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Robert Muth

CURRICULUM VITAE

Education

2011–2016 **University of Oregon**, Eugene, OR.
Ph.D. in Mathematics, June 2016
Advisor: Alexander Kleshchev
Thesis: "Representations of KLR algebras of affine Lie type"

2007–2011 **University of Arizona**, Tucson, AZ.
B.S. in Mathematics, May 2011

2001–2004 **University of Arizona**, Tucson, AZ.
B.F.A. in Visual Arts, May 2004

Academic positions

2022–present **Duquesne University**, Pittsburgh, PA. Assistant Professor.

2018–2022 **Washington & Jefferson College**, Washington, PA. Assistant Professor.

Spring 2018 **Mathematical Sciences Research Institute**, Berkeley, CA. Uhlenbeck Fellow.
Program: Group Representation Theory and Applications

2016–2018 **Tarleton State University**, Stephenville, TX. Assistant Professor.

2011–2016 **University of Oregon**, Eugene, OR. Graduate Teaching Fellow.

2009–2010 **University of Arizona**, Tucson, AZ. Undergraduate Teaching Assistant.

Research interests

My research interests include representation theory and algebraic combinatorics, with a focus on the following topics:

- Representation theory of symmetric groups and Lie algebras.
- Tableau combinatorics and canonical bases for quantum groups.
- Categorification and diagrammatic algebra.

Publications and preprints

Publications

[1] D. Abbasian, L. Difulvio, R. Muth, G. Pasternak, I. Sholtes and F. Sinclair, Cuspidal ribbon tableaux in affine type A, *Algebraic Combinatorics*, 37 pp., (to appear), https://arxiv.org/abs/2009.07344

[2] D. Denniston, R. Muth and V. Singh, The configuration space of a robotic arm over a graph, *Discrete Mathematics, Algorithms and Applications*, 20pp. (to appear), https://arxiv.org/abs/2111.06252

[3] A. Kleshchev and R. Muth, Schurifying quasi-hereditary algebras, *Proceedings of the London Mathematical Society* **125** (2022), 54pp., https://doi.org/10.1112/plms.12466, https://arxiv.org/abs/1810.02849

[4] R. Muth, L. Speyer and L. Sutton, Decomposable Specht modules indexed by bihooks II, *Algebras and Representation Theory* (2021), 40pp., https://doi.org/10.1007/s10468-021-10093-3, https://arxiv.org/abs/2101.11175

[5] A. Iams, H. Johnston and R. Muth, Searching for quicksand ideals in partially ordered sets, *Australasian Journal of Combinatorics* **79**(2) (2021), 27 pp., https://ajc.maths.uq.edu.au/pdf/79/ajc_v79_p256.pdf, https://arxiv.org/abs/2009.07348

[6] A. Kleshchev and R. Muth, Generalized Schur algebras, *Algebra & Number Theory* **14** (2020), 44 pp., https://doi.org/10.2140/ant.2020.14.501, https://arxiv.org/abs/1810.02846

[7] A. Kleshchev and R. Muth, Based quasi-hereditary algebras, *Journal of Algebra* **558** (2020), 18 pp., https://doi.org/10.1016/j.jalgebra.2019.04.034, https://arxiv.org/abs/1810.02844

[8] R. Muth, Super RSK correspondence with symmetry, *Electronic Journal of Combinatorics* **26**(2) (2019), #P2.27, 26 pp., https://doi.org/10.37236/8150, https://arxiv.org/abs/1711.00420

[9] R. Muth, Graded skew Specht modules and cuspidal modules for Khovanov-Lauda-Rouquier algebras of affine type A, *Algebras and Representation Theory* (2019), 32 pp., https://doi.org/10.1007/s10468-018-9808-2, https://arxiv.org/abs/1412.7514

[10] A. Kleshchev and R. Muth, Affine zigzag algebras and imaginary strata for KLR algebras, *Transactions of the American Mathematical Society* **371** (2019), 48 pp., https://doi.org/10.1090/tran/7464, https://arxiv.org/abs/1511.05905

[11] A. Kleshchev and R. Muth, Imaginary Schur-Weyl duality, *Memoirs of the American Mathematical Society* **245** (2017), no. 1157, xvii, 83 pp., https://arxiv.org/abs/1312.6104

[12] A. Kleshchev and R. Muth, Stratifying KLR algebras of affine ADE types, *Journal of Algebra* **475** (2017), 37 pp., https://doi.org/10.1016/j.jalgebra.2016.07.006, https://arxiv.org/abs/1511.05511

Submitted for publication

[13] N. Davidson, J. R. Kujawa and R. Muth, Webs of Type P, 41pp., (submitted), https://arxiv.org/abs/2109.03410

[14] N. Davidson, J. R. Kujawa, R. Muth, Howe Duality of Type P, 46 pp., (submitted), https://arxiv.org/abs/2109.03984

[15] T. Einolf, R. Muth and J. Wilkinson, Injectively k-colored rooted forests, 22pp., (submitted) https://arxiv.org/abs/2107.13417

[16] D. Florentino, E. Moy and R. Muth, Cooperative half-guards in art galleries, 16 pp., (submitted), https://arxiv.org/abs/2007.03737

Talks

Sept. 2022 Mathematisches Forschungsinstitut Oberwolfach, Character Theory and Categorification Workshop.

June 2022 Okinawa Institute of Science and Technology, Representation Theory Seminar.

Nov. 2021 Allegheny Mountain Colloquium, MAA Allegheny Mountain Section.

Oct. 2021 University of Colorado, Boulder, Algebraic Lie Theory Seminar.

Mar. 2021 University of Manchester, Algebra Seminar.

Oct. 2020	Okinawa Institute of Science and Technology, Representation Theory Seminar.
Sept. 2020	Reed College, Mathematics Colloquium.
May 2020	Combinatorial Representation Theory of Symmetric Groups, Okinawa Institute of Science and Technology. *(Cancelled due to COVID-19)*
Mar. 2020	Spring Southeastern Sectional Meeting of the American Mathematical Society, Special Session on Categorical Representation Theory and Beyond, University of Virginia. *(Cancelled due to COVID-19)*
Oct. 2019	Illustrating Number Theory and Algebra, Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University.
Feb. 2019	Symposium on Democracy, Washington & Jefferson College.
Oct. 2018	University of Oklahoma, Algebra Seminar.
May 2018	Mathematical Sciences Research Institute, Group Representation Theory and Applications Seminar.
May 2018	University of Oregon, Algebra Seminar.
Feb. 2018	University of Virginia, Algebra Seminar.
Dec. 2017	Representation Theory of Symmetric Groups and Related Algebras Workshop, Institute of Mathematical Sciences, Singapore.
Nov. 2017	Loyola University Chicago, Algebra and Combinatorics Seminar.
Aug. 2017	Combinatorics of Group Actions and its Applications Workshop, Memorial University of Newfoundland.
Mar. 2017	97th Meeting of the Texas Section of the MAA, Texas A&M University, Commerce.
Nov. 2016	University of Oklahoma, Karcher Colloquium – series of two talks.
Feb. 2016	University of Oregon, Representation Theory Seminar – series of three talks.
Jan. 2016	AMS Special Session: Geometric and Categorical Methods in Representation Theory, Joint Mathematics Meetings, Seattle.
Nov. 2015	Loyola University Chicago, Algebra and Combinatorics Seminar.
Oct. 2015	8th Southeastern Lie Theory Workshop on Algebraic and Combinatorial Representation Theory, North Carolina State University.
Apr. 2015	University of Southern California, Algebra/Categorification Seminar.
Apr. 2015	University of Oregon, Algebra Seminar.

Conferences and workshops organized

Dec. 2021	Co-organizer, Representation Theory of Hecke Algebras and Categorification, Okinawa Institute of Science and Technology. *(Postponed due to COVID-19)*
May 2021	Co-organizer, Special Session on Diagrammatic and Combinatorial Methods in Representation Theory at the AMS Western Sectional Meeting, *Online*.
Dec. 2020	Co-organizer, Superalgebra deformations of web categories workshop, Structured Quartet Research Ensemble, American Institute of Mathematics, *Online*.
Oct. 2018	Co-organizer, Special Session on Combinatorial and Categorical Aspects of Representation Theory, AMS Fall Western Sectional Meeting 2018, San Francisco State University.

Awards/grants/fellowships

Aug. 2022 **Simons Visiting Professorship**.
Support for stay at Mathematisches Forschungsinstitut Oberwolfach and research at host institution University of York.

Dec. 2020 **AIM SQuaRE**.
American Institute of Mathematics, Structured Quartet Research Ensemble. Ongoing support for research group, *Superalgebra deformations of web categories*.

Jan. 2018 **Uhlenbeck Postdoctoral Fellowship**.
Mathematical Sciences Research Institute, Berkeley. Support for semester research program, *Group Representation Theory and Applications.*

Oct. 2017 **Faculty Development Grant**.
Texas A&M University System. Awarded for support of research-related travel.

Oct. 2016 **Faculty Development Grant**.
Texas A&M University System. Awarded for support of research-related travel.

May 2015 **D.K. Harrison Memorial Award**.
University of Oregon. Awarded for exceptional achievement in research.

Mar. 2015 **Johnson Research Award**.
University of Oregon. Awarded for support of research-related travel.

Teaching experience

Instructor of Record for all courses listed below.

Washington & Jefferson College

FYS 199 **First Year Seminar: Just Math**, Fall 2019.
Investigation of issues in social and economic justice with an emphasis on mathematical and statistical modeling; inequality metrics; voting rights and gerrymandering; algorithmic bias.

MTH 151 **Calculus I**, Fall 2018, Spring 2019, Fall 2020.
Limits; continuity; differentiation; optimization; integration and applications.

MTH 152 **Calculus II**, Fall 2019, Spring 2020, Spring 2021, Fall 2021.
Integration techniques; sequences and series; applications.

MTH 211 **Foundations of Higher Mathematics**, Fall 2020.
Basic set theory; number theory and logic; proof reading and writing.

MTH 311 **Number Theory**, Spring 2019, Spring 2021.
Congruence; Fermat's theorem; Diophantine equations; quadratic reciprocity; cryptography.

MTH 317 **Complex Variables**, Spring 2020.
Elementary complex functions; complex differentiation and integration; sequences and series; Cauchy-Goursat and residue theorems.

MTH 320 **Junior Math Talks**, Spring 2020, Spring 2021.
Advisor for student research/writing/presentation projects.

MTH 420 **Senior Math Talks**, Fall 2021.
Advisor for student research/writing/presentation projects.

MTH 361 **Combinatorics**, Fall 2020.
Combinatorial and enumerative problem solving; permutations and combinations; Eulerian and Catalan numbers; generating functions.

MTH 412 **Algebraic Structures**, Fall 2021.
Theory of groups and rings; isomorphism theorems; group actions.

MTH 415 **Real Analysis**, Fall 2018.
Theory of calculus; topology of the reals; convergence of sequences and series; power series.

Tarleton State University

Math 1316 **Trigonometry**, Fall 2016.
Trigonometric functions; modeling periodic behavior; vectors; complex numbers.

Math 2413 **Calculus I**, Spring 2017, Fall 2017.
Limits; continuity; differentiation; optimization; integration and applications.

Math 3310 **Discrete Math**, Fall 2016.
Introduction to proof; set theory; graph theory; recursive definitions; induction; combinatorics.

Math 4332 **Abstract Algebra**, Spring 2017.
Group theory; ring theory; computational methods in abstract algebra.

Math 4309 **Advanced Analysis**, Fall 2017.
Theory of calculus; topology of the reals; convergence of sequences and series.

Math 4390 **Math Topics: Game Theory**, Spring 2017.
Probability and utility theory; games in extensive form and normal form; equilibria; strategy; decision theory; some Python programming.

Math 5308 **Graduate Abstract Algebra**, Fall 2016.
Group theory; ring theory; module theory.

University of Oregon

Math 111 **College Algebra**, Fall 2011, Winter 2012, Spring 2012, Fall 2012.
Functions; polynomials; exponential functions; logarithms; mathematical modeling.

Math 112 **Elementary Functions**, Fall 2013.
Trigonometric functions; periodic functions; vectors; applications in physical sciences.

Math 242 **Business Calculus II**, Summer 2013.
Integral calculus; optimization; modeling and applications in business and social sciences.

Math 246 **Calculus for Biological Sciences**, Winter 2016.
Differential calculus; dynamical systems; modeling and optimization in life sciences.

Math 251 **Calculus I**, Winter 2013, Spring 2013, Spring 2014.
Differential calculus; limits; optimization; modeling.

Math 252 **Calculus II**, Fall 2014.
Integral calculus; methods of integration; volume; areas; differential equations; applications.

Math 307 **Introduction to Proof**, Winter 2015.
Construction and analysis of formal mathematical proofs; set theory; basic number theory.

Service

2019–present **Research Advisor**, Washington & Jefferson College.
Advise and collaborate with undergraduate students in research projects in areas such as combinatorics, geometry, and algebra (see papers [2, 12, 13, 14, 15] above for representative projects). Mentor students in presentation skills. Some conference presentations by students include: "The Configuration Space of a Robotic Arm Over a Graph" at the 2022 Joint Mathematics Meetings, Jan. 2022, by Derric Denniston and Vikram Singh, and "Cuspidal Ribbon Tableaux" at the 52nd Southeastern International Conference on Combinatorics, Graph Theory and Computing, Mar. 2021, by Lena Difulvio and Isabella Sholtes.

2019–present **Academic Advisor**, Washington & Jefferson College.
General academic advisor for fifteen first- and second-year students, and major advisor for eight mathematics major students. Mentor and aid students in course selection, general college skills, seeking internships and research opportunities.

2019–present **Committee Member**, Academic Affairs Assessment Committee, Washington & Jefferson College.
Guide and support assessment of student learning outcomes college-wide.

2019–present **Committee Member/Secretary**, Academic Status Committee, Washington & Jefferson College.
Evaluate student performance, establish principles and methods for ascertaining the proficiency of students, and assignment of honors.

2019–present **Faculty Advisor**, Association for Women in Mathematics Chapter, Washington & Jefferson College.
Advise and aid in organization of AWM activities and various outreach projects.

2019–2020 **Committee Member**, Symposium on Democracy, Washington & Jefferson College.
Aid in organization and planning of annual Symposium on Democracy event featuring multiple guest speakers, breakout sessions, student and community events.

2016–2018 **Research Advisor**, Tarleton State University.
Advised graduate and undergraduate students in research projects in areas such as combinatorics, representation theory, computational abstract algebra, and applied mathematics. Some conference presentations by students include: "Quantifying gerrymandering via transit compactness" at the 14th Annual Texas A&M University System Pathways Research Symposium, Nov. 2017, by Peter Hayes, Casey Sutton, Maria Tovar, and Preston Ward, and "Implementing KLR algebras and related objects in Sage" at the 97th Meeting of the Texas Section of the MAA, April 2017, by Mary Barker.

2017–2018 **Faculty Advisor**, Tarleton Mathematics Club, Tarleton State University.
Aid in organization of Mathematics Club activities, including semimonthly meetings, arrangement of undergraduate travel to sectional conferences, Calculus Bowl, and various outreach projects.

2017–2018 **Program Committee Member**, MAA Texas Section Conference 2019.
Organize plenary/research speaker program and short courses for large sectional conference.

2017–2018 **Graduate Committee Member/Chair**, Tarleton State University.
Served on five graduate committees, including once as chair, intended to evaluate graduate student mathematical knowledge and communication skills in final semester oral exams.

2015–2016 **Committee Chair**, AWM Undergraduate Mentoring Committee, University of Oregon.
The Undergraduate Mentoring Committee provides resources for women undergraduates studying mathematics, including providing panel discussions on REUs and post-graduation opportunities for math majors, and organizing the Undergraduate Reading Program.

2014–2016 **Undergraduate Mentor**, Undergraduate Reading Program, University of Oregon.
Mentored undergraduates in reading projects related to group theory, representation theory, and knot theory, as part of a reading program which culminates in a presentation and poster session.

2014–2016 **Committee Member**, AWM Distinguished Speaker Series, University of Oregon.
The Speaker Series Committee invites experts to give talks targeted to graduate students and upper-level undergraduate students in mathematics and its applications in other disciplines. The aim is to spark interest in mathematics, particularly among members of groups who are under-represented in higher level mathematics.

2014–2015 **Organizer**, Graduate Notions Seminar, University of Oregon.
Organized weekly seminar encompassing a range of graduate level mathematical topics.