# Patricia L. Hersh

University of Oregon

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## Education

- Ph.D., **Massachusetts Institute of Technology** in Mathematics — June 1999
  Thesis: *Decomposition and Enumeration in Partially Ordered Sets.*
  Advisor: Richard Stanley
- A.B., Magna cum laude, **Harvard University** in Mathematics/Computer Science — June 1995
  Undergraduate Senior Thesis: *Approximate Counting of Contingency Tables Using Markov Chains.*
  Advisor: Persi Diaconis

## Experience

- **University of Oregon**, Department of Mathematics — Fall 2019 - present (on leave Fall 2019)
  Professor, 2019 - present
- **North Carolina State University**, Department of Mathematics — Fall 2008 - Fall 2019
  Professor, 2015 - 2019
  Associate Professor, 2009 - 2015
  Assistant Professor, 2008 - 2009
- **Indiana University-Bloomington**, Department of Mathematics — Fall 2004 - Summer 2009
  Promoted to Associate Professor with Tenure, Spring 2009
  Assistant Professor, 2004 - 2009 (on leave Fall 2008 - Spring 2009)
- **Mathematical Sciences Research Institute** (MSRI), Berkeley, CA — Fall 2004
  MSRI Postdoctoral Fellowship, Semester Program on Hyperplane Arrangements
- **University of Michigan**, Department of Mathematics — Summer 2001 - Spring 2004
  NSF Math. Sciences Postdoctoral Research Fellow and Assistant Professor (postdoctoral position)
- **University of Washington**, Department of Mathematics — Fall 1999 - Spring 2001
  Acting Assistant Professor (postdoctoral position)

## Selected Grants, Fellowships and Awards

- Simons Foundation Research Grant, PI — 2024-2029
- NSF Research Grants in Combinatorics, PI: DMS-1953931 (2020-2024), DMS-1500987 (2015-2019), DMS-1200730 (2012–2016), DMS-0757935/1002636 (2008–2012), DMS-0500638 (2005–2009).
- NSF Research Training Grant (RTG), co-PI: DMS-2039316 (2.26 million USD) — 2021–2026
- Fellow of the American Mathematical Society — 2016
- AMS One Hour Invited Address, Southeastern Spring Sectional Meeting — March 2013
- Ruth Michler Prize — Fall 2010
  (Association for Women in Mathematics national prize for a recently tenured female mathematician)
- Several NSF, NSA, and Clay Math Institute conference grants, PI or coPI: Triangle Lecture in Combinatorics (TLC) Conference Series and Stanley@70 Conference at MIT — 2010–2019

- NSF Mathematical Sciences Postdoctoral Research Fellowship — Summer 2001–Spring 2004
- Hertz Foundation Graduate Fellowship — Fall 1995–Spring 1999
- Elected to Phi Beta Kappa, Harvard University (Harvard-Radcliffe chapter) — Spring 1995
- Alice T. Schafer Prize National Runner-up — Spring 1994
  (Association for Women in Mathematics prize for an undergraduate woman)

## Invited Visiting Positions

- **ICERM**, Providence, RI — Fall 2016
  Full semester long-term visitor, Program on Topology in Motion (during 2016-17 sabbatical year)
- **University of Chicago**, Chicago, IL — May/June 2016
  One month visitor and invited mini-course
- **IMA**, Minneapolis, MN — Fall 2014
  Full semester long-term visitor, Program on Discrete Mathematics
- **Cornell University**, Ithaca, NY — Fall 2010
  Ruth I. Michler Prize Winner (national prize providing a research semester)

## Research Interests

- Algebraic and topological combinatorics. Connections to representation theory, topology, computer science.

## Refereed publications and preprints during past six years (excluding student publications)

1. Submitted for Publication: (with James F. Davis and Ezra Miller) "Fibers of maps to totally nonnegative spaces", 63 page preprint, 2024, available at arXiv:1903.01420.
2. Submitted for Publication: (with Christian Gaetz) "Poset topology, moves, and Bruhat interval polytope lattices", 14 page preprint, 2024, available at arXiv:2410.08076.
3. Submitted for Publication: (with John Machacek) "Diameter bound for facet-ridge incidence graphs of geometric lattices", 13 page preprint, 2024, available at arXiv:2408.09197.
4. Publication: (with Grace Stadnyk) "Generalized recursive atom ordering and equivalence to CL-shellability", *Combinatorial Theory*, **4 (1)** 2024, 44 pages.
5. Publication: "Posets arising as 1-skeleta of simple polytopes, the non-revisiting path conjecture and poset topology", *Discrete and Computational Geometry*, **72** (2024), 1463–1492. 30 pages.
6. Publication: "The AMS nomination process demystified", *Notices of the American Mathematical Society* (April 2023 issue), 3 pages.
7. Publication: (with Richard Kenyon) "Shellability of face posets of electrical networks and the CW poset property", *Advances in Applied Math.*, **127** (2021), 37 pages.

## Refereed publications and dissertations during past six years by Ph.D. students on research conducted under my supervision

1. Ph.D. Dissertation: Stephen Lacina, "A partial order structure on the shellings of lexicographically shellable posets", U. Oregon, Spring 2023.

2. Submitted for Publication: Stephen Lacina, "Maximal chain descent orders: A tool for studying the structure of lexicographic shellings", 2023.

3. Publication: Stephen Lacina, "Poset topology of $s$-weak order via SB-labelings", *J. Combinatorics*, **13** (2022), 357-395.

4. Publication: Molly Lynch, "Relations in doubly laced crystal graphs via discrete Morse theory", *J. Combinatorics*, **12** (2021), 117-155.

5. Publication: Grace Stadnyk, "The edge-product space of phylogenetic trees is not shellable.", *Advances in Applied Math*, **135** (2021), 17 pp.

6. Publication: Stephen Lacina, "Poset topology of $s$-weak order via SB-labelings", *Sem. Lothar. Combin.*, **84B** (2020), 12pp. Extended abstract accepted to FPSAC conference.

7. Ph.D. Dissertation: Chetak Hossain, "Quotients derived from posets in algebraic and topological combinatorics", North Carolina State University, Fall 2019.

8. Ph.D. Dissertation: Grace Stadnyk, "Lexicographic shellability, the enriched Tamari poset, and the edge-product space of phylogenetic trees", North Carolina State University, Summer 2019.

9. Ph.D. Dissertation: Molly Lynch, "Topological and algebraic combinatorics of crystal posets", North Carolina State University, Spring 2019.

## Earlier Publications

1. (with Cristian Lenart) "From the weak Bruhat order to crystal posets." *Mathematische Zeitschrift*, **286** (2017), 1435–1464.

2. (with Karola Mészáros) "$SB$-labelings and posets with each interval homotopy equivalent to a sphere or a ball." *J. Combinatorial Theory, Series A*, **152** (2017), 104–120.

3. (with Victor Reiner) "Representation stability for cohomology of configuration spaces in $\mathbf{R}^d$" (including an appendix with Victor Reiner and Steven Sam) *IMRN*, **2017** (2017), no. 4, 1433–1486.

4. "Regular cell complexes in total positivity," *Inventiones Mathematicae*, **197** (2014), no. 1, 57–114.

5. (with John Shareshian and Dennis Stanton) "The $q = -1$ phenomenon via homology concentration." *Journal of Combinatorics*, **5** (2014), no. 1, 167–194.

6. (with Ruth Davidson) "A lexicographic shellability characterization of geometric lattices." *J. Combinatorial Theory, Ser. A*, **123** (2014), no. 1, 8–13.

7. (with Anne Schilling) "Symmetric chain decomposition for cyclic quotients of Boolean algebras and relation to cyclic crystals." *IMRN*, **2013** (2013), 463–473.

8. (with Alex Engström and Bernd Sturmfels) "Toric cubes." *Rend. Circ. Mat. Palermo (2)* (special volume on algebraic geometry), **62** (2013), no. 1, 67–78.

9. (with Drew Armstrong) "Sorting orders, subword complexes, Bruhat order and total positivity." *Advances in Applied Mathematics.* (special volume in honor of Dennis Stanton's 60th birthday), **46** (2011), 46–53.

10. (with Cristian Lenart) "Combinatorial constructions of weight bases: the Gelfand-Tsetlin basis," *Electronic J. Combinatorics*, **17** (2010), no. 1, R33, 14 pp.

11. "Shelling Coxeter-like complexes and sorting on trees." *Advances in Mathematics*, **221** (2009), no. 3, 812–829.

12. (with Sam Hsiao) "Random walks on quasisymmetric functions." *Advances in Mathematics*, **222** (2009), no. 3, 782–808.

13. (with Robert Kleinberg) "A multiplicative deformation of the Möbius function for the poset of partitions of a multiset." *Contemporary Mathematics*, **479** (2009), 113-119. (Special volume in honor of Joe Gallian's 65th birthday.)

14. (with John Shareshian and Dennis Stanton) "The $q = -1$ phenomenon for bounded (plane) partitions via homology concentration." *Discrete Mathematics and Theoretical Computer Science*, 471–484. (Special volume for FPSAC 2009.)

15. (with Stephen Fienberg, Allesandro Rinaldo and Yi Zhou) "On maximum likelihood estimation in latent class models for contingency table data." In "Algebraic and geometric methods in statistics", Cambridge University Press, 2009.

16. (with Edward Swartz) "Coloring complexes and arrangements." *J. Algebraic Combinatorics*, **27** (2008), no. 2, 205–214.

17. (with Alexander Berglund and Jonah Blasiak) "Combinatorics of multigraded Poincaré series for monomial rings." *J. Algebra*, **308** (2007), no. 1, 73–90.

18. (with John Shareshian) "Chains of modular elements and lattice connectivity." *Order*, **23** (2006), no. 4, 339–342.

19. "On optimizing discrete Morse functions." *Advances in Applied Math.*, **35** (2005), 294–322.

20. (with Volkmar Welker) "Gröbner basis degree bounds on $Tor_{\bullet}^{k[\Lambda]}(k,k)_{\bullet}$ and discrete Morse theory for posets", Integer Points in Polyhedra–Geometry, Number Theory, Algebra, Optimization, 101–138, *Contemporary Mathematics*, **374**, Amer. Math. Soc., Providence, RI, 2005.

21. (with Eric Babson) "Discrete Morse functions from lexicographic orders." *Trans. Amer. Math. Soc.*, **357** (2005), 509–534.

22. (with Phil Hanlon) "A Hodge decomposition for the complex of injective words." *Pacific J. Math.*, **214** (2004), no. 1, 109–125.

23. "Connectivity of $h$-complexes." *J. Combinatorial Theory, Ser. A*, **105** (2004), no. 1, 111–126.

24. "Chain decomposition and the flag $f$-vector." *J. Combinatorial Theory, Ser. A*, **103** (2003), No. 1, 27–52.

25. "Lexicographic shellability for balanced complexes." *J. Algebraic Combinatorics*, **17** (2003), No. 3, 225–254.

26. "A partitioning and related properties for the quotient complex $\Delta(B_{lm})/S_l \wr S_m$." *J. Pure and Applied Algebra*, **178** (2003), No. 3, 255–272. (With an appendix by Victor Reiner.)

27. (with Phil Hanlon) "Multiplicity of the trivial representation in rank-selected homology of the partition lattice." *J. Algebra*, **266** (2003), no. 2, 521–538.

28. "Two generalizations of posets of shuffles." *J. Combinatorial Theory, Ser. A*, **97** (2002), No. 1, 1–26.

29. (with Isabella Novik) "A short simplicial $h$-vector and the upper bound theorem." *Discrete and Computational Geometry*, **28** (2002), No. 3, 283–289.

30. "Deformation of chains via a local symmetric group action." *Electronic J. Combinatorics*, **R27** (1999).

31. "Decomposition and enumeration in partially ordered sets." MIT Ph.D. Thesis, 1999.

32. "On exact n-step domination." *Discrete Mathematics*, **205** (1999), 235–239. Based on research done as an undergraduate at Joe Gallian's REU at the University of Minnesota, Duluth.

## Books Edited

1. Selected Works of Richard P. Stanley (co-edited with Thomas Lam, Pavlo Pylyavskyy and Victor Reiner). Published by the American Mathematical Society, 2017.

2. The Mathematical Legacy of Richard P. Stanley (co-edited with Thomas Lam, Pavlo Pylyavskyy and Victor Reiner). Published by the American Mathematical Society, 2017.

## Other Research Related Activities

- **Ph.D. students (7 total)**: **Annika Christiansen** (University of Oregon), current third year student. **Stephen Lacina** (University of Oregon), graduated June 2023, tenure track assistant professor at Truman State University. **Chetak Hossain** (NCSU), graduated December 2019 (coadvised by Nathan Reading), assistant professor of instruction at Texas State University. **Grace Stadnyk** (NCSU), graduated August 2019, tenure track assistant professor at Furman University. **Molly Lynch** (NCSU), graduated May 2019, tenure track assistant professor at Hollins University. **Ruth Davidson** (NCSU), graduated May 2014 (coadvised with Seth Sullivant), first position NSF postdoctoral research fellow at UIUC math and computer science departments. **Rebecca Swanson** (Indiana University–Bloomington), graduated May 2010, teaching professor at Colorado School of Mines.

- **Postdoctoral fellows mentored**: **John Machacek** (University of Oregon), 2021-2024. **John Wiltshire-Gordon** (ICERM), Fall 2016.

- **Reading courses with UO graduate students: Shreeya Moghe**, winter 2025 (as part of Vitulli Scholar's program); **Kate Bernklau Halvor**, summer 2024 (as part of Vitulli Scholar's program); **Annika Christiansen**, winter 2024, fall 2023, and winter 2023 (as part of Vitulli Scholar's program); **Elliot Granath**, winter 2020.

- **Editorial Boards: Forum of Mathematics, Pi**, March 2019–present; **Forum of Mathematics, Sigma**, March 2019–present; **Springer Graduate Texts in Mathematics (GTM)** Advisory Board, April 2019–present; **Proceedings of American Mathematical Society** (combinatorics editor), February 2014 – June 2021; **SIAM Journal on Discrete Mathematics**, January 2011 – December 2016.

- Editor-in-Chief: **Springer Graduate Texts in Mathematics (GTM)** (one of three managing editors), January 2023–present.

- **University of Miami Math Department External Review Committee**: April 4-6, 2023.

- **American Mathematical Society (AMS) Nominating Committee**: elected for three year term. Jan. 1, 2021–Dec. 31, 2023. **Committee chair**, Nov. 1, 2021–October 31, 2022.

- **AMS Nominating Committee of the Executive Committee and Board of Trustees**: ex officio member, one year term. Jan. 1, 2022–Dec. 31, 2022.

- **AMS Fellows Selection Committee**: appointed for three year term, Feb. 1. 2017–Jan. 31, 2020. **Committee chair**, Feb. 1, 2018–Jan. 31, 2020.

- **AMS Southeastern Section Program Committee:** appointed for two year term, Feb. 1, 2017–Jan. 31, 2019. Committee chair, Feb. 1, 2018–Jan. 31, 2019.

- **AMS Council:** elected to three year term, Feb. 1, 2011–Jan. 31, 2014, Council of the American Mathematical Society (governing body of the society).

- **AMS Committee on the Profession, Chair of Prize Oversight Subcommittee, and Liaison to AWIS:** appointed as AMS council representative to Committee on the Profession for Feb. 1, 2011–Jan. 31, 2014. Chair of subcommittee on AMS prize oversight; member of subcommittee on membership services; organizer of panel at 2013 joint math meetings (JMM) on "Getting started as a research mathematician" and coorganizer of panel at 2014 joint math meetings (JMM) on "Online courses: benefits and pitfalls"; AMS liaison to AWIS (Association for Women in Science).

- **NSF Panels and Site Visit Teams:** served/serving on eight NSF panels and two NSF math research institute site visit teams since 2006 (including one NSF panel during the review period). These have included panels for grants in my research area, combinatorics, and various general mathematical panels including multiple years on the postdoctoral research fellowship panel for mathematics and on CAREER grant panels for mathematics.

- **AWM Michler Prize Selection Committee:** Aug. 1, 2013 – July 31, 2016. Committee chair, Aug. 1, 2015–July 31, 2016.

- **FPSAC Program Committees:** served/serving on program committees for annual conferences on Formal Power Series and Algebraic Combinatorics (FPSAC) held in Valparaiso, Chile in summer 2008, Reykjavik, Iceland in summer 2011, and Chicago, Illinois in summer 2014, respectively.

- **AWM Mentoring Travel Grants Selection Committee:** reviewed proposals for the Association for Women in Mathematics, Feb. 1, 2010 – Jan. 31, 2012. Committee chair, Feb. 1, 2011–Jan. 31, 2012.

- **Refereeing and Reviewing (including Quick Opinions):** Advances in Mathematics, Algebraic Combinatorics, American Math Monthly, Annals of Combinatorics, Beitrage zur Algebra und Geometrie, Bulletin London Math. Soc., Combinatorial Theory, Compositio Math., Discrete and Computational Geometry, Discrete Math, Duke Math Journal, Duke Math. Journal, Electronic J. Combinatorics, European J. Combinatorics, Geometry and Topology, Indiana University Math Journal, Israel J. Math., J. Algebraic Combinatorics, J. Amer. Math. Soc., J. Combinatorial Theory Ser. A, Journal of Topology, Math Reviews, Memoirs Amer. Math. Soc., Order, Pacific J. Math., Proc. Amer. Math. Soc., Proc. London Math. Soc., Rocky Mountain Math. J., Selecta Math., SIAM J. on Discrete Math. Trans. Amer. Math. Soc.

- **Tenure, Promotion and Recommendation Letters:** I wrote several recommendation letters for undergraduates, grad students and early-career faculty members as well as tenure letters and promotion letters during the review period. I did not keep count, but I wrote at least a couple letters per year on average.

- **Book Review:** for Math Reviews of "Algebraic combinatorics. Lectures from the Summer School held in Nordfjordeid, June 2003" by Peter Orlik and Volkmar Welker.

- **Additional Dissertation Committees: Cruz Godar** (In progress, advisor: Ben Young, U. Oregon, combinatorics); **Tatyana Benko** (In progress, advisor: Ben Young, U. Oregon, combinatorics); **Adam Bamforth** (In progress, advisor: Ben Young, U. Oregon, combinatorics); **Leigh Foster** (2024, advisor: Ben Young, U. Oregon, combinatorics); **Dane Miyata** (2023, advisor: Nick Proudfoot, U. Oregon, combinatorics); **Jake Potter** (2022, advisor: Ben Young, U. Oregon, combinatorics); **Gautam Webb** (2021, advisor: Ben Young, U. Oregon, combinatorics); **Erika Ordog** (2020, advisor: Ezra Miller, Duke, combinatorial commutative algebra); **Michael Weselcouch** (2019, advisor: Ricky Liu, NCSU, combinatorics); **Daniel Scofield** (2018, advisor: Radmila Sazdanovik, NCSU, topology); **Shira Polster** (2018, advisor: Nathan Reading, NCSU, combinatorics); **Emily Barnard** (2017, advisor: Nathan Reading, NCSU, combinatorics); **Emily Meehan** (2017, advisor: Nathan Reading, NCSU, combinatorics); **Jennifer Gamble** (2015, advisor: Hamid Krim, NCSU Electrical and Computer Engineering, applied topology); **Chris O'Neill** (2014, advisor: Ezra Miller, Duke, commutative algebra and combinatorics); **Shirley Law** (2013, advisor: Nathan Reading, NCSU, combinatorics); **Emily Braley** (2012, advisor: Prakash Belkale, UNC Chapel Hill, representation theory and algebraic geometry); **J.T. Hird** (2012, advisors: Naihuan Jing and Ernie Stitzinger, NCSU, representation theory and combinatorics); **Erin Bancroft** (2011, advisor: Nathan

Reading, NCSU, combinatorics); **Daniel Jordan** (2006, advisor: Michael Larsen, Indiana U., computational algebra); **Scott Kravitz** (2004, advisor: Phil Hanlon, U. Michigan, combinatorics); **Jingui Ha** (2001, advisor: Neal Koblitz, U. Washington, cryptography).

- **Member:** AMS (Americian Mathematical Society), AWM (Association for Women in Mathematics).

## Recent/Selected Service and DEI Activities

- Tenure track hiring committee: (2024-25, U. Oregon math department).
- Post tenure review committee: (2023-25, chair 2024-25, U. Oregon math department) – two years of service. Committee handled six post-tenure review cases in 2023-24.
- Executive committee: (2020-24, U. Oregon math department) – four years of service.
- Institutional hiring plan (IHP) faculty advisory committee: (2021-23, U. Oregon university-wide committee) – two years of service.
- Tenure track hiring committee: (2022-23, U. Oregon math department).
- Colloquium committee: (2020-23, **chair 2021-22**, U. Oregon math department) – three years of service.
- Tuition and fee advisory board (TFAB): (2020-22, U. Oregon university-wide committee) – two years of service.
- Climate committee: (2021-22, U. Oregon math department). Committee wrote policy document.
- Math club faculty mentor: (2020-21, U. Oregon math department).
- Ph.D. advisory committee: (2020-21, U. Oregon math department).
- Leader of biography reading group: (June 2020–August 2021, U. Oregon math department). Created and ran a reading group that met weekly, discussing biographies of mathematicians from underrepresented groups. The readings served as a launching point for discussions of issues that members of underrepresented groups may face and how others may support them. Hopefully this also provided somewhat of a support network during the COVID-19 pandemic.
- Math Festival volunteer: (March 2020, U. Oregon).
- **Reappointments, promotion and tenure (RPT) committee:** (2017–19, NCSU math department). This committee involved substantial work, reviewing approximately 20 assistant professors, associate professors and lecturers in April/May 2019, during this PTR review period.
- **Geometry/topology tenure track hiring committee:** (2015–16, NCSU math department).
- **Interdisciplinary hiring cluster proposal:** (2012, NCSU). Led math department component of successful proposal to NCSU Chancellor's Faculty Excellence Fund (jointly with Seth Sullivant) for inter-college hiring cluster (of 4 faculty hires) on data driven science involving colleges of sciences and of engineering.
- **Women in science program (WISP) advisory board member**: (2008, Indiana University).
- **Departmental chair election committee member**: (Fall 2005, Indiana University math department) elected by math department to committee (of 3 people) that conducted departmental chair election.
- **MIT Graduate Student Council executive committee, co-chair of two committees and math department representative:** (1996–1998) Co-chaired committee that redesigned MIT-wide new graduate student orientation program.

## Seminar and Conference Organizing

- Cascade Lectures in Combinatorics (CALICO), Eugene, OR — Fall 2021–present
  *Conference Series (Nov. 6, 2021; April 2, 2022; Oct. 15, 2022; April 22, 2023; Nov. 4, 2023; May 18, 2024; December 14, 2024; more to come twice yearly through Spring 2026, funded by RTG grant)*
- **Triangle Lectures in Combinatorics (TLC)**, Raleigh, NC — Fall 2009–Spring 2020
  *Conference Series (Feb. 6, 2010; Sept. 25, 2010; April 9, 2011; Nov. 5, 2011; Feb. 11, 2012; Sept. 22, 2012; Feb. 9, 2013; Sept. 21, 2013; Feb. 22, 2014; Oct. 4, 2014; Feb. 21, 2015; Oct. 3, 2015; Feb. 27, 2016; Nov. 19, 2016; March 24, 2018; Nov. 10, 2018; March 30, 2019; Nov. 16, 2019)*
- **MSRI Workshop on Geometric and Topological Combinatorics** — October 9-13, 2017
- **AMS Central Sectional Meeting**, Bloomington, IN — April 1-2, 2017
  *Special Session on Representation Stability and its Applications*
- **Richard Stanley 70th Birthday Conference**, Cambridge, MA — June 23–27, 2014
- **AMS Southeastern Sectional Meeting**, Oxford, MS — March 2013
  *Special Session on Algebraic Combinatorics*
- **Joint Math Meetings (JMM)**, New Orleans, LA — January 2011
  *AWM Special Session in memory of Alice T. Schafer*
- **AMS Eastern Sectional Meeting**, Syracuse, NY — October 2010
  *Special Session on Topology and Combinatorics*
- **SIAM Meeting on Discrete Mathematics**, Austin, TX — June 2010
  *Mini-symposium on Topological Combinatorics*
- **North Carolina State University**, Raleigh, NC — Fall 2008–Spring 2010
  *Algebra and Combinatorics Seminar*
- **AMS Southeastern Sectional Meeting**, Raleigh, NC — April 2009
  *Special Session on Rings, Algebras, and Varieties in Combinatorics*
- **AMS Central Sectional Meeting**, Bloomington, IN — April 2008
  *Special Session on Combinatorial Representation Theory, Topological Combinatorics and their Interactions*
- **Indiana University**, Bloomington, IN — Spring 2005–Spring 2008
  *Combinatorics Seminar*
- **Joint American/Austrian/German Math. Society Meeting**, Mainz, Germany — June 2005
  *Special Session on Algebraic Combinatorics*

## Teaching Experience

- University of Oregon, Eugene, OR — Spring 2020 – present
  *Instructor – Enumerative Combinatorics* (graduate class), *Instructor – Elementary Linear Algebra* (undergrad class), *Instructor – Introduction to Abstract Algebra I* (upper level undergrad and beginning grad class), *Instructor - Linear Algebra with Theory* (upper level undergrad and beginning grad class), *Topological Combinatorics* (graduate topics class), *Point Set Topology* (upper level undergrad and beginning grad class), *Discrete Math* (upper level undergrad class), *Algebraic Topology* (graduate class), *Combinatorics of Coxeter Groups* (graduate topics class).

- Course design and innovative teaching (during this PTR review period)
  *Combinatorics of Coxeter Groups, spring 2021* (graduate topics class designed and taught for first time); *Applied Algebra and Communicating Mathematics, fall 2019 at NCSU during the review period* (undergrad math class focused on developing student math communication skills through oral and written presentations. This was my first experience teaching such a course. More than half the students emailed me afterwards thanking me for this class they found exceptionally valuable, so I hope some day to create a similar course at Oregon).

- **North Carolina State University**, Raleigh, NC Fall 2008 – Fall 2019
  *Instructor - Algebra* (two semester graduate class), *Enumerative and Geometric Combinatorics* (two semester graduate class), *Topology* (two semester graduate class); *Applied Algebra* (one semester undergraduate class), *Combinatorial Commutative Algebra* (one semester graduate topics class); *Topological Combinatorics* (one semester graduate topics class); *Discrete Mathematics* (one semester undergraduate class).

- **Indiana University**, Bloomington, IN Spring 2005 – Spring 2008
  *Instructor - Linear Algebra with Applications*, *Brief Survey of Calculus II*, *Calculus III*, *Topological Combinatorics* (graduate topics class), *Calculus II*, *Linear Algebra for Undergrad.*

- **University of Michigan**, Ann Arbor, MI Spring 2004, Fall 2003, Fall 2002
  *Instructor - Applied Modern Algebra*; *Combinatorics and Graph Theory* (mixture of undergraduate and graduate students); *Linear Spaces and Matrix Theory* (joint math/electrical engineering course)

- **University of Washington**, Seattle, WA Fall 1999 – Spring 2001
  *Instructor - Calculus I, Calculus II* (160 students each); *Graduate Topics in Algebraic Combinatorics, Advanced Multivariable Calculus, Linear Algebra, Undergraduate Graph Theory, Undergraduate Combinatorics*

- **PROMYS Program - Boston University**, Boston, MA Summers 1991, 1992; Summer 1996
  *Counselor* (helped gifted high school students learn number theory in discovery style); *Recitation Instructor.*

## Selected Other Teaching and Mentoring Activities

- ICERM panelist: (Fall 2020) virtual zoom panel on professional advice for early career mathematicians.

- **Duke SWIM invited speaker**: (Summers 2019 and 2016) one hour talk aimed at gifted female high school students interested in mathematics.

- **NCSU math graduate program advisory committee**: fall 2012–summer 2016.

- **Plenary lecturer at REU conference for undergraduates**: (July 2005, Indiana University) conference hosted by Indiana University-Bloomington for students participating in REU programs across Indiana.

## Conference Plenary Talks, Colloquia, and Mini-courses

- 2023: *GallianFest one hour plenary talk*, University of Minnesota, Duluth, July 31-August 4, 2023.

- 2022: *AlGeCom (Algebra, Geometry, Combinatorics) conference one hour plenary talk*, UIUC, Urbana-Champaign, Illinois, October 22, 2022.

- 2021: *University of Oregon Computer Science Departmental Colloquium*, on Zoom, May 27, 2021; *Northeast Women in Algebra and Combinatorics Conference Celebrating the 50th Anniversary of the Association for Women in Mathematics* (one hour plenary talk), on Zoom, November 20, 2021.

- 2020: *51st Southeastern Conference in Combinatorics, Graph Theory and Computing* (two one hour plenary talks), Boca Raton, FL, March 9-13, 2020; *Western Carolina/Appalachian State University Math Departmental Colloquium*, on Zoom, October 29, 2020.

- 2019: *U. South Carolina Math Departmental Colloquium*, November 21, 2019, cancelled due to family medical emergency; *UC Irvine Math Departmental Colloquium*, March 14, 2019; *University of Oregon Math Departmental Colloquium*, January 28, 2019.

- 2018: *Combinatorics and beyond: the many facets of Sergey Fomin's mathematics conference* (one hour invited address), Ann Arbor, MI, November 8-11, 2018; *Notre Dame Math Departmental Colloquium*, October 3, 2018; *ICM Satellite Meeting* (45 minute invited talk), University of Miami, July 26-29, 2018; *Cumberland Conference* (one hour plenary address), Huntington, WV, May 19-20, 2018; *UNC-Greensboro Helen Barton Distinguished Lecture*, April 6, 2018.

- 2017: *MSRI Connections for Women Conference on Geometric and Topological Combinatorics* (one hour invited address), Berkeley, CA, August 31–Sept. 1, 2017; *Algebraic and Geometric Combinatorics of Reflection Groups Conference* (one hour invited address), June 5-9, 2017, UQAM, Montreal, Canada; *University of Washington-PIMS Mathematics Departmental Colloquium*, February 10, 2017; *University of Southern California Math Departmental Colloquium*, February 8, 2017.

- 2016: *Cornell Topology Festival* (one hour invited address), May 13-15, 2016; *University of Chicago mini-course (3 lectures) on "Topological combinatorics of posets and stratified spaces"*, May 25, 27, and June 1, 2016; *ICERM Workshop on "Topology and Geometry in a Discrete Setting"*, (one hour invited address), November 28-December 2, 2016; *ICERM mini-course (3 lectures) on "Topological combinatorics of posets and stratified spaces"*, Nov. 8, 12, and 15, 2016.

- 2015: *Brown University Math Departmental Colloquium*, February 23, 2015; *Combinatorial Algebra meets Algebraic Combinatorics Conference* (one hour invited address), January 23-25, 2015, Queen's U., Kingston, Ontario, Canada; *WachsFest Conference* (one hour invited address), Jan. 5-9, 2015, U. Miami, Miami FL.

- 2014: *Institute for Math and its Applications (IMA) Workshop on Topology and Geometry of Networks and Discrete Metric Spaces* (45 minute invited talk), April 28-May 2, 2014, Minneapolis, MN.

- 2013: *AMS Southeastern Sectional Meeting* (one hour plenary address), March 1-3, 2013, Oxford, Mississippi; *FPSAC Conference* (one hour plenary address), June 24-28, 2013, Paris, France.

- 2012: *George Mason University Math Departmental Colloquium*, Nov. 16, 2012.

- 2011: *University of Southern California Math Departmental Colloquium*, March 9, 2011; *MIT Women in Math Lecture Series*, April 4, 2011; *McKnight-Zame mini-symposium, University of Miami*, March 2011; *UNC Charlotte Math Departmental Colloquium*, January 21, 2011.

- 2010: *Cornell Oliver Club (Math Departmental Colloquium)*, Nov. 4, 2010; *SUNY Albany Math Departmental Colloquium*, Oct. 29, 2010; *UBC Math Departmental Colloquium*, March 19, 2010; *Southeastern Lie Theory Conference, Athens, GA* (one hour plenary address), May 22-24, 2010; *Combinatorics 2010: Advances, Trends and Speculations, Lexington, KY* (one hour plenary address), March 26-28, 2010.

- 2009: *Virginia Tech Math Departmental Colloquium*, April 2009; *IDA-CCR Princeton Colloquium*, November 9, 2009.

- 2008: *CombinaTexas Conference, El Paso, TX* (one hour plenary address), April 2008.

- 2007: *North Carolina State University Special Seminar*, March 2007; *Georgia Tech Special Seminar*, February 2007; *University of Illinois, Urbana-Champaign Math Departmental Colloquium*, February 2007; *UT Austin Special Algebra Seminar*, January 2007.

- 2005: *Conference on Trends in Topological Combinatorics, KTH-Stockholm, Sweden* (one hour plenary address), February 2005.

- 2004: *University of Virginia Math Departmental Colloquium*, March 2004; *Indiana University Math Departmental Colloquium*, February 2004.

- 2003: *LSU Math Departmental Colloquium*, December 2003; *Temple University Math Departmental Colloquium*, November 2003; *University of Wisconsin Special Seminar*, November 2003; *Western Michigan University Math Departmental Colloquium*, October 2003; *Topological and Geometric Combinatorics Conference, Oberwolfach, Germany* (one hour plenary address), April 2003; *UCSD Special Seminar*, January 2003.

- 2002: *Michigan State University Math Departmental Colloquium*, December 2002.

## Seminar Talks and Non-Plenary Conference Talks

- Upcoming invited talks and conferences: *Joint Math Meetings Special Session*, January 8-11, 2025, Seattle, WA; *BIRS Workshop*, January 20-24, 2025, Banff ,CANADA; *Oregon State University Topology Seminar*, April 14 2025; *U. Michigan Combinatorics Seminar*, March 28, 2025; *ICERM Workshop speaker*, Sept. 15-19, 2025, Providence, RI; *MIT Combinatorics Seminar*, date TBD.

- "Generalized recursive atom orderings and equivalence to CL-shellability." *U. Southern California Combinatorics Seminar*, April 3, 2024; *Oberwolfach Geometric and Topological Combinatorics, GERMANY*, December 10-16, 2023; *UC Berkeley Combinatorics Seminar*, Nov. 9, 2023; *UC Davis Combinatorics Seminar*, Nov. 7, 2023; *TATERS Seminar (Topics in Algebra, Topology, etc. Research Seminar)*, Boise State University, December 9, 2022 on Zoom; *Michigan State University Combinatorics Seminar*, October 13, 2022 on Zoom.

- "Unimodality in refined path counting: a surprising application of combinatorics and representation theory." *U. Oregon Basic Notions Seminar*, June 9, 2023.

- "Equivalent conditions to EL-shellability and CL-shellability." *Washington University in St. Louis Combinatorics Seminar*, October 4, 2021 on Zoom.

- "Shelling face posets of stratified spaces of electrical networks and phylogenetic trees." *ICERM Workshop on Symmetry, Randomness and Computation in Real Algebraic Geometry*, August 24-28, 2020.

- "Fibers of maps to totally nonnegative spaces." *Oberwolfach Workshop on "Geometric, algebraic and topological combinatorics*, Oberwolfach, Germany, August 25-31, 2019; *AMS Special Session on Combinatorial Lie Theory*, Gainesville, FL, Nov. 2-3, 2019.

- "Posets arising as 1-skeleta of simple polytopes, the nonrevisiting path conjecture and poset topology." *University of Southern California Combinatorics Seminar*, February 10, 2021; *Simon Fraser Discrete Math Seminar*, November 12, 2020; *University of Oregon Combinatorics/Topology Seminar*, December 6, 2018; *Cornell Discrete Geometry and Combinatorics Seminar*, May 7, 2018; *WINRS conference, Special Session on Algebra and Combinatorics*, Charlottesville, VA, September 15, 2018.

- "Posets from Polytopes." *Joint Math Meetings Special Session on "Special Functions and Combinatorics" in honor of Dennis Stanton*, San Diego, CA, January 10-13, 2018.

- "Crystal graphs and SB-labelings." *MIT Combinatorics Seminar*, October 12, 2016; *Brown Discrete Math Seminar*, October 11, 2016; *UCLA Combinatorics Seminar*, February 7, 2017; *Cornell Discrete Geometry and Combinatorics Seminar*, January 30, 2017; *Notre Dame Cluster Algebras Seminar*, November 27, 2017.

- "From the weak Bruhat order to crystal posets." *University of Oregon Algebra/Discrete Math Seminar*, February 2020; *AMS Eastern Sectional Meeting 45 Minute Talk* Brunswick, ME, Sept. 24-25, 2016; *2016 Joint Math Meetings AWM session invited talk*, January 9, 2016; *Southeastern Lie Theory Meeting*, Oct. 9-11, 2015, NCSU; *UIUC Combinatorics Seminar*, August 5, 2016; *U. Minnesota Combinatorics Seminar*, December 10, 2015.

- "Representation theoretic stability in the partition lattice." *UBC Joint Combinatorics/Topology Seminar*, February 15, 2017; BIRS Workshop on "Free Resolutions, Representations, and Asymptotic Algebra", April 3-8, 2016, Banff Canada; *U. Wisconsin Combinatorics Seminar*, Nov. 3, 2014; *Stanford University Representation Stability Seminar*, Dec. 2, 2014.

- "SB-labelings and posets with each interval homotopy equivalent to a sphere or ball." *AMS Central Sectional Meeting*, Sept. 20-21, 2014, Eau Claire WI; Stanley@70 Conference, June 23-27, 2014, Cambridge MA.

- "Regular cell complexes in total positivity." University of Illinois at Chicago algebraic geometry seminar, March 7, 2016; *U. Chicago Topology/Geometry Seminar*, Nov. 18, 2014; Stanford Topology Seminar, Dec. 2, 2014; *UC Berkeley Combinatorics Seminar*, March 10, 2014; *University of Michigan Combinatorics Seminar*, November 1, 2013; *UCLA Combinatorics Seminar*, December 12, 2013; *Ohio State Univ. Combinatorics Seminar*, April 18, 2012.

- "Toric cubes." *AMS Southeastern Sectional Meeting*, October 13-14, 2012, New Orleans, LA.

- "Symmetric chain decomposition for cyclic quotients of Boolean algebras and relation to cyclic crystals." *SIAM Meeting on Discrete Math*, June 18-21, 2012, Halifax, Nova Scotia; *Indiana U. Combinatorics Seminar*, April 20, 2012; *U. Michigan Combinatorics Seminar*, March 30, 2012; *AMS Eastern Sectional Meeting*, March 17-18, 2012, Washington D.C.; *Georgia Tech Combinatorics Seminar*, Nov. 18, 2011; *U. Penn/Drexel Combinatorics and Algebraic Geometry Seminar*, Oct. 18, 2011; *UNC Chapel Hill Geometric Methods in Representation Theory Seminar*, Sept. 16, 2011;

- "Discrete Morse theory (for posets)", *Banff (BIRS) Algebraic Combinatorixx Workshop*, May 2011.

- "Interplay of combinatorics with topology through posets." *Joint Meetings Michler-Mentoring Session*, New Orleans, January 2011 (talk aimed at young mathematicians from AWM workshop).

- "Subword complexes, 0-Hecke algebras and a map to Bruhat order." *AMS Central Sectional Meeting Special Session* St. Paul, MN, April 2010; *UIUC Algebra, Geometry and Combinatorics Seminar*, October 2009.

- "A combinatorial topological toolkit for stratified spaces." *Oberwolfach Geometric and Topological Combinatorics Workshop*, February 2011.

- "The $q = -1$ phenomenon for bounded (plane) partitions via homology concentration." *University of Miami Minisymposium on Algebraic and Geometric Combinatorics*, March 2011; *UC Davis Combinatorics Seminar*, March 2011; *MIT Combinatorics Seminar*, December 2010; *Cornell Combinatorics Seminar*, October 2010; *SUNY Binghamton Combinatorics Seminar*, October 2010; *Univ. Minnesota Combinatorics Seminar*, October 2010; *FPSAC Conference, Linz, Austria*, July 2009.

- "Combinatorics and topology of regular CW complexes." *Duke Algebraic Geometry Seminar*, April 2010; *Ulam Centennial Conference, U. Florida*, March 2009; *U. Kentucky WILDCATS Seminar*, February 2009.

- "Regular cell complexes, Bruhat order, and total positivity." *Univ. Minnesota Combinatorics Seminar*, November 2008; *UNC-Chapel Hill Geometric Methods in Representation Theory Seminar*, October 2008; *MIT Combinatorics Seminar*, February 2008; *Univ. Michigan Combinatorics Seminar*, January 2008.

- "A homological obstruction to weak order on trees." *UC Berkeley Combinatorics Seminar*, March 2011; *Cornell Topology/Geometric Group Theory Seminar*, Nov. 29, 2010; *Joe Gallian 65th birthday conference, Duluth, Minnesota*, July 2007; *University of Washington Algebra Seminar*, May 2007; *IMA Applications of Algebraic Geometry Seminar*, May 2007; *North Carolina State University Special Seminar*, March 2007.

- "Connectivity bounds in combinatorics." *Georgia Tech Special Department Seminar*, February 2007.

- "Coloring complexes and arrangements." *University of Minnesota Combinatorics Seminar*, May 2007; *AMS Eastern Sectional Meeting*, October 2006; *AMS Central Sectional Meeting*, October 2006.

- "Shelling Coxeter-like complexes and sorting on trees." *Oberwolfach (Germany), Geometric and Topological Combinatorics Conference*, February 2007; *UIUC Geometric Potpourri Seminar*, September 2006; *Joint meetings special session*, January 2006; *AMS Eastern Sectional Meeting*, October 2005.

- "The $q = -1$ phenomenon via homology concentration." *North Carolina State University Algebra and Combinatorics Seminar*, March 2009; *UBC Joint Discrete Math, Topology and Algebra Seminar*, July 2006; *University of Washington Discrete Geometry and Combinatorics Seminar*, May 2006; *University of Wisconsin Combinatorics Seminar*, May 2006; *Ohio State University Combinatorics Seminar*, May 2006; *University of Michigan Combinatorics Seminar*, March 2006.

- "Combinatorics of multigraded Poincaré series for monomial rings." *Philipps-Universität Marburg Combinatorics Seminar (Germany)*, June 2005; *Univ. of Kentucky Combinatorics Seminar*, April 2005; *Univ. of Minnesota Combinatorics Seminar*, March 2005.

- "Small resolutions over toric rings and discrete Morse theory for posets." *Cornell Commutative Algebra Seminar*, November 2010; *Ohio State University Combinatorics Seminar*, March 2005.

- "A $GL_n(q)$ analogue of the partition lattice and discrete Morse theory for posets." *Stanford University Representation Theory Seminar*, Dec. 2004; *Cornell University Combinatorics Seminar*, Nov. 2004; *Park City Mathematics Institute, Program on Geometric Combinatorics*, July 2004; *North Carolina State University Algebra Seminar*, April 2004; *AMS Eastern Sectional Meeting*, Oct. 2003.

- "Discrete Morse functions on posets." *University of Pennsylvania Combinatorics Seminar*, January 2003; *AMS Central Sectional Meeting*, March 2001; *MIT Combinatorics Seminar*, March 2001.