

# Matthew Andres Moreno

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Biomedical and Physical Sciences Building

567 Wilson Road Room 1441

East Lansing, MI 48824

## Education

Dual Ph.D., in Computer Science and Ecology, Evolutionary Biology, & Behavior (GPA: 4.0/4.0)

Expected: May 2022

Research Advisor: Dr. Charles Ofria

Michigan State University, East Lansing, MI

Bachelors of Science in Mathematics, Computer Science (GPA: 3.96/4.0)

May 2017

Minor in Chemistry

University of Puget Sound, Tacoma, WA

## Skills

Programming Languages: Python, Java, C, C++, OpenCL, Prolog, Haskell

Miscellaneous: L<sup>A</sup>T<sub>E</sub>X, Matlab, SageMath, Git

## Academic Awards

- Recipient of National Science Foundation Graduate Research Fellowship (national award; 17% acceptance rate; 2018)
- Recipient of Blake and Mary Krueger University Distinguished Fellowship (institutional award; 0.2% acceptance rate; 2017)
- Recipient of BEACON Science and Technology Center Top Up Fellowship (departmental award; 2017)
- COMAP Mathematical Competition in Modeling Finalist (international award; 0.7% acceptance rate; 2017)
- Recipient of National Science Foundation Graduate Research Fellowship Program Honorable Mention (national award; 2017)
- Recipient of Edward Goman Outstanding Senior Award (departmental award, mathematics and computer science; 2017)
- Recipient of Roderick MacArthur Award for an Outstanding Honors Thesis Presentation (departmental award; 2017)
- Washington Consortium for the Liberal Arts College Essay Contest Campus Finalist (institutional award; 2017)
- Recipient of Great Lakes National Scholarship Program Award (national scholarship in STEM; 2016-2017)
- Recipient of James R. Slater Phi Beta Kappa Award (institutional award; 2016-2017)
- Recipient of Puget Sound Association of Phi Beta Kappa Scholarship (regional essay competition; 2016-2017)
- Recipient of Honors Alumni Scholarship (departmental award; 2015-2016, 2016-2017)
- Recipient of Thomas and Hilda Jack (2014-2015), Sprenger (2015-2016, 2016-2017), and McKnight Memorial (2016-2017) Scholarships in chemistry (departmental awards)
- Recipient of McGill Family (2015-2016), McKnight (2015-2016), and Thomas and Hilda Jack (2016-2017) Scholarships in mathematics (departmental awards)
- Recipient of Beta Theta Pi Men of Principle Scholarship (institutional award; 2014-2015)
- Recipient of University of Puget Sound Trustee Scholarship (institutional award; 2013-2017)
- Dean's List (institutional award; Spring 2014-Spring 2017)
- Member of Otis C. Chapman Honors Program (2013-2017)
- Member Phi Beta Kappa, Pi Mu Epsilon, Phi Kappa Phi, Upsilon Pi Epsilon

## Projects and Research Experience

Otis C. Chapman Honors Thesis — University of Puget Sound, Tacoma, WA

Fall 2016, Spring 2017

- *Student Researcher*

- Conducted a review of evolutionary computing literature and synthesize a theoretical analysis of evolvability in collaboration with advisor Dr. America Chambers and reader Dr. Adam Smith
- Performed computational experiments with Genetic Regulatory Network models to probe the relationship between phenotypic plasticity and evolvability.
- Prepared and delivered general-audience oral presentations at NW Honors Symposium and at the University of Puget Sound.

Software Engineering Term Project — University of Puget Sound, Tacoma, WA

Fall 2016

- *Student Team Member*

- Collaborated with two other students to develop a full-stack web service leveraging the MEAN.JS framework.
- Designed and developed an idea journal service that collects and displays metadata to help users understand where, when, and how they are most creative.

Mathematical Biosciences Institute (MBI) Research Experience for Undergraduates — Newark, NJ

Summer 2016

- *Student Researcher*

- Designed and numerically evaluated an individual-based set of differential equations to model the foraging behavior of ants over uneven terrain, analyzed predictions of the model over various experimental conditions.
- Collaborated with advisors Dr. Jason Graham and Dr. Simon Garnier in the Swarm Lab at the New Jersey Institute of Technology to develop and execute project.
- Prepared and delivered oral and poster presentations at a capstone conference in Columbus, Ohio.
- Participated in seminars and workshops on mathematical biology coordinated by MBI at The Ohio State University.

COMAP Mathematical Contest in Modeling — Tacoma, WA

Spring 2015, 2016, 2017

- *Contest Participant*

- Collaborated in a small team of three students for four days to develop a mathematical model in response to a prompt.

- Communicated results in a journal-style paper describing our model and outlining recommendations to policy makers.
- In 2017, developed a model of vehicular traffic in the greater Seattle area to assess the impact of self-driving cars on commuter travel delays. Our model predicted that, in certain areas, designating lanes for exclusive use of autonomous would become advantageous once these vehicles constitute approximately 5% of traffic volume. Our team received a “Finalist” designation in the competition, ranking among the top 11 of 1,527 participating teams.
- In 2016, developed a model of satellite fragmentation events and the subsequent disbursement of debris in orbit to investigate the feasibility of quick-response efforts to neutralize debris generated by satellite explosions and collisions; our model suggested that, although technically feasible, such efforts would be economically impractical without a significant reduction in launch costs. Our team received received an “Honorable Mention” designation in the competition.
- In 2015, developed an epidemiological model to investigate the spread of Ebola virus disease and make recommendations on vaccine distribution; our model suggested that regional travel restrictions would not significantly curb the Ebola epidemic in West Africa and that efficient distribution of any vaccination should be prioritized over uniform or widespread distribution.

NASA Undergraduate Research Scholarship — Tacoma, WA

Summer 2015

- *Student Researcher*

- Designed, applied for grant funding, and carried out project to develop algorithms for automated extraction of mouse ultrasonic vocalizations from noisy recordings in collaboration with advisor Dr. Adam Smith.
- Developed and tested filtering algorithms inspired by the Sobel Edge detection method that, after being trained on human-annotated spectrograms of mouse vocalizations, distinguish between true mouse vocalization signals and background noise, achieving 75% accuracy at 25% recall.
- Presented results and methodology at a poster session on campus attended by faculty, summer research students, and other students.

US Department of Agriculture Horticultural Crops Research Unit — Corvallis, OR

Jun. 2013 – Jun. 2017

- *Biological Science Aide*

- Collected data for patent applications, performed plant propagation, assisted with field maintenance.

## Publications

Matthew Andres Moreno and Charles Ofria. *Toward open-ended fraternal transitions in individuality*. *Artificial Life*. 2019 25(2) 117-133.

Matthew Andres Moreno and Charles Ofria. *Understanding Fraternal Transitions in Individuality*. The Third Workshop on Open-Ended Evolution at ALIFE 2018. 2018.

Matthew Andres Moreno, Wolfgang Banzhaf, and Charles Ofria. *Learning an Evolvable Genotype-Phenotype Mapping*. Proceedings of the Genetic and Evolutionary Computation Conference. 2018 983-990.

Rex Cole, Valera Peremyslov, Savannah Van Why, Ibrahim Moussaoui, Ann Ketter, Renee Cool, Matthew Andres Moreno, Zuzana Vejlupkova, Valerian Dolja, John E Fowler. *A Broadly-Conserved NERD Interacts With The Exocyst To Affect Root Growth And Cell Expansion*. *Journal of Experimental Botany*. 2018 69(15) 3625-3637.

## Presentations

Alexander Lalejini and Matthew Andres Moreno. *Guest Lecture: Digital Evolution*. CSE 848: Survey of Evolutionary Computation, Michigan State University. October 2019.

Matthew Andres Moreno. *Empirical: a C++ library to support efficient, reliable, and accessible scientific software*. CppCon Poster Session, Aurora, CO. September 2019.

Matthew Andres Moreno. *A Digital Framework for Fraternal Transitions in Individuality*. Evolution of Complex Life Poster Session, Atlanta, GA. May 2019.

Alexander Lalejini and Matthew Andres Moreno. *Evolving Signal-driven Digital Organisms with SignalGP*. Evolution of Complex Life Poster Session, Atlanta, GA. May 2019.

Matthew Andres Moreno. *Understanding Fraternal Transitions in Individuality*. BEACON Seminar, East Lansing, MI. September 2018.

Matthew Andres Moreno. *Learning an Evolvable Genotype-Phenotype Mapping*. BEACON Congress, East Lansing, MI. August 2018.

Matthew Andres Moreno. *Understanding Fraternal Transitions in Individuality*. The Third Workshop on Open-Ended Evolution at ALIFE, Tokyo, Japan. July 2018.

Matthew Andres Moreno. *Plasticity and Evolvability in a Genetic Regulatory Network Model*. ALIFE Poster Session, Tokyo, Japan. July 2018.

Matthew Andres Moreno. *Learning an Evolvable Genotype-Phenotype Mapping*. The Genetic and Evolutionary Computation Conference, Kyoto, Japan. July 2018.

Matthew Andres Moreno. *Plasticity and Evolvability in a Genetic Regulatory Network Model*. BEACON Congress Poster Session, East Lansing, MI. August 2017.

Matthew Moreno. *Investigating the Relationship Between Plasticity and Evolvability in a Genetic Regulatory Network Model*. Math/CS Day, University of Puget Sound. April 2017.

Jordan Fonseca, Jesse Jenks, and Matthew Moreno. *MCM: Impact of Autonomous Vehicles on Seattle Traffic*. Math/CS Day, University of Puget Sound. April 2017.

Matthew Moreno. *COMAP Mathematical Competition in Modeling 2017*. Spring Experiential Learning Symposium, University of Puget Sound. April 2017.

- Matthew Moreno. *Evolvability and Plasticity in a Genetic Regulatory Network Model*. Math & Computer Science Department Seminar, University of Puget Sound. April 2017.
- Matthew Moreno. *Modeling the Collective Behavior of Ants on Uneven Terrain*. Phi Sigma Undergraduate Research Symposium, University of Puget Sound. April 2017.
- Matthew Moreno. *Evolvability: What Is It and How Do We Get It?*. Otis C. Chapman Honors Program Thesis Presentation, University of Puget Sound. March 2017.
- Matthew Moreno. *Modeling the Collective Behavior of Ants on Uneven Terrain*. Joint Mathematics Meetings, Atlanta, GA. January 2017.
- Matthew Moreno. *Modeling Ant Foraging on Uneven Terrain*. Elements Science Magazine, University of Puget Sound. December 2016.
- Matthew Moreno. *Evolvability in Evolving Artificial Neural Networks*. NW Honors Research Symposium, Seattle Pacific University. November 2016.
- Matthew Moreno. *Modeling the Collective Behavior of Ants on Uneven Terrain*. Fall Poster Symposium, University of Puget Sound. September 2016.
- Matthew Moreno. *Modeling the Collective Behavior of Ants on Uneven Terrain*. Undergraduate Capstone Conference, Mathematical Biosciences Institute at The Ohio State University. August 2016.
- Matthew Moreno and Becky Hanscam. *Relieving the Space Jam: Assessment of a Quick-Response Satellite Mission to Neutralize Debris from Orbital Fragmentation Events*. Math/CS Day, University of Puget Sound. April 2016.
- Matthew Moreno. *Automated Extraction of Mouse Vocalizations from Noisy Recordings*. Fall Poster Symposium, University of Puget Sound. September 2015.
- Matthew Moreno. *Mathematical Contest in Modeling: Eradicating Ebola*. Math/CS Day, University of Puget Sound. May 2015.

### STEM Community Activities

- Michigan State University, PyGame workshop co-lead instructor (2018, 2019)
  - Prepared and co-instructed a one week intensive introduction to Python and video game design for high school students.
  - Worked one-on-one with students to design video games for live demonstration at a end of the week symposium and tackle programming challenges along the way.
- Macdonald Middle School, assistant in general and intervention mathematics classrooms (2017-2018)
  - Worked four hours weekly in a sixth grade geometry classroom and a seventh grade math intervention classroom.
  - Worked one-on-one and with small groups of students outside of the classroom to help students keep up with class material or cover new topics.
  - In the classroom, assisted students with questions and worked one-on-one to keep students engaged with class material.
- BEACON Elementary Science Nights outreach at Donley, Marble, Whitehills, Glencairn, Murphy, Hiawatha, and Beagle Elementary Schools (2017-2018)
- BEACON outreach at MSU Science and Engineering Festival (2018)
  - Along with other NSF BEACON members, led hands-on activities to engage kids with key evolutionary ideas like natural selection and natural history.
- University of Puget Sound, computer science departmental mentoring program co-coordinator (2017)
  - Recruited upperclassmen mentors to lead small groups of underclassmen in computer science activities.
  - Planned and led social, brain teaser, and coding activities.
  - Publicized program through departmental announcement, posters, and classroom visits.
- Mount Tahoma High School, tutor (2016)
- University of Puget Sound Access Services, access coach for Tuesday Night Tutoring (2016)
  - Met with local middle and high school students for two hours weekly in an informal helproom setting on the University of Puget Sound campus.
  - Tutored homework material, shared study skills, and worked to make higher education feel approachable by building relationships with students and discussing college life.
- Oakland High School, volunteer (2016)
  - Worked with Communities in Schools for two hours weekly at a credit-recovery-focused alternative high school in Tacoma, WA.
  - Co-led an after-school Homework Club, aiming to help students complete assignments and feel more connected to the school.
  - Served as a classroom assistant, answering student questions and keeping students engaged with class material.
- Wilson High School, AP Tutor (2014)

### Miscellaneous Community Activities

- Puget Sound Wind Youth Wind Ensemble, coach (2015-2016)
  - Played alongside local high school oboists in ensemble rehearsal and concert.
  - Planned and led sectional rehearsals, working to develop individual technique, section coordination, and social connections.
- National Conference on Peer Tutoring in Writing, session chair and volunteer (2016)
- Jason Lee Middle School Access to College Days, student panelist (2016)
- University of Puget Sound Office of Donor Relations, student speaker (2016)
- University of Puget Sound Student Accessibility and Accommodation, note taker (2015, 2016)

## Employment

Summer Research Opportunities Program (SROP) — East Lansing, MI

May 2019 - July 2019

- *Writing Facilitator*

- Led weekly chalk talk sessions for sixteen students to practice and iteratively develop the foundation for their final presentations, providing verbal coaching and written feedback.
- Prepared written feedback on iterative drafts of student documents: annotated bibliography, resume, personal statement, and final research paper.
- Held weekly one-on-one meetings with eight students to check in on their personal wellbeing, make sure they were receiving adequate support from their research group, plan for upcoming deadlines, outline new documents, and discuss feedback on draft documents.
- Cohort consisted of majority underrepresented students.

University of Puget Sound Center for Writing, Learning, & Teaching — Tacoma, WA

Sept. 2015 – May 2017

- *Tutor and Academic Consultant*

- Helped mathematics students work through assignments, led study sessions to prepare students for examinations, and provided a safe and supportive environment to discuss frustrations and build self-confidence.
- Conducted academic advising appointments, working with students develop organization, communication, and time-management skills, particularly in the context of executive function or other impairments.
- Liaised with faculty members to discuss coursework and support students.
- Developed, led, and participated in professional development activities for student staff.

University of Puget Sound Mathematics & Computer Science Department — Tacoma, WA

Sept. 2014 – May 2017

- *Tutor and Grader*