

# Nancy C. Scherich

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Educator ◦ Researcher ◦ Math-Dancer

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## APPOINTMENTS

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<b>Institute Postdoctoral Fellow</b> , ICERM at Brown University	Current position
<ul style="list-style-type: none"><li>• Full-time research position</li></ul>	
<b>Mentor for Research Experiences for Undergraduates (REU)</b> , Georgia Institute of Technology	Summer 2021
<ul style="list-style-type: none"><li>• Co-organized an 8 week summer intensive REU with weekly colloquium and professional development seminars.</li><li>• Mentored a research project which resulted in a student co-authored paper submitted for publication.</li></ul>	
<b>Postdoctoral Fellow</b> , University of Toronto	2020 — 2021
<ul style="list-style-type: none"><li>• Research Mentor: Dror Bar-Natan</li><li>• Teaching load of 1 course per semester with class sizes 200-400</li></ul>	
<b>Visiting Assistant Professor</b> , Wake Forest University	2019 — 2020
<ul style="list-style-type: none"><li>• Teaching load of 3 courses per semester with class sizes 35+</li></ul>	

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## EDUCATION

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<b>Ph.D. in Mathematics</b> , University of California Santa Barbara, Advisor: Darren Long	2019
<b>M.S. in Mathematics</b> , Oregon State University, Advisor: William Bogely	2013
<b>B.S. in Mathematics</b> , University of California Los Angeles	2011
<b>A.A. in Mathematics</b> , Antelope Valley Community College	2008

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## TEACHING EXPERIENCE

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### Lecturer

- Upper Division Linear Algebra University of Toronto, Winter 2021
- Differential Calculus (taught 7 times) University of Toronto, Fall 2020; Wake Forest University, Fall 2019, Spring 2020
- Integral Calculus University of California Santa Barbara Summer 2014
- College Algebra Oregon State University Summer 2012
- Mathematics for Elementary Teaching University of California Santa Barbara Summer 2017
  - A course for the Education department's credentialing program, taught through collaborative explorations.

**Graduate Teaching Assistant**, University of California Santa Barbara and Oregon State University 2011-2019  
College algebra, differential calculus, integral calculus, vector calculus, group theory, analysis, introduction to proofs, and classical number systems for math education. **Inquiry based learning experience:** I assisted an IBL course on ordinary differential equations. I attended all classes, aided in class discussion and graded all assignments.

**Mentor at Canada/USA Mathcamp** Summer 2015  
A 5-week summer program for talented high school students. I taught one-week classes in point set topology, knot theory, braid groups, Galois theory and the Sylow theorems. I lived in the dorms and served as a residential advisor.

**Instructor for Students in the Summer Institute in Mathematics and Science (SIMS)**, Summer 2014, 2016, 2017  
A 2-week intensive program for incoming freshmen to prepare them for academic life at the University of California Santa Barbara. I taught a course in differential calculus in an uncompromising, condensed classroom environment.

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## PUBLICATIONS

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### Research Papers

1. *Yarn Ball Knots and Faster Computations*, joint with Dror Bar-Natan, Itai Bar-Natan, and Iva Halacheva, 2021 Submitted. arXiv:2108.10923
2. *An Invariant of Virtual Trivalent Spatial Graphs*, joint with Sheri Tamagawa, 2021 Submitted. arXiv:2104.03830
3. *Finite Image Homomorphisms of the Braid Group and its Generalizations*, joint with Yvon Verberne, 2020 Submitted. arXiv:2012.01378
4. *Discrete Real Specializations of Sesquilinear Representations of the Braid Groups*, 2020, Submitted. arXiv:1910.04595
5. *Ribbon 2-knots,  $1+1=2$ , and Duflo's Theorem for arbitrary Lie Algebras*, joint with Dror Bar-Natan and Zsuzsanna Dancso, *Algebr. Geom. Topol.* 20 (7) 3733 - 3760, 2020

6. *A Survey of Grid Diagrams and a Proof of Alexander's Theorem*, Knots, Low-Dimensional Topology and Applications, Springer, 2019
7. *Real Discrete Specializations of the Burau Representation for  $B_3$* , Mathematical Proceedings of the Cambridge Philosophical Society, 1-10, 2018.
8. *A Simplification of Grid Equivalence*, Involve Journal, 2015, vol. 8, no. 5.

### Research Papers with Undergraduate Students

1. *Large 1-systems of Curves in Non-Orientable Surfaces*, joint with Sarah Ruth Nicholls and Julia Shneidman, 2021 Submitted. arXiv:2109.04882

### Expository Papers

1. *A Survey of the Burau Representation*, joint with Jessica Liu, In preparation.
2. *Turning Math Into Dance; Lessons From Dancing My PhD*, Proceedings of Bridges 2018: Mathematics, Art, Music, Architecture, Education, Culture; pg 351-354
3. *The Alexander Polynomial*, Master's Thesis 2013

## GRANTS & FELLOWSHIPS

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• AMS Simons Travel Grant	2020-2022
• AWM-NSF Travel Grant	2019
• UCSB Individualized Professional Skills Grant	2018
• UCSB Academic Senate Doctoral Student Travel Grant	2018
• UCSB Graduate Division Special Fellowship in the STEM Disciplines, full academic year	2017-18
• Research Training Group (RTG) Fellowship UCSB, Spring quarter	2016
• UCLA Alumni Scholar, full tuition scholarship for two years	2009-2011

## MATH-DANCE PROJECTS

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### Representations of the Braid Groups

In the summer of 2017, I made an aerial dance video describing the basics of braid groups and representation theory. This video garnered international attention and can be viewed on my YouTube channel [HERE](#).

<b>Awards:</b> Winner of Science Magazine's <i>Dance Your PhD</i> competition	2017
Official Selection in Raw Science Film festival	2018
Official Selection in Bridges Math Art Films Festival	2018
Honorable mention in UCSB's <i>Art of Science</i> competition	2018

### Algebra, Geometry, and Topology: What's the Difference?

This Math-Dance video describes how the fields of mathematics are different. This video can be found at this link [HERE](#).

<b>Awards:</b> Honorable mention in the NSF <i>We are Mathematics</i> video competition	2019
First place in UCSB's <i>Art of Science</i> competition	2019

### Performative Lectures

*Performative Lecture* is a phrase I coined to describe a new lecture style where I perform aerial dancing in addition to a traditional lecture. These performances are outreach events to engage public interest in math.

<b>Performances:</b> A special event for the UCSB AWM student chapter	May 26, 2018
UCSB Lunch and Learn Series	June 1, 2018

## SERVICE

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### Journal Referee

I have refereed for the following journals: Journal of Mathematics and the Arts, Geometry & Topology, and Involve.

### Volunteer for Women in Science and Engineering (WISE) Mentoring Program, UCSB

Fall 2016-Spring 2019

WISE is a nonprofit campus organization founded to promote equal opportunity for women and girls in science and engineering. I served as a graduate mentor for an undergraduate math student. I met bimonthly with my mentee offering academic and personal support.

### Volunteer for POWERS Math Day

April 2017, Feb 2019

POWERS Math Day is an undergraduate run outreach event for high school and middle school girls interested in math. I served as a graduate student panelist, opening invited speaker, and ran a session on Math-Dance.

**Volunteer Math Consultant for MOXI**

Nov 2017- Aug 2018

MOXI is a children's museum of innovation in Santa Barbara which hosts a workshop on art, craft and hands on creative activities. I helped design four math projects for the workshop in knot theory, string art, minimal surfaces with bubbles, and tessellations.

**Volunteer for Girls Inc.**

March 2017

Girls Inc. is an after school program for middle school girls. I co-hosted a group of girls at UCSB and we taught them how to gather data for the famous Monty Hall math problem in a simplified version of the game show, *Let's Make a Deal*.

**NanoDays Volunteer**

April 2016

NanoDays is part of a nationwide festival of educational programs about nanoscale science and engineering. It is a festival of interactive experiments and displays for children to learn about Nano-science. I hosted a booth about art in science.

**Graduate Student Coordinator for TA Training, UCSB**

Fall 2015

The mathematics department hosts a 1.5 week TA training for incoming graduate students. One faculty member, myself, and another graduate student ran the training together. We facilitated grading simulations, teaching demonstrations, and instructional development.

**TALKS AND PRESENTATIONS**

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**Invited Talks**

- 2021 Spring Southeastern Sectional meeting of the AMS, Special Session on *Groups, Geometry, and Topology*, "Finite image homomorphisms of the braid group and its generalizations"
- 2021 GRAAL seminar in Caen, "Finite image homomorphisms of the braid group and its generalizations"
- 2020 USC Topology seminar, "The Braid Groups and their Representations"
- 2020 Virginia Tech Topology seminar, "The Braid Groups and their Representations"
- 2019 Tech Topology Conference, "The Braid Groups and their Representations"
- 2019 JMM, AMS Special Session on Number Theoretic Methods In Hyperbolic Geometry, "Discrete Representations of the Braid Groups"
- 2018 Australian National University, Quantum seminar, "Discrete Representations of the Braid Groups"
- 2018 University of Melbourne, Australia, Topology seminar, "Discrete Representations of the Braid Groups"
- 2018 Monash University, Australia, Topology seminar, "Discrete Representations of the Braid Groups"
- 2018 University of Sydney, Australia, Algebra seminar, "Discrete Representations of the Braid Groups"
- 2018 Claremont McKenna Topology seminar, "An application of Salem numbers to Representations of the Braid Groups"
- 2018 Oregon State Topology Seminar, "An application of Salem numbers to Representations of the Braid Groups"
- 2017 Loyola University, Chicago, Algebra seminar invited speaker, "An application of Salem numbers to Representations of the Braid Groups"

**Research Presentations**

- 2021 GA Tech REU colloquium, "Introduction to Knot Theory and the Braid Groups"
- 2018 Topology Student Workshop, GA Tech, "Salem Numbers and Braid Group Representations"
- 2018 Knots in Washington conference, "An application of Salem numbers to Representations of the Braid Groups"
- 2018 GSTGC University of Chicago, at Illinois, "An application of Salem numbers to Representations of the Braid Groups"
- 2018 Bridges Math-Art Conference, Stockholm, "Turning Math into Dance; Lessons from Dancing My PhD"
- 2017 WimSoCal, "Mapping the Braid Groups into Lattices"
- 2016 UCSB Topology Seminar, "Mapping the Braid Groups into Lattices"
- 2016 Knots in Hellas Conference, poster presentation "Mapping the Braid Groups into Lattices"
- 2016 USCB Planar algebra seminar, "Intro to grid diagrams and possible applications to planar algebras"
- 2013 Oregon State University, Topology seminar, "The Alexander Polynomial"
- 2012 Oregon State University, Topology seminar, "Grid diagrams and the Alexander Polynomial"
- 2011 UCLA, Topology seminar, "On Grid Equivalence"

**Outreach Talks**

- 2021 Knot at Lunch Lecture Series, "The Braid Groups and Their Representations"
- 2021 GA Tech REU Professional Development Seminar, "Imposter Syndrome"
- 2021 Panelist for the National Math Festival, "Witches of Agnesi"
- 2021 Fairfield University, Undergraduate outreach talk, "A Dancing Introduction to the Braid Groups"
- 2020 Keynote speaker, Florida Women in Mathematics Day at Florida Atlantic University, "A Dancing introduction to the Braid Groups"

- 2019 Davidson College, Math and Coffee Seminar, "Math, Dance, and Braids"
- 2019 MSRI National Math Festival, "A Fine Art of Problem Solving: How Mathematicians Use Braids to Save the Day, One Ribbon at a Time"
- 2019 Power's Math day, Opening speech
- 2017 UCSB AWM student chapter "Coping with Imposter Syndrome"
- 2016 UCSB AWM student chapter meeting, "On Imposter Syndrome"

## CONFERENCES ATTENDED

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Braids and Beyond /Tresses et Perspectives	2021
Spring Southeastern Sectional meeting of the AMS	2021
MSRI Higher Categories and Categorification, Connections for Women,	2020
Joint Math Meetings, Denver	2020
Tech Topology Conference, GA Tech	2019
Expansions, Lie algebras and Invariants, CRM University du Montreal	2019
Joint Math Meetings, Baltimore	2019
Knots in Washington	2019
Bridges Math-Art Conference, Stockholm	2018
Topology Student Workshop, GA Tech	2018
Thin Groups in Number Theory, Geometry and Topology Conference	2018
Knots in Washignton	2018
GSTGC University of Chicago, at Illinois	2018
Joint Math Meetings, San Diego	2018
AAAS annual meeting, Austin Tx	2018
GSAGT, Temple University	2017
AWM Symposium, UCLA	2017
WimSoCal, USC	2017
Joint Math Meetings, Atlanta	2017
Knots in Hellas, Ancient Olympia	2016
WimSoCal, Pomona College	2015
Cascade Topology Seminar, Portland State University	2013