020 Assistant Professor, Department of Chemistry; *William & Mary*
- 2011–2013 Postdoctoral Research Fellow; *RWTH Aachen University (Aachen, Germany)*
Postdoctoral advisor: Prof. Bernhard Blümich
- 2010 Adjunct Faculty, Chemistry Department; *Contra Costa College; San Pablo, California*

Honors, Prizes, and Awards

- 2011 R&D 100 Award from R&D Magazine, *Magnetic Resonance Microarray Imaging*
Awarded for research and development of miniaturized, xenon-based chemical sensors
- 2010 Alexander von Humboldt Research Fellowship for Postdoctoral Researchers
Deutscher Akademischer Austauschdienst (DAAD) postdoctoral fellowship
- 2006 Office of Research and Creative Activities Research Grant, Brigham Young University
Physical Chemistry Student of the Year, Brigham Young University
Outstanding Teaching Assistant, Brigham Young University
- 2005 Departmental Research Grant, Brigham Young University
Outstanding Presenter, Undergraduate Research Conference, Brigham Young University

Courses Taught

- 2021 CHEM 301 (Physical Chemistry I, 53 students)
 CHEM 309L (Instrumental Analysis Laboratory, 10 students)
 Sabbatical (Spring)
- 2020 CHEM 302 (Physical Chemistry II, 59 students)
 CHEM 302L (Physical Chemistry Laboratory, 63 students)
 Sabbatical (Fall)
- 2019 CHEM 302 (Physical Chemistry II, 53 students)
 CHEM 304 (Integrated/Physical Chemistry Laboratory II; ~50 students)
 CHEM 341 (Physical and Analytical Chemistry for Life Sciences, 23 students)
 CHEM 309L (Instrumental Analysis Laboratory, 20 students)
- 2018 CHEM 302 (Physical Chemistry II, 49 students)
 CHEM 304 (Integrated/Physical Chemistry Laboratory II; ~50 students)
- 2017 CHEM 302 (Physical Chemistry II, 47 students)
 CHEM 303 (Integrated/Physical Chemistry Laboratory I; 8 students)
 CHEM 304 (Integrated/Physical Chemistry Laboratory II; ~50 students)
 CHEM 341 (Physical Chemistry for the Life Sciences, 14 students)
- 2016 CHEM 341 (Physical Chemistry for Life Sciences; 24 students)
 CHEM 304 (Integrated/Physical Chemistry Laboratory II; 16 students)
 CHEM 320 (Introduction to Chemical Research; 3 students)
 CHEM 291, 409, 495 (Chemical Research; 11 undergraduate students total)
- 2015 CHEM 341 (Physical Chemistry for Life Sciences; 9 students)
 CHEM 103 (General Chemistry I; 139 students)
 CHEM 303 (Integrated/Physical Chemistry Laboratory I; 18 students)
 CHEM 304/392 (Integrated/Physical Chemistry Laboratory II; 17 students)
 CHEM 320 (Introduction to Chemical Research; 5 students)
 CHEM 291, 409, 495 (Chemical Research; 11 students total)
- 2014 CHEM 103 (General Chemistry I; 150 students)
 CHEM 303/391 (Integrated/Physical Chemistry Laboratory I; 35 students)
 CHEM 392 (Physical Chemistry Laboratory II; 19 students)
 CHEM 320 (Introduction to Chemical Research; 3 students)
 CHEM 291, 409, 495 (Chemical Research; 8 students total)
- 2013 CHEM 103 (General Chemistry I; 100 students)
 CHEM 391 (Physical Chemistry Laboratory I; 16 students)
 CHEM 291 (Chemical Research; 3 students)
- 2010 CHEM 119 (Introductory Chemistry, Contra Costa Community College; 19 students)

Funded Fellowships and Grants

- 2021 United States-Israel Binational Science Foundation
Metals, magnets, and microwaves: Enhancing single-sided NMR signals in materials with DNP
 Joint proposal with Dr. Daphna Shimon, Hebrew University of Jerusalem
 Total two-year funding (Feb 2022–Jan 2024): \$150,000; W&M portion: \$75,000
- 2020 Small Business Technology Transfer (STTR) Sequential Phase II Grant
Method for Locally Measuring Strength of a Polymer-Inorganic Interface During Cure and Aging
 Cooperative project between Metna Co. (Lansing, MI), Rutgers University (Newark, NJ), and William & Mary.
 Oct 2020–Sept 2022; Total funding: \$1,100,000. W&M portion: \$165,000
- 2018 Small Business Technology Transfer (STTR) Phase II Grant
Method for Locally Measuring Strength of a Polymer-Inorganic Interface During Cure and Aging
 Cooperative project between Metna Co. (Lansing, MI), Rutgers University (Newark, NJ), and William & Mary.
 Oct 2018–Dec 2020; Total funding: \$1,000,000. W&M portion: \$150,000
- 2016 Faculty Summer Research Grant (*internal funding*)
 Awarded for Summer 2017
- 2015 Colonial Williamsburg Foundation
 Summer stipend for undergraduate research student; focus on analysis of dyed textiles
 Summer 2015; \$3450
- 2014 Faculty Summer Research Grant (*internal funding*)
 Awarded for Summer 2014
- American Chemical Society Petroleum Research Fund;
 Undergraduate New Investigator Proposal:
Investigating the Development of Intermolecular Networks in Coatings with Single-sided NMR.
 Awarded October 2014; \$55,000

Unfunded Grant Proposals

- 2020 University of St. Andrews Global Fellowship
- Jeffress Trust Award in Interdisciplinary Research
Development of Single-sided NMR as a Nondestructive Tool to Assess Mechanical Adhesion Strength
Total funding: \$100,000
- 2019 US Air Force Small Business Innovation Research (SBIR)
Nondestructive Instrument to Determine Composite Surface Activation State in Manufacturing Environment
Total funding: \$150,000; W&M portion: \$35,000
- 2018 US Army Small Business Technology Transfer (STTR) Phase I grant.
Nondestructive Evaluation of Composite Substrate Below Thick Top-coat Materials
Cooperative project between Metna Co. (Lansing, MI) and William & Mary.
Total funding: \$150,000; W&M portion: \$30,000
- 2017 National Endowment for the Humanities
Investigating the role of solvents and resins in the formation of metal soaps in paint
\$81,087
- 2017 National Science Foundation, CAREER Award
NMR Measurements of Molecular Diffusion in Membranes
\$487,911
- 2016 Research Corporation for Science Advancement; Cottrell Scholar Award
Understanding the role of solvents and resins in the formation of metal soaps in paint
\$100,000
- 2016 National Science Foundation, CAREER Award
Methods development for single-sided NMR to enable rapid measurement of physical properties
\$457,195
- 2015 National Endowment for the Humanities, Research and Development Tier I Grant
Comparing Paint Film Properties of Traditional and Water-mixable Oil Paints
\$95,560
- 2014 Research Corporation for Science Advancement; Cottrell College Science Award
Development of T_2 -D Chemical Sensors for Use with NMR in Low- and Inhomogeneous-fields
\$55,000

Publications (reverse chronological order)

Boldface names are William & Mary students

Underlined names are William & Mary graduate students

18. **Rooney, Mary T.**; Meldrum, Tyler. Effect of pigment volume concentration on acrylic emulsion paints. *Magn. Reson. Chem.* **2020**, 58, 880–888. Special issue: NMR in cultural heritage. [doi:10.1002/mrc.5053](https://doi.org/10.1002/mrc.5053)
17. **Kelley, M.**; Abdol, N.; Soroushian, P.; Keating, K.; Balachandra, A.; Meldrum, T. Monitoring Real-time Curing of Epoxies in situ using Single-Sided NMR. *J. Polym. Sci.* **2020**, 58, 616–623. [doi:10.1002/pol.20190117](https://doi.org/10.1002/pol.20190117)
16. Ma, X.; Beltran, V.; Ramer, G.; Pavlidis, G.; Parkinson, D.Y.; Thoury, M.; Meldrum, T.; Centrone, A.; Berrie, B. Revealing the Distribution of Metal Carboxylates in Oil Paint from the Micro- to Nanoscale. *Angew. Chemie Int. Ed.* **2019**, 58, 11652–11656. [doi:10.1002/anie.201903553](https://doi.org/10.1002/anie.201903553)
15. **King, J. N.; Fallorina, A.; Yu, J.**; Zhang, G.; Telkki, V.-V.; Hilty, C.; Meldrum, T. Probing molecular dynamics with hyperpolarized ultrafast Laplace NMR using a low-field, single-sided magnet. *Chem. Sci.* **2018**, 9, 6143–6149. Open access. [doi:10.1039/C8SC01329B](https://doi.org/10.1039/C8SC01329B)
14. **Brass, M.; Morin, F.**; Meldrum, T. Spatially Resolved Measurements of Crosslinking in UV-Curable Coatings Using Single-Sided NMR. *Magnetochemistry* **2018**, 4(1), 8. Open access. [doi:10.3390/magnetochemistry4010008](https://doi.org/10.3390/magnetochemistry4010008)
13. Rehorn, C.; Kehlet, C.; Del Federico, E.; Zia, W.; Meldrum, T.; Blümich, B. Automatizing the Comparison of NMR Depth Profiles. *Strain* **2017**, e12254. [doi:10.1111/str.12254](https://doi.org/10.1111/str.12254)
12. **Udell, N. A.**; Hodgkins, R. E.; Berrie, B. H.; Meldrum, T. Physical and chemical properties of traditional and water-mixable oil paints assessed using single-sided NMR. *Microchem. J.* 133, **2017**, 31–36. [doi:10.1016/j.microc.2017.03.013](https://doi.org/10.1016/j.microc.2017.03.013)
11. Fife, G.; Stabik, B.; Blümich, B.; Hoppenbrouwers, R.; Meldrum, T. Evidence for the Accumulative Effect of Organic Solvent Treatments on Paintings and What to Do about It: A Case Study of Two “Identical” Seventeenth-Century Paintings Using Single-Sided Nuclear Magnetic Resonance; in *The Noninvasive Analysis of Painted Surfaces: Scientific Impact and Conservation Practice*; Nevin, A. and Doherty, T., Eds. *Smithsonian Contribution to Museum Conservation* 5(5), **2016**, 15–23. [doi:10.5479/si.19492367.5](https://doi.org/10.5479/si.19492367.5)
10. **King, J. N.; Lee, V. J.**; Ahola, S.; Telkki, V.-V.; Meldrum, T. Ultrafast Multidimensional Laplace NMR Using a Single-sided Magnet. *Angew. Chemie Int. Ed.* 55, **2016**, 5040–5043. [doi:10.1002/anie.201511859](https://doi.org/10.1002/anie.201511859)
9. Fife, G.; Stabik, B.; **Kelley, A. E.; King, J. N.**; Blumich, B.; Hoppenbrouwers, R.; Meldrum, T. Characterization of aging and solvent treatments of painted surfaces using single-sided NMR. *Magn. Reson. Chem.*, **2014**, 53, 58–63. [doi:10.1002/mrc.4164](https://doi.org/10.1002/mrc.4164)

8. Garimella, P. D.; Meldrum, T.; Witus, L. S.; Smith, M.; Bajaj, V. S.; Wemmer, D. E.; Francis, M. B.; Pines, A. Hyperpolarized Xenon-Based Molecular Sensors for Label-Free Detection of analytes. *J. Am. Chem. Soc.*, **2014**, 136, 164–168. [doi:10.1021/ja406760r](https://doi.org/10.1021/ja406760r)
7. Fukunaga, K.; Meldrum, T.; Zia, W.; Ohno, M.; Fuchida, T.; Blumich, B. Nondestructive Investigation of the Internal Structure of Fresco Paintings. In *2013 Digital Heritage International Congress (DigitalHeritage)* IEEE, **2013**, 1, 81–88. [doi:10.1109/DigitalHeritage.2013.6743716](https://doi.org/10.1109/DigitalHeritage.2013.6743716)
6. Meldrum, T.; Bajaj, V. S.; Wemmer, D. E.; Pines, A. Band-Selective Chemical Exchange Saturation Transfer Imaging with Hyperpolarized Xenon-Based Molecular Sensors. *J. Magn. Reson.*, **2011**, 213, 14–21. [doi:10.1016/j.jmr.2011.06.027](https://doi.org/10.1016/j.jmr.2011.06.027)
5. Meldrum, T.; Seim, K. L.; Bajaj, V. S.; Palaniappan, K. K.; Wu, W.; Francis, M. B.; Wemmer, D. E.; Pines, A. A Xenon-Based Molecular Sensor Assembled on an MS2 Viral Capsid Scaffold. *J. Am. Chem. Soc.* **2010**, 132, 5936–5937. [doi:10.1021/ja100319f](https://doi.org/10.1021/ja100319f)
4. Meldrum, T.; Schröder, L.; Denger, P.; Wemmer, D. E.; Pines, A. Xenon-Based Molecular Sensors in Lipid Suspensions. *J. Magn. Reson.* **2010**, 205, 242–246. (Cover article.) [doi:10.1016/j.jmr.2010.05.005](https://doi.org/10.1016/j.jmr.2010.05.005)
3. Schröder, L.; Meldrum, T.; Smith, M.; Schilling, F.; Denger, P.; Zapf, S.; Wemmer, D. E.; Pines, A. Xenon Biosensors for Multi-Purpose Molecular Imaging. World Congress on Medical Physics and Biomedical Engineering, September 7–12, 2009, Munich, Germany. *IFMBE Proc.* **2009**, 25/13, 176–179.
2. Schröder, L.; Chavez, L.; Meldrum, T.; Smith, M.; Lowery, T. J.; Wemmer, D. E.; Pines, A. Temperature-Controlled Molecular Depolarization Gates in Nuclear Magnetic Resonance. *Angew. Chem. Int. Ed.* **2008**, 47, 4316–4320. (Frontispiece.) [doi:10.1002/anie.200800382](https://doi.org/10.1002/anie.200800382)
1. Schröder, L.; Meldrum, T.; Smith, M.; Lowery, T. J.; Wemmer, D. E.; Pines, A. Temperature Response of ^{129}Xe Depolarization Transfer and Its Application for Ultrasensitive NMR Detection. *Phys. Rev. Lett.* **2008**, 100, 257603(4). [doi:10.1103/PhysRevLett.100.257603](https://doi.org/10.1103/PhysRevLett.100.257603)

Presentations and talks

- 2021 Society for the Advancement of Material and Process Engineering (SAMPE) National Meeting
Evaluating epoxy cure through single-sided NMR measurements of molecular mobility
 prerecorded talk
- Interfaces and Effects in Composite Energetic Materials (IECEM 2021)
Nondestructive Inspection of Polymer-Inorganic Interfaces via Single-sided Nuclear Magnetic Resonance
- 2019 University of Delaware; Newark, DE
A Little R&R: Single-sided Magnetic Resonance and Relaxation
- Workshop on Low-field Magnetic Resonance
 Invited speaker, *National Institute of Standards and Technology, Boulder, CO*
- 2018 American Chemical Society National Meeting; Boston, MA
How Pigment/Binder Interactions Affect Single-sided NMR Measurements of Acrylic Paints
- 2017 American Chemical Society National Meeting; Washington, D.C.
Physical and Chemical Properties of Traditional and Water-mixable Oil Paints Assessed Using Single-sided NMR
- New York University Abu Dhabi, United Arab Emirates
 Invited speaker, *Scientific Research for Cultural Heritage symposium*
- 2017 Old Dominion University; Norfolk, VA
 2016 Texas A&M University; College Station, TX
 Brigham Young University; Provo, UT
 Georgetown University; Washington, DC
departmental seminar talks, applications of single-sided NMR in cultural heritage research
- 2015 Harvard Art Museums; Cambridge, MA
 Workshop on applications of single-sided magnetic resonance to cultural heritage problems
 Leader/instructor
 Experimental NMR Conference; Asilomar, CA
poster submission
" T_2 -D Studies of Biomolecular Interactions Using Single-sided NMR"
- SE/SW Joint Regional Meeting of the American Chemical Society; Memphis, TN
poster submissions (3):
"Characterization of historical lime mortar using single-sided nuclear magnetic resonance"
"Ultrafast two-dimensional relaxometry with single-sided NMR"
"Monitoring the development of intermolecular networks during the curing of coatings using single-sided NMR"
- 2014 The Non-Invasive Analysis of Painted Surfaces: Scientific Impact and Conservation Practice; Washington, D.C.
"Evidence for the accumulative effect of organic solvent treatments on paintings and what to do about it: A case study of two 'identical' 17th century paintings with single-sided NMR"
 presentation available online at <http://youtu.be/qDee6QUc0gg>

- 2013 New techniques for the non-invasive investigation of the surface and subsurface structure of heritage objects; Toruń, Poland
invited speaker, "Of MOUSE and Men: Single-sided NMR in Cultural Heritage"
- Ampere Summer School in Analyzing Cultural Heritage Using Portable Magnetic Resonance; Volterra, Italy
conference organizer, instructor
"Principles of NMR"
- Experimental NMR Conference; Asilomar, California
poster submission
"Advancements in Stray-field NMR Relaxometry in Testing of Pipes, Soil, and Paintings"
- 2012 EUROMAR World Wide Magnetic Resonance Conference; Dublin, Ireland
poster presenter, travel stipend award recipient
"Contact-free Investigations of Master Paintings Using Single-sided NMR"
- Gordon Conference, *Scientific Methods in Cultural Heritage Research*; West Dover, Vermont
poster presenter, travel stipend award recipient
"Contact-free Investigations of Master Paintings Using Single-sided NMR"
- 2011 Leibniz Institut für Molekulare Pharmakologie, Berlin
invited speaker
"Optimization of CEST Contrast in Hyperpolarized Xenon Systems"
- 2010 EUROMAR World Wide Magnetic Resonance Conference; Florence, Italy
promoted to oral presentation
"A Xenon-based Molecular Sensor Assembled on an MS2 Viral Capsid Scaffold"
- 2009 Gordon Conference, *Magnetic Resonance*; Biddeford, Maine
poster presenter, travel stipend award recipient
"Application of Multiple-pulse Saturation Transfer Sequences in $hp\text{-}^{129}\text{Xe}$ NMR"
- 2009 Experimental NMR Conference; Asilomar, California
poster presenter
"Multiplexing with Xenon Biosensors in a Macroscopically Homogeneous Phase"
- 2008 International Society for Magnetic Resonance in Medicine; Toronto, Canada
poster presenter, travel stipend award recipient
"Optimization of Xenon Biosensors for Increased Sensitivity"
- Experimental NMR Conference; Asilomar, California
poster presenter
"Temperature Response of Functionalized Xenon Biosensors and Its Application to Ultra-sensitive NMR Detection"

Other professional contributions

- 2021 Reviewer (3)
 Distinguished Thesis Awards Committee member
- 2020 Reviewer (3)
- 2019 Graduate Research Symposium judge
 Reviewer (6)
 Grant reviewer (1)
- 2018 Redeveloped CHEM 304 (Physical Chemistry Lab) pedagogy for Spring2019
 Reviewer (2)
 Presenter at the Associate Provost for eLearning Panel, *Using Infographics*
- 2017 Consultant for the U.S. Department of Defense (Gunpowder, Maryland; single-sided NMR)
 Reviewer (1)
 Panelist for the University Teaching Project Workshop “*Digital Creative Projects: Designing and Assessing Technology-based Assignments*”
 Member of the consulting committee to hire a science librarian
- 2016 Developed Speed of Sound (statistical mechanics) experiment for CHEM 304
 Member of the engineering steering committee at W&M
 Reviewer (1)
- 2015 Developed Differential Scanning Calorimetry experiment for CHEM 303
 Department representative at SERMACS (regional ACS conference) graduate student fair
 Faculty search committees (2)
 Reviewer (3)
- 2014 Faculty search committee
 Reviewer (4)

Outreach activities

- 2019 Chemistry Magic Show presenter at the Williamsburg Regional Library
 Host for high-school tour of department
 Presenter of chemistry of cooking class for adults, Williamsburg Regional Library
- 2018 Presenter/host for various programs at the Williamsburg Regional Library
 Forensic Science panelist, program for youth
 Chemistry Magic Show
 Simmer and Sear (chemistry of cooking), program for adults
 Thankful for Chemistry, STEAM Saturday program for children
- 2017 Volunteer/guest speaker at Williamsburg Regional Library
 Eating molecules, a science program for children ages 7–12
 Science fair judge, Jamestown High School
- 2016 Volunteer/guest speaker at Williamsburg Regional Library
 Energy and You!, a science program for children ages 7–12
- 2015 Volunteer/guest speaker at Williamsburg Regional Library
 Light and Color, a science program for children ages 8–12
- Invited panelist
 Vaccinate! Because, Science!! Hosted by the W&M Graduate Student Assembly