

Inga Jo Anne Johnson

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- Education** Ph.D. **University of Oregon, Eugene.** Ph.D. in Mathematics, June, 2001. Dissertation “The Effect of Multiplication by 2^k on the Root Invariant.”
M.S. **University of Oregon, Eugene.** Mathematics, June, 1997.
B.A. **Richard Stockton College of New Jersey, Pomona, New Jersey.** Mathematics, June, 1995.
- Academic Positions** **Willamette University, Professor** Fall 2015 – present.
Willamette University, Associate Professor. Fall 2009 – Spring 2015.
Willamette University, Assistant Professor. Fall 2004 – Spring 2009.
University of Rochester, Visiting Assistant Professor. Fall 2001 – Spring 2004.
University of Oregon, Graduate Teaching Fellow. Fall, 1995 – Spring, 2001.
- Research Interests** Knot theory: knot games, pseudo knots, virtual knots. Algebraic and Applied Topology: persistence homology and applications.
- Book** I. Johnson, A. Henrich. An Interactive Introduction to Knot Theory, Dover (2017).
- Book Chapter** [1] I. Johnson, E. McNicholas. Group Examinations in Introduction-to-Proof Courses. Beyond Lecture: Techniques to Improve Student Proof-Writing Across the Curriculum, MAA Notes Series (2015).
- Publications** [8] C. Cericola, I. Johnson, J. Kiers, M. Krock, J. Purdy, J. Torrence. Extending Hypothesis Testing with Persistence Homology to Three or More Groups. *Involve* 11 (1), 27-51, (2018).
[7] A. Henrich, S. Jablan, I. Johnson. The signed weighted resolution set is not a complete pseudoknot invariant. *Journal of Knot Theory and Its Ramifications* 25 (09) 1641007 (2016).
[6] F. Dorais, A. Henrich, S. Jablan, I. Johnson. Isotopy and Homotopy Invariants of Classical and Virtual Pseudoknots. *Osaka Journal of Mathematics* 52 (2), 409-423 (2015).
[5] A. Henrich, I. Johnson. The Link Smoothing Game, *AKCE Int. J. Graphs Comb.*, 9, No. 2 (2012), pp. 145-159.
[4] I. Johnson, S. Powers, C. Starr, C. Trevelyan, C. Webster. Characterizing an infinite family of Frobenius semigroups by filtration. *Journal of Integer Sequences*, vol. **12** (1), 2009, Article 09.1.2.
[3] I. Johnson, J. L. Merzel. A class of left ideals of the Steenrod algebra. *Homology, Homotopy and Applications*, vol. **9** (1), 2007, pp.185–191.
[2] F. R. Cohen, I. Johnson. On the degree two map of a sphere. *Recent Developments in Algebraic Topology.* 83–99 Contemp. Math., **407**, Amer. Math. Soc., Providence, RI, 2006.
[1] I. Johnson. The effect of multiplication by 2^k on the root invariant. *Topology and Its Applications*, **141** (2004) 21–57.
- ♣ Works in progress.
◦ (Submitted for publication) A.Henrich, I. Johnson, J. Ostroff. The Region Smoothing Game. ArXiv:1909.12370 [math.CO]

- (Submitted for publication) I. Johnson. *Pseudoknots*, an entry in The Encyclopedia on Knot Theory (Taylor and Francis)
- (Submitted for publication) I. Johnson. *Gauss Diagrams*, an entry in The Encyclopedia on Knot Theory (Taylor and Francis)

Grants & Awards

2013, Finalist for Pacific Northwest MAA Distinguished Teaching Award. Nominated by Willamette colleagues and students.

2013, June, R. L. Moore Conference Travel Award. Award \$440.

2012 United Methodist Award for Exemplary Teaching and Service. Award \$1200.

2012 Willamette Valley Mathematics Research Consortium for Undergraduates and Teachers, REU-RET site grant renewal with Co-PI Colin Starr. Award \$ 514,268.

2011-2013 Keck iScience Grant Participant. Award \$1500.

2011 Academy for Inquiry-Based Learning Grant. Award \$3500.

2011 Atkinson Faculty Development Award. Award \$1200.

2011 Hewlett Grant Co-recipient. Award \$3,000 for *Examining 100-Level Mathematics Course Offerings: Incorporating High Impact Pedagogy and Experiential Learning*.

2010 Willamette Valley Mathematics Research Consortium for Undergraduates and Teachers, NSF REU-RET site grant with Co-PI Colin Starr. Recommended for funding February 2011, but grant not awarded due to delayed National Science Foundation budgetary decisions by United States Congress.

2008-2009 Diversity Grant: Women in Math, Physics, and Computer Science

2007 Willamette Valley Consortium for Undergraduate Mathematics Research, NSF REU-RET site grant with Co-PI Colin Starr. Award \$491,400.

2006 Hewlett Grant Recipient. Bridge Funding for the Summer Mathematics Undergraduate Research Program.

2007 Willamette University Junior Faculty Leave. Award one semester release from teaching.

2005 Willamette University Merit Award.

2002 National Project NExT Fellow. American Mathematics Society sponsored National NExT Fellow.

2001 University of Oregon Harrison Award Recipient. Awarded for outstanding potential in research.

Undergraduate Research and Scholarship Projects

Mentor to four College Colloquium Students for SSRD 2010 Presentation. I mentored four freshman, Richard Leibing, Candace Hamar, Victoria Smith & Heidi Wolfe, on the presentation of their game *Root-a-bega: An Introduction to Combinatorial Game Theory* that they developed and analyzed as part of my College Colloquium class on games.

Willamette Valley Consortium for Undergraduate Mathematics Research, NSF funded REU-RET site grant. Willamette University 2007 & 2009 & 2014.

- In 2007, I worked with Professor Colin Starr, 3 undergraduates (Jette Petersen, Meghan Flink, and Phan Le), and one teacher (Greg Houser) on an 8-week research project in Number Theory.
- In 2009, I worked with Professor Erin McNicholas, 4 undergraduates (Leo Maloney, Tom Brounstein, Robert Zyskowski, and Aaron Mosher) and a teacher (Cary Takara) on a 8-week research project in Graph Theory.
- In 2014, I worked with Professor Jordan Purdy and 4 undergraduates (Johanna Torrence, Mitchell Krock, Joshua Kiers, and Christopher Cericola) on a 8-week applied mathematics research project on Topological and Statistical Data Analysis.

Summer Mathematics Undergraduate Research Program. Willamette University 2005 & 2006.

- I worked with Professor Colin Starr and mentored three undergraduate students, Charles Trevelyan, Sean Powers, Craig Webster, in 2005 for a six week research project on Frobenius semigroups. This work resulted in a publication.
- I worked with Professor Colin Starr and mentored three undergraduate students, Paige Cudworth, Travis Dailey, Brad Kehr, in 2006 on a six-week research project on Frobenius Semigroups. This project received funding from a 2006 Hewlett Grant.

**Teaching
Interests**

Pedagogy: Inquiry-Based Course Design & the Moore method, collaborative teaching, collaborative and student-centered learning techniques such as using Group Examinations, flipped classrooms.

**Courses
Taught**

Senior Seminar on Knot Theory. Students completed, presented, and L^AT_EX'ed all proofs and exercises in an inquiry-based knot theory textbook that contained only definitions and statements of theorems.

Topology. Compactness, classification of surfaces, Euler characteristic, map coloring, the five-color theorem for S^2 , the fundamental group, and Seifert-van Kampen Theorem.

Real Analysis I & II. Sequences & series, limits, continuous functions, completeness, compactness, connectedness, differentiation, Riemann integral, uniform convergence, power series, Newton's method, the implicit function theorem, spaces of continuous functions, solutions to differential equations.

Foundations of Advanced Mathematics. A course on set theory, functions, equivalence relations, and cardinality with main focus on proof reading and writing.

Linear Algebra. A course in linear algebra emphasizing the connections between matrix algebra, linear systems, and linear transformations with emphasis on theory through proofs reading and writing.

Accelerated Calculus II. Integral calculus, taught as a half semester course.

Sequences and Series. Taylor Series, Fourier Series and applications, taught as a half semester course.

Modeling with Calculus. Modeling and application based modeling course. Topics include Fermi problems, applications of the Buckingham Pi theorem, linear algebra applications to find curves of best fit, and the differential and integral applications of calculus.

College Colloquium: What's in a Game? The Mathematics of Games and Puzzles. A discussion and inquiry-based course with emphasis on writing and problem solving.

College Colloquium: Math in America. An analysis of the history, controversies, and current mathematics education with emphasis on writing and critical thinking.

Discrete Math. Logic, proof techniques, elementary number theory, algorithms, and recursion.

Contemporary Mathematics. A survey of mathematical topics for liberal arts students.

Chaos and Fractals. A discovery of chaos theory and fractals through theory, WinFract, and Mathematica.

Multivariable Calculus and Quest Calculus. Quest Calculus includes proofs and more challenging Calculus problems. Taught from both the Harvard calculus reform textbook and from Stewart.

Calculus for Biology I, II, & Business Calculus I, II. Differential and integral calculus taught from a modeling viewpoint and an economics/finance viewpoint respectively.

Elementary Functions. A pre-calculus class with emphasis on trigonometric functions.

College Algebra. An algebra course in preparation for calculus.

**Pre-College
Education
Development**

2002-2004 Mathematician and Teacher in Participation with Warner School NSF Grant to Deepen Content Knowledge of K-12 math teachers. I have developed and taught courses for K-12 teachers to deepen their content knowledge in mathematics. University of Rochester.

**Academic
Services**

General Education Proposal Writing Group Explore, Engage, Empower and Quest. Governance Council Member. Willamette University, 2017-2018.

Asian Studies Thesis Advisor. Second reader for Taylor Matsumura, 2017.

STEM Grants Group Member. Grant planning and strategy, 2016-2017.

Budget Advisory Committee Member. Willamette University, 2014-2016.

Department of Mathematics Hiring Committee. 2015-2016, search for Statistician cancelled Aug 2016.

Faculty Council Member. Willamette University, 2012-2014.

VP Admission and Communications Search Committee Member. Fall 2012-Spring 2013.

Math Department Visiting Instructor Search Committee Member. Spring 2013.

Pi Day Convocation Speaker. March 14, 2013.

NW5C Workshop Attendee. Skamania Lodge, Fall 2012.

Budget Advisory Committee Member. Willamette University 2010-2011.

Math Department Webwork Administrator. Willamette University 2009-present. Manage and create Webwork course sites for faculty at Willamette and Linfield College.

Presenter in Expanding Your Horizons. A career exploration day for middle school girls. Willamette University, January 2011.

Faculty Resource Committee Chair. Willamette University 2008-2009 & 2009-2010.

Organized Math Department Thursday lunch talks. Seminar for Math Faculty. Each week talks alternated between research presentations and pedagogy discussions. Co-organized with C. Giusti and N. Seaders 2010-2011 & 2011-2012.

Director of Residence Life Search Committee, Faculty Representative. Willamette University 2009-2010.

Department of Mathematics Hiring Committee Member. Willamette University 2005-2006 & 2006-2007 & 2008-2009 & 2009-2010.

Faculty Resources Committee Member. Willamette University 2007-2008.

Math Department Colloquium Organizer. Willamette University, Spring 2009.

Ford Hall Art Committee. Willamette University 2008-2009.

Willamette Committee for Undergraduate Grants and Awards. Willamette University 2005-2007.

Department of Computer Science Hiring Committee Member. Willamette University 2008-2009.

Faculty Advisor for Ultimate Frisbee Club. Willamette University 2006-2008.

Faculty Advisor of Mathematical Contest in Modeling Teams. Two teams of three Willamette undergraduates are preparing to compete in the Mathematical Contest in Modeling (MCM) in February 2006. The MCM is a contest where teams of undergraduates use mathematical modeling to present their solutions to real world problems.

Organizer of Basic Notions Seminar. This monthly seminar was established Spring 2004 at Willamette University. Colleagues with in the Department of Mathematics and invited speakers present their current research and mathematical interests to peers and advanced undergraduate students. 2005-2006.

Assistant for Webwork Mini-course at MAA-AMS Joint Meetings. January, 2003.

**Talks &
Presentations**

- An Interactive Introduction to Knot Theory.** Willamette University Faculty Colloquium. February 2017.
- An Introduction to Topological Data Analysis.** Liberal Arts Mathematics Colloquium, Invited Speaker. October 2016.
- Another Knotty Game: The Link Smoothing Game.** The UnKnot Conference, Invited Speaker. July 2016.
- An Assortment of Knot Games.** MathIly Daily Gatherings, Willamette University. July 2016.
- Topology, Homology & Data.** Willamette Faculty Colloquium Series, Spring 2013.
- Topology, Homology & Data.** Invited Keynote Address at the Northwest Undergraduate Mathematics Symposium, Pacific Lutheran College, Spring 2013.
- The Link Smoothing Game.** Pacific Northwest Mathematical Association of America Sectional Meeting, Willamette University, Spring 2013.
- The Link Smoothing Game.** University of Portland Mathematics Colloquium, April 2012.
- The Link Smoothing Game.** Willamette University Mathematics Colloquium, September 2011.
- The Magic Number that Lives on the Surface of a Doughnut.** Presentations in Expanding Your Horizons, January 2011, a career exploration day for middle school girls.
- Conway's Classification of Rational Tangles.** Invited Speaker, Pacific Lutheran University. April 2008.
- Planting Trees.** Willamette University Mathematics Colloquium. September 2007.
- An Introduction to Homotopy Theory.** Mathematics Colloquium, Willamette University. May 2007.
- Conway's Classification of Rational Tangles.** Invited Speaker, University of Rochester Society of Undergraduate Math Students. February 2007.
- The Nature of Mathematical Research.** Joint presentation with Colin Starr. Willamette Faculty Colloquium, October 2006.
- The degree 2 map for a sphere. Poster presentation.** MAA-AMS Joint Meeting Conference. San Antonio, TX. January 2006.
- On the degree 2 map for a sphere.** University of Oregon Topology Seminar. Winter 2006.
- Group exams in calculus.** Pacific Northwest MAA Conference. University of Puget Sound, Tacoma, Washington. Spring 2005.
- Homotopy theory and the degree 2 map on the sphere.** Pacific Northwest MAA Conference. University of Puget Sound, Tacoma, Washington. Spring 2005.
- An introduction to WeBWorK. (two day seminar)** Pacific Lutheran University. June 2004.
- Multiplication by 2 and the H-space squaring map on $\Omega^k S^{n+k}$.** AMS-MAA Joint Meeting Conference. Phoenix, Arizona, January 2004.
- Loops on the degree 2 map of an odd sphere.** Cornell University Topology Seminar, invited speaker, November, 2003.
- On the degree 2 map for a sphere.** University of Chicago Topology Seminar, invited speaker, November, 2003.
- On the degree 2 map for a sphere.** SUNY Binghamton AMS sectional meeting. Invited speaker in special session honoring Peter Hilton's 80th birthday, October, 2003.
- Loops on the degree 2 map and the H-space squaring map on ΩS^{2n+1} .** University of Rochester Topology Seminar, October, 2003.
- Factorizations of Powers of 2 on Stunted Projective Spaces and the Root Invariant.** Massachusetts Institute of Technology Topology Seminar, invited speaker, November, 2002.
- Stunted Projective Spaces and the Root Invariant.** Topology Seminar at the University of Rochester, Fall 2001.

**Conferences
& Workshops
Attended**

Liberal Arts Mathematics Colloquium October 2016.

PNW MAA Conference and Project NExT Meeting April 2016.

The UnKnot Conference July 2016.

MAA MathFest Portland, OR, August 2014. Advisor to four student presenters.

PIMS: Applied Topology - Methods, Computation and Science 6 May 2014 University of British Columbia, Vancouver, BC.

AMS Western Sectional Meeting Riverside, CA, November 2013.

R. L. Moore Legacy Conference Austin, TX, June 2013.

MAA Sectional Meeting, University of California Riverside November 2013.

NUMS Conference Pacific Lutheran University, April 2013.

MAA PNW Sectional Meeting Willamette University, April 2013.

Cascade Topology Seminar. May 2013 at Portland State University, Portland, Oregon. November 2000 at The University of Oregon, Eugene, Oregon, **Invited Speaker.** May 2000 at Portland State University, Portland, Oregon. October 1999 at The University of British Columbia, Vancouver, British Columbia. May 1999 at The University of Puget Sound, Tacoma, Washington. November 1998 at Boise State University, Boise, Idaho.

NITLE Seminar Teaching to Fail, by Ed Burger. Nov 2012.

AAC&U Institute on High Impact Practices and Student Success June 2012.

MAA-AMS Joint Meetings Conference. Boston, January 2012.

Teaching Modeling Based Calculus Workshop Boston, January 2012.

Mathematics Research Communities Program on Computational and Applied Topology. Snowbird Resort, Utah, June 2011.

Workshop on Inquiry Based Learning. University of Michigan, Ann Arbor, May 2011.

Pacific Northwest MAA Sectional Meeting. Seattle University, April 2010. I co-organized a panel on outreach to local schools and the community.

The UnKnot Conference. Denison University, July 2009.

MAA Mathfest Portland, OR, August 2009. Conference participant and mentor to four undergraduate and one high-school teacher attendee.

MAA-AMS Joint Meetings Conference. Washington D.C., January 2009.

College Colloquium Workshop on Teaching Writing, by Greg Coloumb. Willamette University, May 2009.

MAA Pacific Northwest Sectional Meeting. Linfield College, McMinnville, Oregon. April 2007.

Project NExT Pacific Northwest Sectional Meeting. Linfield College, McMinnville, Oregon. April 2007.

Learning Spaces and Technology Workshop, CIC & NITLE. University of Puget Sound, Tacoma, Washington. March 2007. Attended at the request of Dean Carol Long.

Complex Cobordism and Homotopy Theory: its impacts and prospects. Johns Hopkins University, Baltimore, Maryland. March 2007.

MAA-AMS Joint Meetings Conference. New Orleans, Louisiana. January 2007. San Antonio, Texas. January 2006.

MAA Pacific Northwest Sectional Meeting. University of Puget Sound, Tacoma, Washington. Spring 2005. Invited speaker.

AMS Eastern Sectional Meeting. Invited speaker in special session honoring Peter Hilton's 80th birthday. Binghamton, New York, October 11-12, 2003.

Fields Institute Program on Homotopy Theory and its Applications. University of Western Ontario, London, Ontario September, 2003.

Topology Conference in Honor of John Moore's 80th Birthday. University of Rochester, Rochester, New York, May, 2003.

MAA-AMS Joint Meetings Conference. Phoenix, Arizona, January 2004. Baltimore, Maryland, January 2003. New Orleans, Louisiana, January 2001.

MAA Seaway Sectional meeting. Brock University, St. Catharines, Ontario, Canada, Fall 2001. SUNY Brockport, Brockport, New York, Spring 2002. Rochester Institute of Technology, Rochester, New York, Fall 2003. I attended these conferences with undergraduates from the University of Rochester.

Northwestern University International Conference on Algebraic Topology. March 24-28, 2002.

MAA Mathfest. Burlington, Vermont, July 2002. Boulder, Colorado, July 2003.

Homotopie stable, nilpotence et périodicité. Une introduction (sous la direction scientifique de M. J. Hopkins). An introduction to stable homotopy, nilpotence and periodicity. A five day workshop/conference under the direction of Mike Hopkins. CIRM, Luminy, France, January, 2001.