Emily Barnard

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Research Interests

Algebraic combinatorics, particularly lattice theory in connection with Coxeter groups and representation theory.

Employment and Education

Current	Assistant Professor DePaul University, Chicago, IL.	
2017 – 2019	Zelevinsky Research Instructor Northeastern University, Boston, MA.	
2017	Ph.D., Mathematics North Carolina State University, Raleigh, NC.	
2010	B.A., Mathematics (with honors), Economics Northwestern University, Evanston, IL.	

Publications and Peer Reviewed Conference Proceedings

(11) "Dynamical combinatorics and torsion classes."
(with G. Todorov and S. Zhu)
Journal of Pure and Applied Algebra, **25** (2021), no. 9.

(10) "Lattices from graph associahedra and subalgebras of the Malvenuto-Reutenauer algebra."
(with T. McConville)
Algebra Universalis, **82** (2021) no. 2.

(9) "The canonical join complex of the Tamari lattice."
Journal of Combinatorial Theory, Series A, **174** (2020).

(8) "Lattices from Graph Associahedra."
(with T. McConville) *Sem. Lothar. Combin. proc.* **FPSAC** 2019

(7) "The canonical join complex."
Electron. J. Combin. (2019). arxiv: 1610.05137.

(6) "Minimal inclusions of torsion classes."
(with A. Carroll and S. Zhu) *Alegebraic Combinatorics,* **2** (2019) no. 5, pp. 879–901.
arxiv: 1710.08837.

Publications Continued

(5) "The canonical join complex of the Tamari lattice."
Sem. Lothar. Combin. proc. **FPSAC** 2018

(4) "Coxeter-biCatalan Combinatorics."
(with N. Reading) *J. Algebraic Combin.* **47** (2018), no. 2, 241–300. arxiv: 1605.03524.

(3) "Universal geometric coefficients for the four-punctured sphere."
(with E. Meehan, N. Reading, and S. Viel) *Ann. Comb.* **22** (2018), no. 1, 1–44.
arxiv: 1602.03448.

(2) "Coxeter-biCatalan Combinatorics."
(with N. Reading) *DMTCS Proceedings* **FPSAC** 2015

(1) "Universal geometric coefficients for the four-punctured sphere."
(with E. Meehan, N. Reading, and S. Viel) *DMTCS Proceedings* **FPSAC** 2015

Preprints and In Preparation

(2) "Pairwise Compatibility for 2-Simple Minded Collections II:
Preprojective Algebras and Semibrick Pairs of Full Rank." (with E. Hanson).
Preprint available arxiv: 2010.08645.

(1) "Cambrian combinatorics on quiver representations (type $\mathbb{A}$)."
(with E. Gunawan, E. Meehan, and R. Schiffler).
Preprint available arxiv: 1912.02840.

Awards and Conference Support

2021 – 2022	(2)	MSRI Summer Research in Mathematics Two week residency at the Mathematical Sciences Research Institute
	(1)	Faculty Summer Research Grant Award (DePaul University)
2017	(4)	Outstanding Teacher of First Year Engineering Students Award Northeastern University
	(3)	Travel grant from MSRI: Algebraic Combinatorixx 2 Follow-up
	(2)	AWM Advance Grant Support for Algebraic Combinatorixx 2 Workshop
	(1)	Winton Rose Award North Carolina State University Excellence in Research
2016		AMS Travel Grant for Sectional Meeting
2015		Thank-A-Teacher Award

Presentations

2020 – 2021   *Invited Course Teacher - Tamari Lattices and Posets*
Summer School in Algebraic Combinatorics, Université du Québec à Montréal.

The Kreweras Complement on the Lattice of Torsion Classes
Dynamical Algebraic Combinatorics Virtual Workshop, BIRS, Alberta, Canada

Cover Relations in the Lattice of Torsion Classes: Dynamics and Completability
Online seminar on representation theory of finite-dimensional algebra

Completability of 2-term Simple Minded Collections
Discrete CATS Seminar, University of Kentucky (Online)

2018 – 2019   *The Kreweras Complement on the Lattice of Torsion Classes*
30th Meeting on Representation Theory of Algebras,
Université de Sherbrooke, Sherbrooke, Québec, Canada

Graph Associahedra and the Poset of Maximal Tubings

(9) Combinatorics Seminar, University of Michigan, Ann Arbor, MI

(8) Algebra and Combinatorics Seminar, Loyola University, Chicago, IL

(7) FPSAC, University of Ljubljana, Slovenia

(6) CanaDAM, Vancouver, British Columbia, Canada

(5) Special Session on Cluster Algebras and Related Topics,
     AMS Spring Sectional Meeting, University of Connecticut, Hartford, CT

(4) Discrete Math Seminar, University of Massachusetts, Amherst, MA.

(3) Combinatorics Seminar, Université du Québec à Montréal,
     Montréal, QC

(2) Algebra and Combinatorics Seminar, NC State University, Raleigh, NC

(1) Special Session on Algebraic, Geometric,
     and Topological Methods in Combinatorics,
     AMS Spring Sectional Meeting, Northeastern University, Boston, MA

2017 – 2018   *The biCatalan Kreweras Complement*
Special Session on Dynamical Algebraic Combinatorics,
Joint Mathematics Meetings, San Diego, CA

The combinatorics of torsion classes

(4) Special Session on Representation Theory of Algebras,
     CMS Summer Meeting, Fredericton, New Brunswick, Canada

(3) Special Session on Noncommutative Algebra and Representation Theory,
     AMS Spring Sectional Meeting, Northeastern University, Boston, MA

(2) Cluster Algebra Seminar, University of Connecticut, Storrs, CT

(1) Geometry-Algebra-Singularities-Combinatorics Seminar,
     Northeastern University, Boston, MA

Presentations Continued

2017 *Counting and the canonical join representation*
Pick My Brain Seminar, Northeastern University, Boston, MA

The canonical join complex of the Tamari lattice
Algebraic Combinatorixx 2 Workshop, BIRS, Alberta, Canada

Quick Fire Talk: The canonical join complex
Connections for Women: Geometric and Topological Combinatorics, MSRI

2016 *The canonical join complex*

(4) Combinatorics Seminar, Massachusetts Institute of Technology,
   Cambridge, MA

(3) Representation Theory Seminar, Northeastern University, Boston, MA

(2) Special Session Algebraic and Enumerative Combinatorics,
   AMS Fall Sectional Meeting, Bowdoin College, Brunswick, ME

(1) Maurice Auslander Distinguished Lectures and International Conference,
   Woods Hole Oceanographic Institution, Quissett Campus,
   Woods Hole, MA

2015 – 2016 *Coxeter-biCatalan Combinatorics*

(7) Combinatorics Seminar, University of Michigan, Ann Arbor, MI

(6) Combinatorics Seminar, University of Minnesota, Minneapolis, MN

(5) Algebra and Combinatorics Seminar, NC State University, Raleigh, NC

(4) Algebra and Combinatorics Seminar, DePaul University, Chicago, IL

(3) Combinatorics Seminar, Université du Québec à Montréal,
   Montréal, QC

(2) FPSAC, Korea Advanced Institute of Science and Technology
   Daejeon, South Korea

(1) Special Session on Cluster Algebras, Joint Mathematics Meetings,
   San Antonio, TX

Panels and Posters

2020 *Pairwise Compatibility for 2-Simple Minded Collections*
31st Sherbrooke Meeting on Representation Theory of Algebras (Online)

2019 *Jumping into IBL Teaching Panel*
Mathfest, Cincinnati, OH

2018 *The canonical join complex of the Tamari Lattice*
FPSAC, Dartmouth College, Hanover, NH

Teaching Experience

2019 – Present   *Instructor on record*, DePaul University

> (9) MAT 303 Theory of Numbers
> (8) MAT 261 Multivariable Calculus II
> (7) MAT 620 Geometry
> (6) MAT 398 Senior Capstone Seminar
> (5) MAT 680 Real Analysis
> (4) MAT 397 Mathematical Pedagogy: Theory and Practice
> (3) MAT 215 Introduction to Mathematical Reasoning
> (2) MAT 320 Geometry I
> (1) MAT 150 Calculus I

2017 – 2019   *Instructor on record*, Northeastern University

> (3) Combinatorial Mathematics (for math majors)
> (2) Introduction to Mathematical Reasoning (for math majors)
> (1) Calculus II (for science and engineering majors)

2014 – 2016   *Instructor on record*, North Carolina State University

> (3) Finite Mathematics
> (2) Calculus I (for science and engineering majors)
> (1) Calculus I (for life and management sciences)

Service

Present   Mathematical Sciences Undergraduate Advisor, DePaul University

Present   Masters in Pure Mathematics Committee, DePaul University

2019 – Present   Masters in Mathematics Education Committee, DePaul University

2019 – Present   Mathematics Undergraduate Curriculum Committee, DePaul University

Present   Referee, peer-reviewed journals

> (7) *European Journal of Combinatorics*
> (6) *The Electronic Journal of Combinatorics*
> (5) *Minnesota Journal of Undergraduate Mathematics*
> (4) *Algebra Universalis*
> (3) *Annals of Combinatorics*
> (2) *Discrete & Computational Geometry*
> (1) *Journal of Algebra*

Outreach and Mentorship

Spring 2021   *Posets from "Nature"* CSH 10 Year Anniversary Spotlight

Winter 2021   (2) Invited Speaker, AWM Student Chapter, Northeastern University

                  (1) *Math Teaching and Tutoring,* DePaul University Math Club

Fall 2020   *The non-crossing game: Circle, Squares and Triangles...Oh my!*
DePaul University Math Club

Fall 2019   (2) Chicago Teachers Math Circle Speaker

                  (1) DePaul University Math Club Speaker

Summer 2019   *Organizer of the Northeastern University RTG REU*

Paired high-performing undergraduate students with Ph.D. student mentors for experiential learning experience. Together groups prepared research-calibre paper and oral presentation.

Acted as lead administrator for the program, making final recommendations for salary, schedule, and outcomes for undergraduate and Ph.D. participants. Point of contact for graduate school administrator, RTG grant administrator, and department chair.

2017   *Undergraduate Colloquium Presentation: "Dots and Squiggles"*

Introduced the idea of counting mathematical objects using bijective maps. In the talk, we present a counting problem, and the audience helps to construct a bijective solution. We also touch on recent related research.

                              (2) Colloquium,
                                    Trinity College, Hartford, CT
                              (1) The SUM Series,
                                    North Carolina State University, Raleigh, NC

2016 – 2017   *Public Engagement Demonstration: "Polytopia"*

Developed a hands-on demonstration aimed at exposing the general public to convex polytopes. Constructed simple props that were used to build hands-on examples. Demos were specifically aimed at reaching an audience that might not otherwise interact with university researchers.

Summer 2013   *Graduate Research Mentor (REG)*, North Carolina State University

Similar in spirit to an REU, the REG program funded early graduate research projects. Mentors functioned as a bridge between student researchers and their faculty supervisors by organizing meetings, distributing tasks and facilitating discussion.

Selected Activities

2021	Best Practices for Teaching in a Zoom+/Tri-Modal Room, DePaul University Teaching Commons Webinar
2020	Algebra, Geometry and Combinatorics Day (AlGeCom) XX, (virtual) DePaul University
2019	Homological Methods and Tilting Theory of Finite Dimensional Algebras Conference, University of Iowa, Iowa City, IA
2019	Discrete Math Day, University of Massachusetts, Amherst, MA.
2018	Combinatorics and beyond: the many facets of Sergey Fomin's mathematics, University of Michigan, Ann Arbor, MI
2018	PRODUCT Inquiry Based Learning Workshop, MAA Carriage House, Washington D.C.
2018	Inclusive Teaching Workshop for Faculty, Northeastern University, Boston, MA
2017 – 2019	Maurice Auslander Distinguished Lectures and International Conference, Woods Hole Oceanographic Institution, Quissett Campus, Woods Hole, MA
2017 – 2018	Boston Math Teachers' Circle, Harvard University, Cambridge, MA
2017	29th Meeting on Representation Theory of Algebras, Université de Sherbrooke, Sherbrooke, Québec, Canada
2017	Connection for Women Workshop: Geometric and Topological Combinatorics, MSRI, Berkeley, CA
2017	Residence at MRSI: Algebraic Combinatorixx 2 Follow-up, MSRI, Berkeley, CA
2017	Algebraic and Geometric Combinatorics of Reflection Groups Workshop, CRM, Montreal, Canada
2017	Algebraic Combinatorixx 2 Workshop, BIRS, Alberta, Canada
2017	Maurice Auslander Distinguished Lectures and International Conference, Woods Hole Oceanographic Institution, Quissett Campus, Woods Hole, MA
2011 – 2017	Triangle Lectures in Combinatorics, North Carolina
2016	Going Beyond Show-And-Tell: Public Engagement Workshop, North Carolina State University, Raleigh, NC