

Richard Ehrenborg
Vita (11/2009)

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Permanent resident of the United States

Research Interests

Combinatorics, coalgebras, geometry, invariant theory, probability, and stochastic processes.

Education

Massachusetts Institute of Technology (8/88–5/93)

- Ph.D. in Mathematics (5/93).
- Dissertation title, *Combinatorial Methods in Multilinear Algebra*.
- Supervised by Professor Gian-Carlo Rota.

University of Stockholm (7/82–8/88)

- B.S. in Mathematics (9/88).
- Minor in Mathematical Statistics.
- Attended in parallel with primary school and high school (7/82–6/87).
- Attended in parallel with military service (6/87–8/88).

Employment

University of Kentucky (8/00–present)

- Professor (7/06–present).
- Sabbatical leave (7/06–6/07).
- First Royster Research Professor (7/04–6/06).
- Associate Professor (8/00–6/04).

Royal Institute of Technology (10/98–6/00)

- Associate Professor.
- On leave the academic year 1998–1999.
- Senior researcher (1/00–6/00).

Institute for Advanced Study (9/98–7/99)

- Member.

Cornell University (7/95–8/98)

- H. C. Wang Assistant Professor.

Université du Québec à Montréal (8/93–6/95)

- Post-doctoral Fellow. Supported by LACIM, Université du Québec à Montréal and CRM, Université de Montréal.

Massachusetts Institute of Technology (8/88–5/93)

- Research Assistant 1/93–5/93 for Prof. Dan Kleitman.
- Research Assistant 6/90–8/90 for Prof. Gian-Carlo Rota.

Swedish Army (6/87–8/88)

- Compulsory military service, detailed to special service as a mathematician.

Visiting Positions

Institute for Pure and Applied Mathematics (IPAM) at UCLA, (10/09)

- Visiting for one week. Workshop on Combinatorial Geometry.

Satellite conference of International Congress of Mathematics 2006, Madrid, Spain (8–9/06)

- Visiting for one week. Workshop on Geometric and Topological Combinatorics.

Massachusetts Institute of Technology (7/06–6/07)

- Visiting Scholar for one year, while on sabbatical.

Banff International Research Station (3/06)

- Visiting for one week. Convex Sets and their Applications.

The Mittag-Leffler Institute, The Royal Swedish Academy of Sciences (3/05)

- Visiting Scholar for one month. Research Program in Algebraic Combinatorics.

Banff International Research Station (8/04)

- Visiting for one week. Combinatorial Hopf Algebra Workshop.

Institute for Advanced Study/Park City Mathematics Institute (7/04)

- Participating for three weeks in the Research Program in Geometric Combinatorics.

Mathematical Sciences Research Institute (11/03)

- Invited speaker and participating in the week-long workshop Combinatorial and Discrete Geometry.

Mathematisches Forschungsinstitut Oberwolfach (4/03)

- Visiting for one week. Workshop in Topological and Geometric Combinatorics.

University of Minnesota (7/02–8/02)

- Visiting Scholar for two weeks.

Institute for Advanced Study (6/02)

- Visiting Member for three weeks.

Massachusetts Institute of Technology (7/01–8/01)

- Visiting Scholar for one month.

Cornell University (6/00–8/00)

- Co-organizer of Research Experiences for Undergraduates Program in Mathematics. Advised four students in research in algebraic combinatorics (6–8/00).

Mathematisches Forschungsinstitut Oberwolfach (4/99)

- Visiting for one week. Workshop in Geometric and Topological Combinatorics.

Massachusetts Institute of Technology (9/98)

- Visiting Scholar for two weeks.

Chalmers University of Technology (5/97)

- Visiting Scholar for three weeks.

Mathematical Sciences Research Institute (10/96 and 1/97)

- General Member for special year in Combinatorics.

AT&T Bell Laboratories, Murray Hill (6/91–8/91)

- Consultant. Worked in the Mathematical Sciences Research Group with Dr. David S. Johnson and Dr. Peter W. Shor.

Ericsson's Computer Science Laboratory (summers of '85,'86,'89)

- Two months each summer. Programmed in modern logic and functional computer languages, such as Prolog and Erlang.

Grants

Bruhat and Balanced Graphs, Manifolds, Partitions and Affine Permutations

- Principal investigator for National Science Foundation grant DMS-0902063. Funded for three years, amount awarded \$156,625.00. (7/09–6/12).

Polytopes: Inequalities for Flag Vectors, Poset Transformations and Complex Polytopes

- Principal investigator for National Security Agency grant H98230-06-1-0072. Amount awarded \$62,691.00 (6/06–5/08).
- During the summer 2006 supported two graduate students to do research.
 - Eric Clark, Inequalities among the exceedance set statistic (6/06–7/06).
 - Michael Slone, Extending the **cd**-index to partially ranked posets (6/06–7/06).
- During the summer 2007 supported two graduate students to do research.
 - JiYoon Jung, Determinant identities for the Dowling numbers (6/07–7/07).
 - Michael Slone, The manifold product of posets (6/07–7/07).

Inequalities for Polytopes and Permutations, and Homology for Newtonian Coalgebras

- Principal investigator for National Science Foundation grant DMS-0200624. Funded for three years, amount awarded \$102,104.00 (6/02–5/05).
- During each of the summers 2002 through 2004 supported one graduate student to do research.
 - Michael Slone, The Hochschild cohomology of interpolation coalgebras (6/04–7/04).
 - Scott Godefroy, New identities for the exceedance set statistic (6/03–7/03).
 - Molly Dunkum, Homology of coalgebras (6/02–7/02).

Inequalities for polytopes and complex zonotopes

- 2004 Summer Faculty Research Fellowship Program. Amount awarded \$4,000.00. (7/04–9/04).
- Supported during the summer 2004 one graduate student to do research.
 - Keith Kohrs, Properties of the beta-invariant of the subspace lattice (7/04–8/04).

Senior Researcher Position

- Senior researcher at the Royal Institute of Technology, Swedish Natural Science Research Council DNR 702-238/98 (1/00–6/00).

Research Experiences for Undergraduates Program

- Co-investigator for National Science Foundation grant DMS-9619681, amount awarded: \$248,788.00 (7/97–8/97).

Rotafest, MIT

- Co-investigator for National Science Foundation grant DMS-9600082, amount awarded: \$12,500.00 (4/96).

- Co-investigator for National Security Agency grant MDA904-96-1-0063, amount awarded: \$10,000.00 (4/96).

Editor

Electronic Journal of Combinatorics

- Editor-in-chief (5/03–4/04).
- Editor (5/04–present).

Order

- Editor (10/05–present).

Invariant Theory

- Joint editor with Joseph Kung on the third volume of Gian-Carlo Rota's collected works.

Organizing Committee

Rotafest, MIT, April 17–20, 1996

- Member of the organizing committee for a conference in honor of Gian-Carlo Rota's 64th birthday. Organized this conference together with Richard Stanley and Neil White.

Special session Algebraic and Analytic Combinatorics, October 28–29, 2006

- Organized the special session Algebraic and Analytic Combinatorics at the AMS sectional meeting in Storrs, CT, together with Margaret Readdy.

Awards

- Post-doctoral fellowship from LACIM, Université du Québec à Montréal and CRM, Université de Montréal (8/93–6/95).
- MIT Applied Mathematics Fellowship (9/88–5/89 and 9/89–12/89).
- Fellowship from Sweden America Foundation, 1988.
- Member of the Swedish team at three International Mathematical Olympiads: Finland 1985; Poland 1986, Third Prize; and Cuba 1987, Third Prize.
- Second place award for the paper "*The Archimedean Tree*" in the final round of European Philips Contest for Young Scientists and Inventors, 1982.

Students

Postdoctoral

- Guoce Xin (9/05–5/06).
- Sergey Kitaev (9/03–12/04).

Doctoral students

- Michael Slone (11/03–4/08).
- Eric Clark (5/06–present).
- JiYoon Jung (6/07–present).

Research Assistants

- JiYoon Jung (6/07–7/07 and 7/08–8/08).
- Eric Clark (6/06–7/06).
- Keith Kohrs (7/04–8/04).
- Michael Slone (6/04–7/04, 6/06–7/06 and 6/07–7/07).
- Scott Godefroy (6/03–7/03).
- Molly Dunkum (6/02–7/02).

Undergraduate Research Students

- Michael Raba, University of Kentucky (6–8/08).
- Debbie Grier, Cornell University (6–8/00).
- Geir Helleloid, University of Wisconsin (6–8/00).
- Michael Levin, Harvard University (6–8/00).
- Adnan Rubai, Binghamton University (6–8/00).
- Harold Fox, Cornell University (6–8/97).
- Dan Johnston, Washington University in St. Louis (6–8/97).
- Rajmohan Rajagopalan, Oberlin College (6–8/97).

Seminar Organizing

Royal Institute of Technology (8/99–5/00)

- Organizer of the Combinatorics Seminar (8/99–5/00).

Institute for Advanced Study (9/98–7/99)

- Organizer of the Working Seminar in Algebraic Combinatorics (10/98–4/99).

Cornell University (7/95–8/98)

- Organizer of the Combinatorics and Algebraic Geometry Seminar (9/95–8/96, 9/97–5/98).
- Cofounder of the Working Seminar in Algebraic Combinatorics (9/96–5/97).

Refereeing

Conferences

- 14th International Conference on Formal Power Series and Algebraic Combinatorics, University of Melbourne.
- 16th International Conference on Formal Power Series and Algebraic Combinatorics, University of British Columbia.
- 20th International Conference on Formal Power Series and Algebraic Combinatorics, Universidad de Talca, Chile.

Journals

- Graphs and Combinatorics
- Discrete and Computational Geometry
- Discrete Mathematics
- Electronic Journal of Combinatorics
- Journal of Algebraic Combinatorics
- Journal of Combinatorial Theory, Series A
- Journal of Computational and Applied Mathematics
- Linear Algebra and its Applications
- Proceedings of the American Mathematical Society

Referee for promotion cases

- Outside letter writer for Dr. William Schmitt's promotion to Full Professor at the George Washington University. (11/06)

Invited Lectures

- To be announced.
 - Invited speaker at 22nd International Conference on Formal Power Series and Algebraic Combinatorics, University of Reykjavik, Iceland, June 2011.
- “The mathematics of juggling”
 - Invited speaker at Southwestern Undergraduate Mathematics Research Conference, University of Texas at El Paso, March 5, 2010.
- “The mathematics of juggling”
 - Morehead State University, 12 November 2009
- “Excedance statistic for affine permutations and skew root polytopes”
 - IPAM, 22 October 2009.
- “Mathematical magic”
 - University of Kentucky High School Mathematics Day, 17 October 2009.
- “An Eulerian poset that lacks an R -labeling”
 - University of Kentucky, 5 October 2009.
- “Toric arrangements”
 - Colloquium, The George Washington University, 20 April 2009.
 - Billerafest, Cornell University, 14 June 2008.
 - Indiana University, 13 November 2007.
 - Michigan State University, 27 October 2007.
 - University of Kentucky, 10 September 2007.
 - AMS meeting, Davidson, NC, 4 March 2007.
- “The mathematics of juggling”
 - Special presentation during Geek Week 2009, University of Kentucky, 8 April 2009.
- “The \mathbf{cd} -index of Bruhat and balanced graphs”
 - AMS meeting, Raleigh, NC, 4 April 2009.
- “The descent set polynomial”
 - University of Kentucky, 23 February 2009.
- “A brief introduction to Coxeter groups and juggling”
 - Graduate colloquium, University of Kentucky, 18 February 2009.
- “Exponential Dowling structures”
 - AMS meeting, Bloomington, IN, 5 April 2008.
 - University of Kentucky, 11 February 2008.
- “A tale of two cities”
 - The Undergraduate Math Club, University of Kentucky, 8 November 2007.
- “The graduate program at the University of Kentucky”
 - Joint 2007 Michigan Undergraduate Mathematics and Midwest Systems Biology Conference, 28 October 2007.

- “Eulerian binomial and Sheffer posets”
 - Northeastern University, 23 April 2007.
 - Cornell University, 28 March 2007.
- “Counting pattern avoiding permutations via integral operators”
 - MIT, 23 February 2007.
 - Brandeis-Harvard-MIT-Northeastern joint mathematics colloquium, 14 September 2006.
 - University of Minnesota, 31 March 2006.
 - Colloquium, University of British Columbia, 24 March 2006.
 - University of Montana, 1 November 2005.
 - Cornell University, 6 October 2005.
 - University of Kentucky, 12 September 2005.
- “Counting pattern-avoiding permutations with Perron and Frobenius”
 - AMS meeting, Storrs, CT, 28 October 2006.
- “The **cd**-index of Gorenstein* lattices”
 - AMS meeting, Cincinnati, OH, 22 October 2006.
- “The **cd**-index, polytopes and Gorenstein* lattices”
 - Workshop on Geometric and Topological Combinatorics - A satellite conference of ICM 2006, Alcalá de Henares (Madrid, SPAIN), 2 September 2006.
 - Banff International Research Station, Canada, 6 March 2006.
- “The Möbius function of partitions with restricted block sizes”
 - University of British Columbia, 21 March 2006.
- “The **cd**-index, polytopes and Gorenstein* lattices”
 - Banff International Research Station, Canada, 6 March 2006.
- “Linear inequalities for flag f -vectors of polytopes”
 - Colloquium, University of Montana, 3 November 2005.
- “The mathematics of juggling”
 - University of Montana, 1 November 2005.
- “Combinatorics and topology”
 - University of Kentucky, 16 August 2005.
- “The Tchebyshev transform”
 - Indiana University, 26 April 2005.
 - University of Minnesota, 15 April 2005.
 - Mittag-Leffler, Sweden, 15 March 2005.
 - University of Kentucky, 1 November 2004.
- “Enumerative properties of Ferrers graphs”
 - Graduate Student Combinatorics Conference, University of Minnesota, Keynote speaker, 17 April 2005
 - University of Kentucky, 22 September 2003.

- “Lifting inequalities for polytopes”
 - Colloquium, University of Linköping, Sweden, 23 March 2005.
 - Workshop in Combinatorial and Discrete Geometry at Mathematical Sciences Research Institute, 21 November 2003.
 - Oberwolfach, Germany, 9 April 2003.
 - Northeastern University, 20 February 2003.
 - MIT, 19 February 2003.
 - University of Kentucky, 13 February 2003.
 - Binghamton University, 9 October 2002.
 - University of Minnesota, 5 August 2002.
- “Juggling”
 - Freshmen writing seminar, University of Kentucky, 26 January 2005.
 - Henry Clay High School, Lexington, 29 April 2003.
 - The Undergraduate Math Club, University of Kentucky, 29 August 2001.
 - The Undergraduate Math Club, Cornell University, 4 September 1996.
 - The Undergraduate Math Club, Cornell University, 20 September 1995.
- “Two theorems and a lemma”
 - The Graduate Colloquium, University of Kentucky, 22 September 2004.
 - The Olivetti Club, Cornell University, 17 September 1996.
- “Geometric transforms of posets and associated coalgebras”
 - Banff International Research Station, Canada, 31 August 2004.
- “Combinatorial conjectures for the holidays”
 - University of Kentucky, 8 December 2003.
- “Inequalities for zonotopes”
 - AMS meeting, Binghamton, NY, 12 October 2003.
- “A brief introduction to polytopes”
 - University of Kentucky, 19 August 2003.
- “The topology of the independence complex”
 - 15th International Conference on Formal Power Series and Algebraic Combinatorics, University of Linköping, 26 June 2003.
- “Lifting the toric g -inequalities for polytopes”
 - 15th International Conference on Formal Power Series and Algebraic Combinatorics, University of Linköping, 25 June 2003.
- “The Greene-Nijenhuis-Wilf proof of the hook formula”
 - University of Kentucky, 20 November 2002.
- “Inequalities for polytopes and some rather recent results”
 - 14th International Conference on Formal Power Series and Algebraic Combinatorics, University of Melbourne, 8 July 2002.
- “Inequalities for polytopes”
 - Washington University in St. Louis, 25 March 2002.
 - AMS meeting, Montréal, Canada, 3 May 2002.

- AMS meeting, Ann Arbor, Michigan 3 March 2002.
- AMS meeting, San Diego, California, 8 January 2002.
- o “Recent progress on inequalities for polytopes”
 - University of Kentucky, 9 October 2001.
- o “Very recent progress on inequalities for polytopes”
 - MIT, 13 August 2001.
- o “Counting faces in the extended Shi arrangement”
 - AMS sectional meeting, University of Kansas, 30 March 2001.
- o “Non-shellable 3-spheres and 3-balls”
 - University of Kentucky, 24 October 2000.
- o “An introduction to shellings”
 - University of Kentucky, 10 October 2000.
- o “Maximizing the descent statistic”
 - Colloquium talk, University of Kentucky, 28 September 2000.
 - University of Stockholm, Sweden, 1 September 1999.
 - Temple University, 27 January 1999.
- o “Two permutation set statistics”
 - Invited speaker at LACIM 2000 Conference, Université du Québec à Montréal, Canada, 8 September 2000.
- o “To shell or not to shell”
 - Research Experiences for Undergraduates, Cornell University, 31 July 2000.
- o “Non-shellable 3-spheres and the bridge index”
 - University of Stockholm, Sweden, 29 March 2000.
 - AMS meeting, Washington, D.C., 22 January 2000.
- o “Inequalities for the **cd**-index”
 - Colloquium talk, University of Georgia, 14 February 2000.
 - Colloquium talk, University of Illinois at Chicago, 11 February 2000.
 - Colloquium talk, College of William and Mary, 8 February 2000.
 - Colloquium talk, University of Iowa, 2 February 2000.
 - Colloquium talk, University of Kentucky, 28 January 2000.
 - Colloquium talk, University of Pittsburgh, 13 January 2000.
 - Colloquium talk, University of California Davis, 10 January 2000.
 - Oberwolfach, Germany, 12 April 1999.
 - AMS sectional meeting, University of Florida at Gainesville, 13 March 1999.
 - University of Pennsylvania, 20 October 1998.
 - MIT, 16 September 1998.
- o “Generic canonical forms for polynomials and tensors”
 - University of Stockholm, Sweden, 25 October 1999.
 - Chalmers University of Technology, Sweden, 2 June 1997.
- o “Three evaluations of the Hankel determinant of exponential polynomials”
 - University of Stockholm, Sweden, 29 September 1999.

- “The **cd**-index”
 - Working Seminar in Algebraic Combinatorics, Institute for Advanced Study, series of three lectures, 7 October through 21 October 1998.
- “Baxter’s theorem: an application of topology to combinatorics”
 - Research Experiences for Undergraduates, Cornell University, 8 July 1998.
- “Tilings”
 - The Undergraduate Math Club, Cornell University, 29 April 1998.
- “Valuations and mixed volumes”
 - Eötvös University, Budapest, Hungary, 17 March 1998.
- “Coproducts and geometric operations”
 - Eötvös University, Budapest, Hungary, 17 March 1998.
- “Polytopes and hyperplane arrangements”
 - Colloquium talk, Dartmouth College, 23 February 1998.
 - Colloquium talk, College of William and Mary, 16 February 1998.
 - Colloquium talk, Michigan State University, 9 February 1998.
 - Colloquium talk, University of Washington, 2 February 1998.
 - Colloquium talk, University of Kansas, 15 January 1998.
 - Colloquium talk, University of Florida at Gainesville, 12 January 1998.
 - Colloquium talk, Georgia Institute of Technology, 13 November 1997.
 - Mid-Atlantic Day for Combinatorics and Probability, Johns Hopkins University, one of four invited speakers, 7 November 1997.
- “The blind bartender’s problem”
 - The Undergraduate Math Club, Cornell University, 19 November 1997.
 - AT&T Bell Laboratories, Murray Hill, 8 August 1991.
- “The **cd**-index of zonotopes and hyperplane arrangements”
 - AMS sectional meeting, University of Montréal, Canada, 27 September 1997.
- “Valuations and the characteristic polynomial”
 - Combinatorics and Algebraic Geometry Seminar, Cornell University, 8 September 1997.
- “Tree counting and Lagrange inversion formula”
 - Research Experiences for Undergraduates, Cornell University, 9 July 1997.
- “The **cd**-index and zonotopes”
 - AMS sectional meeting, Wayne State University, 3 May 1997.
- “Exponential generating functions and the theory of species”
 - Working Seminar in Algebraic Combinatorics, Cornell University, series of four lectures, 3 February 1997 through 3 March 1997.
- “The **c-2d**-index of oriented matroids and hyperplane arrangements”
 - Mathematical Sciences Research Institute, 23 October 1996.
- “The **cd**-index, coproducts and zonotopes”
 - The Tutte colloquium, University of Waterloo, Canada, 12 July 1996.

- “Coproducts and the \mathbf{cd} -index”
 - 8th International Conference on Formal Power Series and Algebraic Combinatorics, University of Minnesota, 25 June 1996 (with Margaret A. Readdy).
 - Rotafest, MIT, 20 April 1996.
 - Geometry and Topology Seminar, Cornell University, 11 April 1996.
- “The game of Nim”
 - The Undergraduate Math Club, Cornell University, 24 April 1996.
- “Apolarity and canonical forms”
 - The Oliver Club, Cornell University, 28 September 1995.
- “Juggling and the affine Weyl group \tilde{A}_n ”
 - Combinatorics and Algebraic Geometry Seminar, Cornell University, 11 September 1995.
- “Juggling and applications to q -analogues”
 - Research Experiences for Undergraduates, Cornell University, 17 July 1995.
 - 6th International Conference on Formal Power Series and Algebraic Combinatorics, DIMACS, Rutgers, 23 May 1994 (with Margaret A. Readdy).
- “Generalizations of Baxter’s theorem”
 - Combinatorics and Algebraic Geometry Seminar, Cornell University, 3 April 1995.
 - Université de Montréal, Canada, 2 November 1994.
 - Università di Milano, Italy, 22 September 1994.
- “Sheffer posets and r -signed permutations”
 - MIT, 8 March 1995.
 - AMS sectional meeting, University of Richmond, 13 November 1994.
 - Royal Institute of Technology (KTH), Sweden, 15 September 1994.
 - Université du Québec à Montréal, Canada, 6 May 1994.
- “Simple and multiplex juggling sequences”
 - Colloquium talk, University of Missouri at Columbia, 14 February 1995.
 - Concordia University, Montréal, Canada, 18 July 1994.
 - University of Pennsylvania, 15 March 1994.
 - MIT, 9 March 1994.
 - Université de Montréal, Canada, 14 February 1994.
- “Juggling patterns”
 - University of Stockholm, Sweden, 12 September 1994.
- “Counting trees on partitions”
 - Université du Québec à Montréal, Canada, 22 October 1993.
 - MIT, 13 November 1992.
- “Colored species, plethysm and Lagrange inversion formula”
 - Université du Québec à Montréal, Canada, 17 September 1993.
- “Plethystic trees and Lagrange inversion formula”
 - MIT, 6 May 1993.
- “Apolarity and canonical forms for homogeneous polynomials”
 - Brandeis, 18 March 1992.

Publications

Book in preparation

- [1] “*Geometric Combinatorics: The ABCD of Enumerating Flags*,” in preparation (with Louis J. Billera and Margaret Readdy).

Refereed journal publications

- [2] “*Heron’s formula from a Pythagoras-type theorem*,” *The Mathematical Gazette* **68** (1984), 124–126.
- [3] “*Apolarity and canonical forms for homogeneous polynomials*,” *European Journal of Combinatorics* **14** (1993), 157–181 (with Gian-Carlo Rota).
- [4] “*Schröder parenthesizations and chordates*,” *Journal of Combinatorial Theory, Series A* **67** (1994), 127–139 (with Miguel Méndez).
- [5] “*A bijective proof of infinite variated Good’s inversion*,” *Advances in Mathematics* **103** (1994), 221–259 (with Miguel Méndez).
- [6] “*Generalizations of Baxter’s theorem and cubical homology*,” *Journal of Combinatorial Theory, Series A* **69** (1995), 233–287 (with Gábor Hetyei).
- [7] “*The blind bartender’s problem*,” *Journal of Combinatorial Theory, Series A* **70** (1995), 249–266 (with Chris M. Skinner).
- [8] “*Sheffer posets and r -signed permutations*,” *Annales des Sciences Mathématiques du Québec* **19** (1995), 173–196 (with Margaret A. Readdy).
- [9] “*The \mathbf{r} -cubical lattice and a generalization of the \mathbf{cd} -index*,” *European Journal of Combinatorics* **17** (1996), 709–725 (with Margaret A. Readdy).
- [10] “*Juggling and applications to q -analogues*,” *Discrete Mathematics* **157** (1996), 107–125, special issue on Algebraic Combinatorics (with Margaret A. Readdy).
- [11] “*On posets and Hopf algebras*,” *Advances in Mathematics* **119** (1996), 1–25.
- [12] “*Playing Nim on a simplicial complex*,” *Electronic Journal of Combinatorics* **3**, R9 (1996), 33pp (with Einar Steingrímsson).
- [13] “*The \mathbf{c} - $2\mathbf{d}$ -index of oriented matroids*,” *Journal of Combinatorial Theory, Series A* **80** (1997), 79–105 (with Louis J. Billera and Margaret A. Readdy).
- [14] “*Mixed volumes and slices of the cube*,” *Journal of Combinatorial Theory, Series A* **81** (1998), 121–126 (with Margaret A. Readdy and Einar Steingrímsson).
- [15] “*On valuations, the characteristic polynomial and complex subspace arrangements*,” *Advances in Mathematics* **134** (1998), 32–42 (with Margaret A. Readdy).

- [16] “*The \mathbf{cd} -index of zonotopes and arrangements*,” in *Mathematical essays in honor of Gian-Carlo Rota* (B. E. Sagan and R. P. Stanley, eds.), Birkhäuser, Boston, 1998, pages 23–40 (with Louis J. Billera and Margaret A. Readdy).
- [17] “*Coproducts and the \mathbf{cd} -index*,” *Journal of Algebraic Combinatorics* **8** (1998), 273–299 (with Margaret A. Readdy).
- [18] “*Maximizing the descent statistic*,” *Annals of Combinatorics* **2** (1998), 111–129 (with Swapneel Mahajan).
- [19] “*On apolarity and generic canonical forms*,” *Journal of Algebra* **213** (1999), 167–194.
- [20] “*Canonical forms of two by two by two matrices*,” *Journal of Algebra* **213** (1999), 195–224.
- [21] “*On flag vectors, the Dowling lattice and braid arrangements*,” *Discrete and Computational Geometry* **21** (1999), 389–403 (with Margaret A. Readdy).
- [22] “*Cutting polytopes and flag f -vectors*,” *Discrete and Computational Geometry* **23** (2000), 261–271 (with Dan Johnston, Rajmohan Rajagopalan and Margaret A. Readdy).
- [23] “*The Hankel determinant of exponential polynomials*,” *American Mathematical Monthly* **107** (2000), 557–560.
- [24] “*A bijective answer to a question of Zvonkin*,” *Annals of Combinatorics* **4** (2000), 195–197.
- [25] “*Flags and shellings of Eulerian cubical posets*,” *Annals of Combinatorics* **4** (2000), 199–226 (with Gábor Hetyi).
- [26] “*Monotonicity of the \mathbf{cd} -index for polytopes*,” *Mathematische Zeitschrift* **233** (2000), 421–441 (with Louis J. Billera).
- [27] “*The excedance set of a permutation*,” *Advances in Applied Mathematics* **24** (2000), 284–299 (with Einar Steingrímsson).
- [28] “*A combinatorial proof of the log-concavity of the numbers of permutations with k runs*,” *Journal of Combinatorial Theory, Series A* **90** (2000), 293–303 (with Miklós Bóna).
- [29] “*Yet another triangle for the Genocchi numbers*,” *European Journal of Combinatorics* **21** (2000), 593–600 (with Einar Steingrímsson).
- [30] “*The toric h -vectors of partially ordered sets*,” *Transactions of the American Mathematical Society* **352** (2000), 4515–4531 (with Margaret Bayer).
- [31] “*The Dowling transform of subspace arrangements*,” *Journal of Combinatorial Theory, Series A* **91** (2000), 322–333 (with Margaret A. Readdy).
- [32] “*Non-constructible complexes and the bridge index*,” *European Journal of Combinatorics* **22** (2001), 475–491 (with Masahiro Hachimori).
- [33] “ *k -Eulerian posets*,” *Order* **18** (2001), 227–236.

- [34] “*A probabilistic approach to the descent statistic,*” *Journal of Combinatorial Theory, Series A* **98** (2002), 150–162 (with Michael Levin and Margaret A. Readdy).
- [35] “*The asymptotics of almost alternating permutations,*” *Advances in Applied Mathematics* **28** (2002), 421–437.
- [36] “*Homology of Newtonian coalgebras,*” *European Journal of Combinatorics* **23** (2002), 919–927 (with Margaret Readdy).
- [37] “*Determinants involving q -Stirling numbers,*” *Advances in Applied Mathematics* **31** (2003), 630–642.
- [38] “*Inequalities for \mathbf{cd} -indices of joins and products of polytopes,*” *Combinatorica* **23** (2003), 427–452 (with Harold Fox).
- [39] “*A conceptual proof of Cramer’s rule,*” *Mathematics Magazine* **77** (2004), 308.
- [40] “*Enumerative properties of Ferrers graphs,*” *Discrete and Computational Geometry*, special issue in honor of Louis J. Billera **32** (2004), 481–492 (with Stephanie van Willigenburg).
- [41] “*Lifting inequalities for polytopes,*” *Advances in Mathematics* **193** (2005), 205–222.
- [42] “*Inequalities for zonotopes,*” in *Mathematical Sciences Research Institute Publication on Combinatorial and Computational Geometry*, (J. E. Goodman, J. Pach and E. Welzl, eds.), Cambridge University Press, Cambridge, England, 2005, pages 277–286.
- [43] “*Decoding the Hamming code,*” *Math Horizons*, special issue on Codes, Cryptography and National Security, **13** (2006), 16–17.
- [44] “*The topology of the independence complex,*” *European Journal of Combinatorics* **27** (2006), 906–923 (with Gábor Hetyei).
- [45] “*Classification of the factorial functions of Eulerian binomial and Sheffer posets,*” *Journal of Combinatorial Theory, Series A* **114** (2007), 339–359 (with Margaret Readdy).
- [46] “*The Möbius function of partitions with restricted block sizes,*” *Advances in Applied Mathematics* **39** (2007), 283–292 (with Margaret Readdy).
- [47] “*Decomposition theorem for the \mathbf{cd} -index of Gorenstein* posets,*” *Journal of Algebraic Combinatorics* **26** (2007), 225–251 (with Kalle Karu).
- [48] “*Exponential Dowling structures,*” *European Journal of Combinatorics* **30** (2009), 311–326 (with Margaret Readdy).
- [49] “*Cyclotomic factors of the descent set polynomial,*” *Journal of Combinatorial Theory, Series A* **116** (2009), 247–264 (with Denis Chebikin, Pavlo Pylyavskyy and Margaret Readdy).
- [50] “*Affine and toric hyperplane arrangements,*” *Discrete and Computational Geometry* **41** (2009), 481–512 (with Margaret Readdy and Michael Slone).

- [51] “*A geometric approach to acyclic orientations*,” Order **26** (2009), 283–288 (with Michael Slone).
- [52] “*Explicit expressions for the extremal exceedance set statistics*,” European Journal of Combinatorics **31** (2010), 270–279 (with Eric Clark).
- [53] “*The Tchebyshev transforms of the first and second kind*,” to appear in Annals of Combinatorics (with Margaret Readdy).
- [54] “*Asymptotics of the Euler number of bipartite graphs*,” to appear in Advances in Applied Mathematics (with Yossi Farjoun).

Submitted papers

- [55] “*Counting faces in the extended Shi arrangement*,” submitted to Transactions of the American Mathematical Society.
- [56] “*The r -signed Birkhoff transform*,” submitted to Transactions of the American Mathematical Society.
- [57] “*Ehrhart-Macdonald reciprocity extended*,” submitted to Contributions to Discrete Math (with Matthias Beck).
- [58] “*The complex of non-crossing diagonals of a polygon*,” submitted to Journal of Combinatorial Theory, Series A (with Benjamin Braun).
- [59] “*The f -vector of the descent polytope*,” submitted to Discrete and Computational Geometry (with Denis Chebikin).
- [60] “*The Frobenius complex*,” submitted to Journal of Combinatorial Theory, Series A (with Eric Clark).
- [61] “*Excedances of affine permutations*,” submitted to Advances in Applied Mathematics (with Eric Clark).
- [62] “*Standard Young tableaux via iterated integrals*,” submitted to European Journal of Combinatorics (with Guoce Xin).

Papers in preparation

- [63] “*A spectral approach to pattern-avoiding permutations*,” in preparation (with Sergey Kitaev and Peter Perry).
- [64] “*Quotient inequalities for Gorenstein* lattices*,” in preparation.
- [65] “*Edge labeled posets*,” in preparation (with Gábor Hetyei and Margaret Readdy).
- [66] “*Level Eulerian posets*,” in preparation (with Gábor Hetyei and Margaret Readdy).

- [67] “*On the Stanley symmetric function of a graph,*” in preparation (with Stephanie van Willigenburg).
- [68] “*Eulerian formal power series,*” in preparation (with Gábor Hetyei and Margaret Readdy).
- [69] “*The \mathbf{cd} -index of Bruhat and balanced graphs,*” in preparation (with Margaret Readdy).
- [70] “*A family of Eulerian posets that lacks R -labelings,*” in preparation (with Margaret Readdy).
- [71] “*Lectures on polynomials,*” manuscript, February 1995 (with Gábor Hetyei and Gian-Carlo Rota).

Refereed conference proceedings and technical reports

- [72] “*Sheffer posets and r -signed permutations,*” Research Report No. 222, May 6th 1994, at Département de Mathématiques et d’Informatique at UQAM (with Margaret A. Readdy).
- [73] “*The \mathbf{r} -cubical lattice and a generalization of the \mathbf{cd} -index,*” Research Report No. 245, March 31st 1995, at Département de Mathématiques et d’Informatique at UQAM (with Margaret A. Readdy).
- [74] “*The \mathbf{r} -cubical lattice and a generalization of the \mathbf{cd} -index,*” Conference Proceedings of 7th International Conference on Formal Power Series and Algebraic Combinatorics (May 1995, Université de Marne-la-Vallée) 173–184 (with Margaret A. Readdy).
- [75] “*Juggling and applications to q -analogues,*” Conference Proceedings of 6th International Conference on Formal Power Series and Algebraic Combinatorics (May 1994, DIMACS/Rutgers) 135–144 (with Margaret A. Readdy).
- [76] “*Mixed volumes and slices of the cube,*” Technical Report No. 1997:31, at Department of Mathematics, Chalmers University of Technology and Göteborg University (with Margaret A. Readdy and Einar Steingrímsson).
- [77] “*Coproducts and the \mathbf{cd} -index,*” Conference Proceedings of 8th International Conference on Formal Power Series and Algebraic Combinatorics (June 1996, University of Minnesota) 151–162 (with Margaret A. Readdy).
- [78] “*The \mathbf{cd} -index of Eulerian cubical posets,*” Conference Proceedings of 7th International Conference on Formal Power Series and Algebraic Combinatorics (May 1995, Université de Marne-la-Vallée) 161–172 (with Gábor Hetyei).
- [79] “*The exceedance set of a permutation,*” Technical Report No. 1998:51, at Department of Mathematics, Chalmers University of Technology and Göteborg University (with Einar Steingrímsson).

- [80] “*Yet another triangle for the Genocchi numbers,*” Technical Report No. 1999:7, at Department of Mathematics, Chalmers University of Technology and Göteborg University (with Einar Steingrímsson).
- [81] “*Counting faces in the extended Shi arrangement $\widehat{\mathcal{A}}_n^r$,*” Conference Proceedings of 13th International Conference on Formal Power Series and Algebraic Combinatorics (May 2001, Arizona State University) 149–158.
- [82] “*Inequalities for polytopes and zonotopes,*” Conference Proceedings of 14th International Conference on Formal Power Series and Algebraic Combinatorics (July 2002, University of Melbourne) 255–265.
- [83] “*The topology of the independence complex,*” Conference Proceedings of 15th International Conference on Formal Power Series and Algebraic Combinatorics (June 2003, University of Linköping) (with Gábor Hetyei), conference cd.
- [84] “*Lifting the toric g -vector inequalities,*” Conference Proceedings of 15th International Conference on Formal Power Series and Algebraic Combinatorics (June 2003, University of Linköping) 164–175.
- [85] “*Classification of the factorial functions of Eulerian binomial and Sheffer posets,*” Conference Proceedings of 18th International Conference on Formal Power Series and Algebraic Combinatorics (June 2006, University of California, San Diego) (with Margaret Readdy), conference cd.
- [86] “*A spectral approach to pattern-avoiding permutations,*” Conference Proceedings of 18th International Conference on Formal Power Series and Algebraic Combinatorics (June 2006, University of California, San Diego) (with Sergey Kitaev and Peter Perry), conference cd.
- [87] “*Affine and toric hyperplane arrangements,*” Conference Proceedings of 20th International Conference on Formal Power Series and Algebraic Combinatorics (June 2008, Universidad de Talca, Chile) (with Margaret Readdy and Michael Slone), conference cd.

Miscellaneous

- [88] Solution to monthly problem 10654, *Pairs with equal squares*, in *American Mathematical Monthly* **107** (2000), page 368.
- [89] Solution to monthly problem 10753, *Leaves of ordered trees*, in *American Mathematical Monthly* **108** (2001), page 873 (composite solution with J. W. Moon).
- [90] Monthly problem 11099, in *American Mathematical Monthly* **111** (2004), page 625–626 (with Matthias Beck and Tom Zaslavsky). The solution appeared in *American Mathematical Monthly* **113** (2006), 464–465.

- [91] Monthly problem 11234, in *American Mathematical Monthly* **113** (2006), page 568 (with Jim Brennan). The solution appeared in *American Mathematical Monthly* **115** (2008), 169–170.
- [92] “*Advertise!*” FOCUS, **26** (2006), August/September issue, number 6, 28–29.

Integer sequences

The following sequences in “The On-Line Encyclopedia of Integer Sequences” by N. J. A. Sloane

- [93] Sequence A6873, *Number of alternating 4-signed permutations*: 1, 1, 7, 47, 497, 6241, 95767, 1704527, 34741217, 796079041, 20273087527, ... (with Margaret A. Readdy).
- [94] Sequence A7286, *Number of alternating 3-signed permutations*: 1, 1, 5, 26, 205, 1936, 22265, 297296, 4544185, 78098176, 1491632525, ... (with Margaret A. Readdy).
- [95] Sequence A7788, *Number of augmented André 3-signed permutations*: 1, 1, 4, 19, 136, 1201, 13024, 165619, 2425216, 40132801, 740882944, ... (with Margaret A. Readdy).
- [96] Sequence A0698, *Number of shellings of an n -cube, divided by $2^n n!$* : 1, 2, 10, 74, 706, 8162, 110410, 1708394, 29752066, 576037442, 12277827850, ... (with Gábor Heteyi).
- [97] Sequence A034428, *Number of permutations on n elements having the descent pattern: up, up, down, up, down, ...*: 1, 1, 3, 9, 35, 155, 791, 4529, 28839, 201939, 1542739, 12767689, 113794603, ... (with Swapneel Mahajan).
- [98] Sequence A108917, *Number of knapsack partitions of n* : 1, 1, 2, 3, 4, 6, 7, 11, 12, 17, 19, 29, 25, 41, 41, 58, 56, 84, 75, 117, 99, 149, 140, 211, 172, 259, 237, 334, 292, 434, ... (with Margaret Readdy).

Teaching Experience

University of Kentucky (8/00–present)

- *Applicable Algebra* Math 340/CS 340 (1–4/10).
- The graduate course *Combinatorics, Commutative Algebra and Topology of Simplicial Complexes* Math 714 (1–4/10).
- *Differential equations* Math 214 (8–12/09).
- *Combinatorics and Graph Theory* Math 415/CS 415 (8–12/09).
- *Applicable Algebra* Math 340/CS 340 (1–4/09).
- The graduate course *Symmetric Functions* Math 714 (1–4/09).
- Large lecture of *Calculus I* Math 113 (8–12/08).
- *Combinatorics and Graph Theory* Math 415/CS 415 (8–12/08).
- *Applicable Algebra* Math 340/CS 340 (1–4/08).
- The graduate course *Enumerative Combinatorics* Math 614 (1–4/08).
- *Differential equations* Math 214 (8–12/07).
- The graduate course *Polytopes* Math 714 (8–12/07).
- Independent study with Eric Clark entitled “Bijective proofs for excedance set statistic” (8–12/07).
- *Applicable Algebra* Math 340/CS 340 (1–4/06).
- The graduate course *Lattice Point Enumeration* Math 714 (1–4/06).
- *Analytic Geometry and Trigonometry* Math 110 (8–12/05).
- The graduate course *Posets and permutations* Math 714 (8–12/05).
- *Applicable Algebra* Math 340/CS 340 (1–4/05).
- The graduate course *Enumerative Combinatorics* Math 614 (1–4/05).
- *Linear Algebra* Math 332 (8–12/04).
- *Combinatorics and Graph Theory* Math 415/CS 415 (8–12/04).
- Independent study with Michael Slone entitled “Homology of Newtonian coalgebras” (1–4/04).
- *Applicable Algebra* Math 340/CS 340 (1–4/04).
- The graduate course *Geometric Probability* Math 714 (1–4/04).
- Large lecture of *Calculus I* Math 113 (8–12/03).
- The graduate course *Polytopes* Math 715 (8–12/03).

- Taught and developed the new undergraduate course *Combinatorics and Graph Theory* Math 415/CS 415 (1–4/03).
- The graduate course *Topics in Linear Algebra* Math 765 (1–4/03).
- Large lecture of *Multivariable Calculus* Math 213 (8–12/02).
- The graduate course *Linear Algebra* Math 565 (8–12/02).
- *Applicable Algebra* Math 340/CS 340 (1–4/02).
- Two sections of *Linear Algebra* Math 332 (8–12/01).
- Large lecture of *Finite Mathematics and its Applications* Math 162 (1–4/01).
- Taught and developed the new undergraduate course *Applicable Algebra* Math 340/CS 340 (1–4/01).
- The graduate course *Enumerative Combinatorics* Math 715 (8–12/00).

Royal Institute of Technology (8/99–12/99)

- *Linear Algebra* (9–10/99).
- *Differential equations and transforms* (9–12/99).
- *Differential and integral calculus* (9–12/99).

Cornell University (7/95–8/98)

- *Multivariable Calculus* Math 222 (2–5/98).
- Taught one section of *Calculus for Engineers* Math 191 and course czar of all four sections (9–12/97).
- *Algebra and Number Theory* Math 332 (9–12/97).
- *Calculus for Engineers* Math 193 (1–5/97).
- Taught and developed the new undergraduate course *Applicable Algebra* Math 336 (1–5/97).
- The graduate course *Topics in Algebra* Math 631 (9–12/96).
- *Honors Calculus* Math 121 (9–12/96).
- Two sections of *Multivariable Calculus* Math 222 (2–5/96).
- Two sections of *Calculus for Engineers* Math 193 (9–12/95).

Massachusetts Institute of Technology (8/88–7/93)

- Mentor for five high school students in Research Science Institute in the MIT Mathematics Department, a joint program between MIT and Center for Excellence in Education (7/93).

- Teaching Assistant for *Introduction to Discrete Applied Mathematics* for Prof. Dan Kleitman (9–12/92).
- Teaching Assistant for graduate *Stochastic Processes* for Prof. Gian-Carlo Rota (2–5/92).
- Teaching Assistant for graduate *Combinatorial Theory* for Prof. Richard Stanley (9–12/91).
- Tutor at Experimental Study Group, MIT, for *Differential Equations* (2–5/91).
- Teaching Assistant for graduate *Stochastic Processes* for Prof. Greta Ljung (2–5/90, 9–12/90).

Committees and Service

University of Kentucky (8/00–present)

Committee work

- Executive committee (9/00–5/01).
- Web committee (9/00–5/01).
- Hiring committee (9/01–5/02).
- Executive committee (9/05–5/06).
- Hiring committee (while on sabbatical) (9/06–5/07).
- Royster research professorship committee (while on sabbatical) (9/06–5/07).
- Promotion and tenure committee (10/08–present).

Service to the graduate program

- Visited Morehead State University and spoke about graduate studies in mathematics at the University of Kentucky, 12 November 2009.
- Faculty stage manager for the Graduate Student Combinatorics Conference March 27–29, 2009.
- Participated in the Joint 2007 Michigan Undergraduate Mathematics and Midwest Systems Biology Conference in order to recruit graduate students to the Department of Mathematics at the University of Kentucky (10/07).
- Prelim committee for the Discrete Math exam (2/03–present).
- Chair of the prelim committee for the Discrete Math (4/04–present).
- Chair of the doctoral committee of
 - Michael Slone, 28 April, 2004 – 11 April, 2008.
 - Eric Clark, February 16, 2009 – present.
 - JiYoon Jung, April 29, 2009 – present.

- The doctoral committees of
 - Jakayla Robbins, 17 April, 2003.
 - Kyoungmi Kim, 21 April, 2003.
 - Laura Schmidt, 22 April, 2003.
 - Robert Riehemann, June 2003.
 - Gareth Bendall, 26 November, 2003.
 - Matt Menzel, 19 April, 2004.
 - Venkata Giruka, 23 September 2004.
 - Philip Busse, 27 April 2006.
 - Patricia Muldoon, October 2006.
 - Daniel Wells, 3 December, 2007.
 - Carlos Nicolas, 7 July, 2008.
- Chair of the masters exams of
 - John Eveland, 24 November, 2003.
 - Jennifer Rowe, 1 December, 2003.
 - Adam Feldhaus, 9 April, 2004.
 - Scott Godefroy, 21 April, 2004.
 - Daniel Wells, 19 April, 2006.
 - JiYoon Jung, 15 April, 2008.
- The masters exams of
 - Cathy Mania, 23 September, 2002.
 - David Harness, 10 April, 2002.
 - Jennifer Rice, 12 April, 2002.
 - Bryson Perry, 14 March, 2003.
 - Ron Williams, 1 May, 2003.
 - Michael Slone, 11 July, 2003.
 - Matthew Brown, 12 April, 2004.
 - Patricia Muldoon, 18 April, 2005.
 - Keith Kohrs, 22 April, 2005.
 - Carlos Nicolas, 17 April, 2006.
 - Matt Zeckner, 6 October, 2008.
- The language exams of
 - Gareth Bendall, March 2001.
 - Jakayla Robbins, April 2001.

Service to the undergraduate program

- Math Club advisor (9/02–12/03).
- Trainer of the Putnam team (9/02–5/03).
- During Arts & Sciences' Geek Week 2006 organized and showed five times the Walt Disney movie "Donald in Mathmagic Land" starring Donald Duck, complete with popcorn (2/06).

- Research project with undergraduate student Michael Raba on a probabilistic method on solving Sudoku puzzles. (6/08–7/08).
- Undergraduate advisor (9/08–present).
- Gave the talk “The mathematics of juggling” during the College of Arts and Sciences’ Geek Week 2009 and demonstrated juggling together with my (fearless) graduate student Eric Clark. This event attracted an audience of size 163 consisting mainly of undergraduates, but also graduate students, visitors and faculty. Lecture posted on YouTube, see also the link http://www.math.uky.edu/~jrge/Mathematics_of_Juggling_2009.html. 8 April, 2009.

Outreach

- Founder and organizer of *Math Movie of Month*, showing six math related movies during the academic year. Duties include choosing the movie program, designing posters, advertising the movies, and running the movies, including a mathematical preshow. The advertising includes writing to nearby local colleges and universities, other departments at the University of Kentucky, and local middle and high schools. See the webpage <http://www.math.uky.edu/~movies>. (8/08–present).
- Organized a session entitled “Mathematical puzzles” for the Cassidy Arts and Science Extravaganza at Cassidy Elementary School. For Kindergarten through 3rd grade. Co-organized with Margaret Readdy, 30 October, 2009.
- University of Kentucky High School Mathematics Day. Gave a magic show for high school students entitled “Mathematical magic”, with my two assistants Eric Clark and JiYoon Jung. 17 October, 2009.
- University of Kentucky High School Mathematics Day. Organized and ran an interactive session on building polyhedra for high school students. 8 November 2008.
- Gave a mathematics talk at the Henry Clay High School, Lexington, 29 April, 2003.

Cornell University (7/95–8/98)

- Faculty advisor of eleven undergraduate students in the College of Arts and Sciences, including four math majors (9/96–5/98).
- Math Club advisor (9/96–5/98).
- Co-organizer of Research Experiences for Undergraduates Program in Mathematics. Advised three students in research in algebraic combinatorics (6–8/97).
- Advanced Placement Committee (8/96–5/97).

Memberships in Professional Organizations

- American Mathematical Society.
- Association for Women in Mathematics.
- Mathematical Association of America.