

**Patrick Chan**  
**Curriculum Vitae**

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<b>EDUCATION</b>	<i>Indiana University Bloomington</i> - Bloomington, IN PhD Student in Mathematics (Advisor: Jim Davis) – PhD Minor in Voice	August 2022-Present
	<i>Loyola University Chicago</i> - Chicago, IL Masters of Science in Mathematics	August 2021-May 2022
	<i>Loyola University Chicago</i> - Chicago, IL Bachelor of Science in Mathematics	August 2018-May 2021
<b>RESEARCH EXPERIENCE</b>	<i>Graduate Research Fellow</i> Department of Engineering Sciences, Loyola University Chicago Supervised by Dr. Vincent Chen <ul style="list-style-type: none"><li>• Model and simulate</li><li>• Design and fabricate solutions for specialized animal testing</li><li>• Mentor Undergraduate and High School Students</li></ul>	Summer 2023 - Present
	<i>Research Assistant, Mathematics</i> Department of Mathematics, Loyola University Chicago Supervised by Dr. Peter Tingley <ul style="list-style-type: none"><li>• Solved for the restrictions on Dyck paths necessary to qualify as a root multiplicity.</li><li>• Created a program that finds root multiplicities in rank three using a quiver variety approach. <a href="#">[Code]</a></li></ul>	Fall 2019 - Spring 2022
	<i>Research Fellow (Carbon Fellowship)</i> Department of Engineering Sciences, Loyola University Chicago Supervised by Dr. Vincent Chen <i>EEG to EMG System Identification</i> <ul style="list-style-type: none"><li>• Processed stroke patient data.</li><li>• Created a Parametric Model which predicts EMG given a EEG input</li></ul>	Fall 2019 - Spring 2022
	<i>EEG Brain Mapping Project</i> <ul style="list-style-type: none"><li>• Administered electrical stimulation while collecting EEG data.</li><li>• Wrote a program that tests correlation between the collected EEG data and the pseudo-random stimulation. (Signal Processing)</li><li>• Writing a program that can test correlation in real-time.</li><li>• Gained CITI Certification for Human Subject Research</li></ul>	
	<i>REU participant</i> Department of Mathematics, Texas A&M University Supervised by Dr. Anne Shiu <i>Algebraic Methods for Computational Biology</i> <ul style="list-style-type: none"><li>• Researched the relation between the closed and open embedding dimension of convex neural codes, introducing the classification of the non-degenerate convex embedding dimension.</li><li>• Researched the geometric criteria for non-closed convexity of neural codes.</li></ul>	Summer 2020

- Researched the identifiability of Linear Compartment Models with a focus on the impact of leaks using the singular locus, SL, method and focusing on dividing edges of a model's SL.
- [Report](#): Relations Between Open and Closed Embedding Dimensions of Neural Codes

FYRE Participant (Sponsored by HHMI) Fall 2018 - Summer 2019

Department of Engineering Sciences, Loyola University Chicago

Supervised by Dr. Vincent Chen

*Mouse's Auditory Reflex Project*

- Worked with load cells and myDaq to design enclosure for mice.
- Collected test data from load cell.
- Guided the programming team on mathematics and statistics.
- Led UNIV 102 Lecture on the unique structures of Aplysia's Nervous Systems using I. Kupfermann's, H. Pinsker's, V. Castellucci's, and E. R. Kandel's paper, *Central and Peripheral Control of Gill Movement in Aplysia*.

## PAPERS & PRE-PRINTS

- P. Chan, Katherine Johnston, Joesph Lent, Alexander Duys De Perez, and Anne Shiu. *Non-degenerate Neural Codes and Obstructions to Closed Convexity*. SIAM Journal on Discrete Mathematics, 37(1):114–145, 2023. Available at [arXiv:2111.04565](https://arxiv.org/abs/2111.04565)
- P. Chan, Katherine Johnston, Anne Shiu, Aleksandra Sobieska, and Claire Spinner. *Identifiability of Linear Compartment Models: The Impacts of Removing Leaks and Edges*. Available at [arXiv:2102.04417](https://arxiv.org/abs/2102.04417)
- P. Chan, and Peter Tingley. [Quiver Varieties and Root Multiplicities in Rank 3](#)

## POSTERS & TALKS

- Topologists and Friends Organized Graduate Seminar “TopFrOGS”
  - *A Wall to Wall Introductions: A storybook view of CTC Wall's construction of an h-cobordism from two of his papers*. August 3rd and 10th, 2025. Bloomington, IN.
  - *Dancing with spheres: a portrait of  $S^2 \tilde{\times} S^2$* . January 30, 2025. Bloomington, IN.
- *The last leg of “On the question of genericity of hyperbolic knots” roadmapped*. Hyperbolic Knots Seminar. March 25, 2025. Bloomington, IN.
- TQFT Learning Seminar. Bloomington, IN
  - *An introduction to (2, 1) TQFTs and Frobenius Algebras*. February 19th, 2025
  - *An introduction to Modular Tensor Categories*. April 16th, 2025
- *Broadening Participation in the Classroom*. Indiana University's Advocates & Allies for Equity: Graduate Student Professional Development Seminar. April 18, 2024. Bloomington, IN.
- *Embedding Dimensions and Geometric Preclusion of Closed Convexity of Neural Codes*. Loyola's Math & Stats Club: Rambler Mathematics Symposiums. April 29, 2021. Online.
- *Degenerate and Non-degenerate Embedding Dimensions of Neural Codes*. Texas A&M Mathematics REU Miniconference. July 21, 2020. Online. [\[Slides\]](#)
- *Relation Between Auditory Stimulation and Reflex*. First Year Research Experience Capstone Conference. June 30, 2019. Chicago, IL. (w/ Dr. V. Chen)

<b>EXPERIENCE</b>	Indiana University Bloomington, Department of Mathematics:	
• Teaching Assistant:		Fall 2022 - Present
<i>MATH-M106: Math of Decision and Beauty</i>		Fall 2022 - Spring 2025
Class covering Perspective Geometry, Game Theory, Graph Theory, Voting Theory, and Symmetry (frieze patterns, $D_n$ , and $C_n$ )		
– Facilitated a flipped classroom.		
– Two hours of pre-scheduled office per week.		
<i>MATH-M125: Pre-Calculus Mathematics</i>		Fall 2022 - Spring 2024
– Created groupworks to flip the classroom.		
Loyola University Chicago, Engineering Department:		
• Graduate Lab Assistant (see Research Experience)		
Loyola University Chicago, Maths and Stats Department:		
• Online Course Assistant:		Spring 2021
<i>MATH 266: Differential Equations and Linear Algebra</i>		
Course lead by Dr. Peter Tingley		
– Ran an hour and a half of office hours per week.		
– Help facilitate group work in class.		
• Teaching Assistant:	Fall 2021 - Spring 2022	
<i>MATH 161: Calculus I</i> (All Sections)	Fall 2021	
Sections lead by Dr. Eric Chang, Dr. John Del Greco, Dr. Antony Giaquinto, Dr. Aaron Lauve, and Dr. Darius Wheeler.		
– Run four hours of standard office hours		
– Pioneered "Enrichment", an hour long inquiry based learning activity which runs four times a week designed to let students better class material and expose them to higher level math concepts. (Students are getting to explore Vector Calculus, Delta-Epsilon Proofs, and Parameterization and Reparameterization of a Curve among other fun topics!)		
<i>MATH 201: Discrete Math &amp; Number Theory</i>	Spring 2022	
Course lead by Dr. Carmen Rovi		
– Run one and a half hours of office hours.		
– Assisted in grading homework, tests, and quizzes.		
– Assisted in teaching L <sup>A</sup> T <sub>E</sub> X.		
– Helped assign and facilitate student projects.		
<b>MathILy</b> "serious Mathematics infused with Levity":		
A five-week intensive summer program for gifted high schoolers to learn undergraduate and graduate level mathematics through <a href="#">inquiry-based learning</a> .		
• PRiME (Protector and Responder in the MathILy Environment):	Summer 2021	
– Handled paperwork, monitored student well-being, ran social activities, and helped critique student write-ups.		
– assist in facilitating group work.		
– Co-taught a week-long course on Complex Analysis, and another on Game Theory.		
Loyola University Chicago, Writing Center:		
• Undergraduate Tutor	Fall 2019 - Spring 2021	

	<ul style="list-style-type: none"> <li>• Member of The Research and Development Subcommittee</li> <li>• STEM Outreach</li> </ul>	Fall 2019 - Spring 2021 Spring 2020 - Spring 2021
<b>OTHER</b>	Graduate Director of Lab of Experimental Mathematics and Math Applications “LEMMA” (Formerly Lab of Geometry at IU “LOG(IU)”) Fall 2025-Present	
	Lab of Geometry at IU “LOG(IU)”: Mentoring a reading course for undergraduates with a focus on geometry based projects with mid- and end- of-semester student presentations.	Fall 2023 - Spring 2025
	<ul style="list-style-type: none"> <li>• Ran Inquiry-Based Classes</li> <li>• (Fall 2023 Project): Fundamental Group, Covering Spaces, and the Galois Correspondence.</li> <li>• (Spring 2024 Project): Visualizing <math>D^n</math> and <math>S^n</math>, Charts and Atlases, Handlebody Decomposition, and Surgery Theory.</li> <li>• (Fall 2024 Project): Knot Theory focusing on knots that arise from crocheting.</li> <li>• (Spring 2025 Project): Quilting covering spaces. Basic group theory, homology, and covering spaces.</li> </ul>	
	Sprouts’ Bloomington Math Circle: Co-pioneered and Co-lead with Julia Plavnik Once a month math activity targeted towards pre-K through 2nd grade students, to help them develop mathematical thinking!	Fall 2025 - Present Fall 2025-Present
	Bloomington Math Circle: Co-lead with Samantha Duckworth Assisted (Program lead by Ayelet Lindenstrauss & Michael Larsen) Weekly meetings with elementary school students (3rd through 6th grade) teaching higher level math concepts through activities. (e.g. modular arithmetic, similar triangles, proof by induction, etc.)	Fall 2024 - Present Fall 2025-Present Fall 2024 - Spring 2025
	Paper Referee for IEEE EMBS Conference on Neural Engineering (NER) 2025	
	Graduate Student Topology and Geometry Conference Organizer	2025
	<ul style="list-style-type: none"> <li>• FIScal Handler Topologically Allied Conference Organizer (FISH TACO)</li> <li>• HOspiTality CORrespeNDent Topologically Allied Conference Organizer (HOT CORN TACO)</li> </ul>	
	Math Quests Program Gail Borden Public Library I created and taught a program at my local library to provide active learning classes for 3 <sup>rd</sup> – 6 <sup>th</sup> grade students covering game theory (introduction to combinatorial and matrix games) and vectors (arithmetic and projections).	Summer 2025
	Seminar organizer of Visualizing Mathematics at Indiana University	Fall 2022