THE UNIVERSITY OF ARIZONA
COLLEGE OF SCIENCE
Mathematics

MATHEMATICS

IN THIS ISSUE

Fall 2016
Volume XVI, Single Issue

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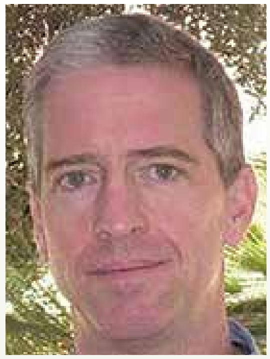
View from the Chair



Another busy and exciting year is underway in the Mathematics Department. I can only mention a few highlights here. Elsewhere in this newsletter you will find the feature article by Joe Watkins on non-hereditary gene mutations and articles by Jen Eli on facilitating group work through Complex Instruction, by Kevin Lin on mathematics and the brain, and by Bill Velez on the undergraduate mathematics major.

Thanks to generous support from the College of Science, the Department has created a new postdoctoral program that will support up to twenty postdocs in residence at one time! This year we have 11 new postdocs joining us as part of this program. We also have three new assistant professors, two new instructors, and five new staff and appointed personnel. You will find short bios for these new colleagues in this newsletter. As a highlight of outstanding faculty service, Oma Hamara retired this Fall after over fifty years on the faculty!

I cannot possibly list all of the awards and grants that our faculty have garnered over the past year, but here are a few. Matti Morzfeld was one of two faculty at UA to receive a Sloan Research Fellowship. Pham Tiep was appointed as a Clay Senior Scholar to participate in a program at EFPL in Lausanne in Fall 2016, and he will be the lead organizer for the program "Group Representation Theory and Applications" to be held at MSRI in Spring 2018. PI Cynthia Anhalt and co-PI's Marta Civil, Jen Eli and Rebecca McGraw were awarded a 1.2 million dollar Robert Noyce Award from NSF to increase the number of mathematics teachers graduating from the Secondary Mathematics Education Program. Helen Zhang was named a Fellow of the Institute of Mathematical Statistics. Finally, Birkhauser has published a collection of some of Rabi Bhattacharya's many influential papers as a book.

March will be a busy month for conferences here. The 20th Arizona Winter School on "Perfectoid Spaces" will be held in Tucson in March 2017 along with Southwestern Group Theory Day 2017. The first joint meeting of the School of Mathematical Sciences with the Centro de Investigación en Matemáticas (CIMAT) was held in Guanajuato last spring, and the second one will be held here in March 2017. Looking farther into the future, the 6th International Conference on Mathematical Modeling and Analysis of Populations in Biological Systems will be held in Tucson in 2017.

It is impossible to thank all our generous financial supporters, but I will mention one recent new endowment. Thanks to very generous support from John and Diane Patience, the Thomas M. and Candace C. Grogan Endowed Fund will provide support for undergraduates, graduate students, and eventually postdocs in the Mathematics and Chemistry/Biochemistry Departments. We expect to award the first fellowship this Spring, and the next newsletter will have more on this wonderful donation.

Finally, a bit of déjà vu: our former Department Head, Ken McLaughlin, left the U of A this past summer. I want to thank Rob Indik for serving as Acting Head following Ken's departure. A search for a new Department Head is underway, and I wish that process a successful and speedy conclusion.

Tom Kennedy, *Professor of Mathematics and Interim Head.*

Contact him at: **tgk@math.arizona.edu**

The 20th annual Arizona Winter School (AWS) on "Perfectoid Spaces" is coming up in March. At the AWS, arithmetic geometry Ph.D. students from around the world attend distinguished mathematicians' lectures by day and work collaboratively and intensely on research projects by night.

BIOGRAPHIES

Tenure-track Faculty

Calvin Zhang, a tenure-track Assistant Professor, does research in mathematical biology. In particular, he is interested in using methods from mathematics and computing to study synaptic transmission and sensorimotor systems. Topics of recent interest are neurotransmitter release and rhythmic motor pattern generation. This research benefits greatly from extensive experimental collaborations. In his spare time, Calvin enjoys reading and outdoor activities. Calvin lives with his husband, Andy (a medical resident at UMC), and their cat, Thomas, in Central Tucson. Calvin received his Ph.D. in Applied Mathematics in 2013 from UC Davis, and was a Courant Instructor from 2013 to 2016 at the Courant Institute of Mathematical Sciences, NYU.

Hang Xue, a tenure-track Assistant Professor, is from Chengdu, China. He completed his Ph.D. in Mathematics at Columbia University in the City of New York in May 2014. His research is on number theory, with a recent focus on automorphic representations. He made two one-year postdocs at the Institute for Advanced Study at Princeton and the Max-Planck-Institut für Mathematik in Bonn, Germany. In his spare time, he enjoys hiking and traveling.

Jack Hall is a tenure-track Assistant Professor. He is from Sydney, Australia. After an undergraduate education in his hometown at the University of New South Wales, he completed a Ph.D. in 2011 at Stanford University. Jack spent his first two postdoctoral years in Stockholm, Sweden at the Royal Institute of Technology (KTH). In 2013, he returned to Australia, where he was a postdoc at The Australian National University (ANU) in Canberra, before joining UA this Fall 2016. Jack's research interests are in algebraic geometry, with a specific focus on moduli theory.

Instructional Faculty

Elizabeth Lugosi earned her Master's Degree in Mathematics at the Lorand Eotvos Science University and her Ph.D. in Operations Research at the University of Economics in Budapest, Hungary. She has a rigorous foundation in Operations Research, which she has effectively utilized during her professional and business career. She gained academic experience teaching Mathematics at the University of Economics in Budapest and also at Pima Community College. She has taught courses in college algebra, pre-calculus, calculus, and statistics. In the past, she was involved in research with three different groups at the University of Arizona. Besides being a mathematician, she has a Project Management Professional (PMP) certificate and a Certified Information System Auditor (CISA) certificate as well. She enjoys hiking and traveling, and learning about different cultures.

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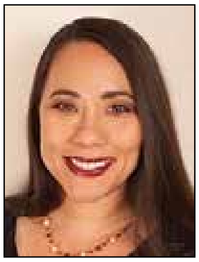
Who's Doing the Math?

Learning to Facilitate Groupwork Through Complex Instruction

Jennifer A. Eli



"There is someone who works faster than the rest of the group and won't listen to other people's solutions. Their way is the only way to do it." "I want to ask my group for help but I don't want to look dumb." Sound familiar? Engaging students in problem solving through groupwork is often regarded as an effective strategy that leads to robust mathematical learning[1]. However, many educators find facilitating groupwork challenging and unsuccessful. Simply putting students together does not mean everyone participates equally or is allowed access and opportunity to have their voice heard.

Students learn best when they listen generously and communicate their ideas to others[2,3,4]. As mathematics educators, our role is to find ways to orchestrate productive mathematical discussions[4] and make pedagogical moves that build upon students' thinking and ways of knowing.

My research focuses on the use of *Complex Instruction* (CI), a research-based form of collaborative learning that centers on student participation in groups[2,3]. How a student is perceived by their peers in a group relative to their capability to make meaningful contributions (that is, issues of status) effects whether the group will listen to an individual.

In my work, I examine how implementing research-based pedagogical strategies for developing individual and group accountability promotes equitable mathematics learning. In particular, in what ways does CI offer strategies mathematics teachers can leverage to engage students in productive struggle? What are the kinds of productive teaching moves that support students in grappling with challenging mathematics in a collaborative group?

Through my research, I have found that CI implemented in mathematics courses for prospective elementary teachers has had a positive impact on their perspectives of what it means to learn and do mathematics. CI has materially facilitated a shift to a view where prospective teachers know themselves CAPABLE of doing mathematics and experience how working in groups can lead to deep mathematical learning and understanding.

***Jennifer A. Eli** is an Associate Professor of Mathematics Education and a recipient of the UA AAU Undergraduate STEM Education Teaching Excellence Award, due in part to her work in Complex Instruction. She is a Co-PI on a $1.2M NSF Robert Noyce Grant, aimed to increase the number of highly qualified secondary mathematics teachers.*

Contact her at: **jeli@math.arizona.edu.**

[1] *Boaler, J., & Staples, M. (2008). Creating mathematical futures through an equitable teaching approach: The case of railside school. Teachers College Record, 110(3), 608-645.*

[2] *Cohen, E., & Lotan, R. A. (2014). Designing groupwork: Strategies for heterogeneous classroom (3rd edition). New York, NY: Teachers College Press.*

[3] *Featherstone, H., Crespo, S., Jilk, L., Oslund, Parks, A., & Wood, M. (2011). Smarter together! Collaborative and equity in the elementary math classroom. Reston, VA: National Council of Teachers of Mathematics.*

[4] *Kazemi, E., & Hintz, A. Intentional talk: How to structure and lead productive mathematical discussion. Portland, MA: Stenhouse Publishers.*

RESEARCH FOR T

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TO LEARN MORE, CONTACT:

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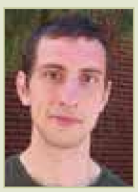
BIOGRAPHIES
Postdoctoral Research Associates

Houssam Abdul-Rahman Houssam recently earned his Ph.D. from the University of Alabama at Birmingham. He is interested in solving certain mathematical problems rising from quantum statistical mechanics, and topics like entanglement and many-body localization are of part of his recent focus. He also has worked in curve fitting and simulation. Houssam has over ten years of teaching experience from high school to college levels. He enjoys playing soccer and volleyball as well as chess and board games.

Jeremy Booher completed his Ph.D. from Stanford University, and continues to study number theory. In particular, he is interested in Galois representations and their deformation theory, which is inspired by the Langlands program and related conjectures due to Serre and Fontaine-Mazur. He plays the recorder and enjoys early music, as well as board games and science fiction. He is looking forward to exploring hiking in the Tucson area.



Paul Carter grew up in and around Washington D.C. and Northern Virginia. He travelled to the United Kingdom to pursue his undergraduate education in mathematics before returning to the United States and completing a Ph.D. in mathematics at Brown University in 2016. Currently, his research interests lie in applied dynamical systems and differential equations with applications related to neuroscience, astrophysics, and traffic modeling. Outside of mathematics, Paul enjoys rock climbing, playing video games, and eating.

Erik Davis, a Postdoctoral Research Associate, found a passion for Mathematics as an undergraduate at the University of Texas at Austin. In 2010, he came to Tucson as a graduate student in the Department of Mathematics here at UA and earned a Ph.D., which he defended this May. This year, he continues research in problems at the intersection of probability theory and the calculus of variations, particularly involving notions of optimal shapes in random structures. Outside of work, he enjoys cooking, hiking, and swing dancing. He was recently became SCUBA certified, although he notes that even after the heaviest monsoons, the potholes in Tucson roads are insufficiently deep to make many local dives!

Ngoc Do grew up in Hanoi, Vietnam. She got her bachelor's degree at Southern Federal University in Rostov on Don, Russia. In August 2016, she defended her Ph.D. dissertation at Texas A&M University, with focus on Spectral Theory. At the

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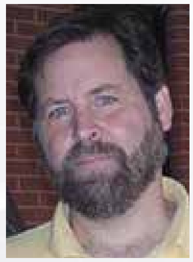
Not Your Parents' Genes: A Statistical Approach to Discovering Clinical Consequences of Non-Hereditary Genetic Mutations

Joe Watkins



Population genetics is one of the great triumphs of human intellect. With close collaborations between mathematicians and evolutionary biologists, the population genetics community has been able to make great strides in the understanding of the history of the diversity of life on Earth while, at the same time, making great advances in the creation of new mathematics and statistics. For example, population genetics approaches were successful in tracking with greater and greater specificity the migrations of humans out of Africa, into Europe and Asia, and then into Oceana and the Americas.

The amount of genetic data has now become so great that we are able to take the mathematical and scientific principles behind these achievements and apply them not only to populations that share a common biological ancestry, but also to populations that also share a common genetic condition. This is the perspective that brought our research team to study Dravet syndrome, a very difficult genetic epilepsy.

Children with Dravet start life developing normally. But by the end of their first year, they can experience frequent and devastating seizures as well as increasing developmental delays. Going into our research we knew that approximately 90% of individuals with Dravet syndrome do not inherit the disease but rather acquire the disease-causing mutation anew from the egg or sperm of the parent. Such mutations are called *de novo* (new).

We also knew that, some of these *de novo* mutations (called missense) result in a change in the shape of a particular sodium channel protein, called $Na_v1.1$. Others (called truncation mutations), result in DNA that no longer encodes a functional version of the $Na_v1.1$ protein. Because our brains are so complex, we depend on well-functioning channel proteins to maintain the chemical balance necessary for healthy transmission of information across the brain.

Working with the primary medical facility in Japan dedicated to assisting families of Dravet syndrome children, we initiated a study that combined genetic information from DNA sequences with patients' medical histories. Having this information in tandem was key in performing the ordinal logistic regression analyses and likelihood ratio tests (along with some nonparametric tests) necessary in bringing new insights into the lives of these patients.

What did we learn? Dravet causing missense mutations cluster at several especially vulnerable parts of the DNA (see Figure 1, red line). We see a broad range of medical outcomes for these patients. Truncation mutations, however, occur uniformly throughout the genetic sequence that codes for $Na_v1.1$ (see Figure 1, blue line). Most patients with this mutation type have steeper rates of cognitive decline than those with missense mutations. In addition, we have started to be able to provide evidence for the effectiveness of anti-epilepsy drugs based on the causal mutation type.

Today, our study continues in a variety of directions. For example, we have found that parents of those who have inherited Dravet syndrome experience a higher rate of seizures that those with *de novo* Dravet. In turn, the parents of those with *de novo* Dravet have a higher rate of seizures than the Japanese population at large. This suggests that the genetic background plays a role in how/how much the disease-causing mutation impacts patients, something we are now investigating.

FEATURE ARTICLE

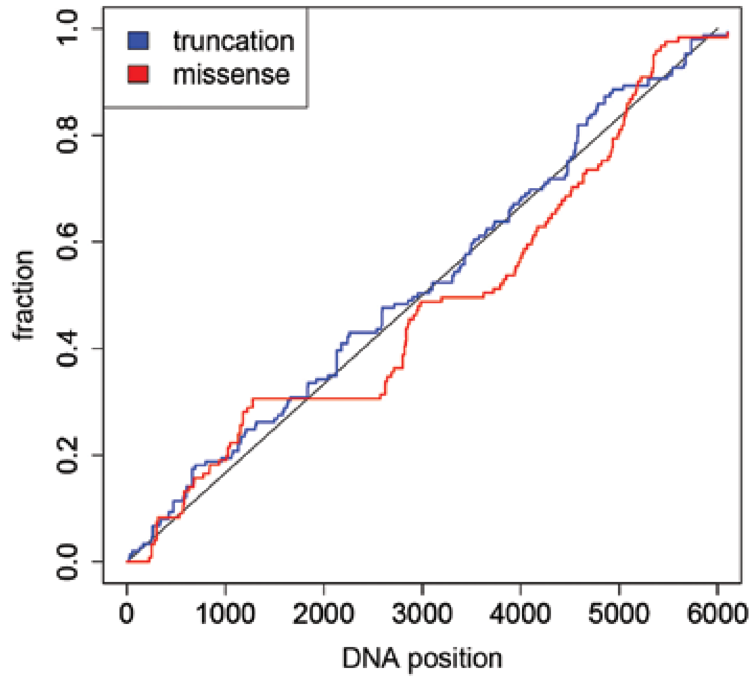


Figure 1. Cumulative distribution of truncation (blue) and missense (red) mutations. The short vertical increases along both the red and blue lines mark sites where de novo mutations occur along the DNA sequence encoding for $Na_v1.1$. Note that truncation mutations occurs uniformly along the DNA sequence, as shown by the steady increase in the blue line. However, missense mutations do not occur uniformly: the flat red line marks regions in the DNA sequence where no mutations occur for Dravet syndrome individuals. From other data sources, we know that healthy individuals have mutations in the flat regions. This leads us to conclude that mutations in these regions have little or no medical consequence.

We are also trying to better understand sodium channels "mismatches." The human nerve cell has four different sodium channel proteins that can cause epilepsy. While these channel proteins look remarkably similar (approximately 98% of their DNA sequence matches up), the places in these sodium channels that are vulnerable to mutations do not always match. We want to have a better understanding of those differences.

To close, I would like to note that the families of patients themselves are among our most important scientific collaborators: their great gifts to us are the insights they bring to our understanding of these epilepsies. Using crowdsourcing approaches, we are currently inviting parents to submit information about epilepsy arising from mutations in a different sodium channel, $Na_v1.6.$, for example.

It is rich interdisciplinary collaborations like ours, that enable mathematicians and life scientists to reciprocate parents' gifts by offering insights into their children's conditions. Our work illustrates the value of public research universities with strong, interactive units in the life and mathematical sciences.

The Dravet Foundation funded this study.
For more go to www.dravetfoundation.org, and scn8a.net

Joe Watkins *is the chair of the Graduate Interdisciplinary Program in Statistics at the University of Arizona and a member of the School of Mathematical Sciences. Joe has engaged in research collaborations with anthropologists, bacteriologists, biochemists, entomologists, geneticists, linguists, physicists, and, of course, mathematicians and statisticians.*

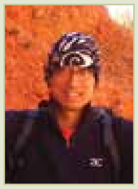
Contact him at **jwatkins@math.arizona.edu**

FEATURE ARTICLE

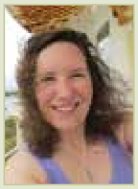
BIOGRAPHIES

University of Arizona, she hopes to expand her research interests into applied and numerical mathematics, in particular inverse problems. In her free time, she loves reading, blogging, cooking, and enjoying a cup of tea while looking at the nice mountain view from her window.

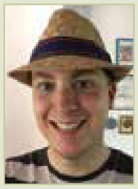
Lidia Mrad recently earned her Ph.D. in Mathematics from Purdue University, Indiana. Her research interests are in applied analysis and partial differential equations. Specifically, she studies the dynamical behavior of liquid crystals used in optical devices through the analysis of energy models. She is excited to be part of new projects in applied mathematics as a Postdoctoral Research Associate at the University of Arizona. Her teaching career started as a high school teacher and she has been building upon her interests as an educator since then. She is also passionate about outreach services; she co-founded the AWM Purdue student chapter, co-organized a student conference as a SIAM officer and organized several seminars and professional development workshops. Her hobbies include playing basketball, learning new dance styles, baking and organizing social events, singing traditional Levantine songs, and losing track of time when reading a good book.



Jingchen Niu recently received his Ph.D. from Stony Brook University. His research focuses on symplectic geometry, in particular the geometric properties of complex and real Gromov-Witten invariants. Outside of research, he likes hiking and team handball.



Tracy Stepien grew up in a suburb of Syracuse, NY. She completed her bachelor's degree at the University at Buffalo and her master's and Ph.D. at the University of Pittsburgh. Most recently, Tracy was a postdoc at Arizona State University, but has done her best to stay neutral in the Wildcats vs. Sun Devils debate. Her research interests include mathematical biology with an emphasis on medicine, dynamical systems, ordinary and partial differential equations, and related numerical methods. In her spare time, Tracy enjoys taking ballet, jazz, and other dance classes, cross-stitching, singing, and traveling.



Jay Taylor obtained his Ph.D. at the University of Aberdeen, Scotland, in 2012. After obtaining his doctorate he spent 2 years as a postdoc at the Technische Universität Kaiserslautern in Germany. For a short 6-month period, he was a postdoc at the EPFL (École polytechnique fédérale de Lausanne) in Switzerland before taking up a Marie Curie Fellowship at the University of Padova, Italy. From Padova, Jay moved directly to the University of Arizona. Jay's main research interests lie in group theory, an area of mathematics that provides an abstract mathematical framework in which we can study the natural concept of symmetry. Outside of work, Jay enjoys singing in choirs, running, a good cup of coffee, and tasty snacks.

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Chaos in the brain: the nonlinear dynamics of neural spike-time reliability

Kevin Lin

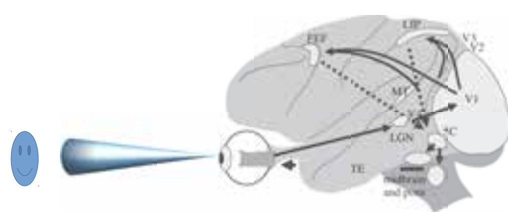
The brain, its structure, its function have fascinated many mathematicians. At first glance, it may not be obvious what the orderly world of mathematics shares with the messy world of biology. Part of the appeal is the fact that nerve cells communicate via electrical impulses ("spikes"), and it's tempting to view the brain as a giant electrical circuit, subject to physical laws in the form of differential equations. Another is that many "neural computations" are reminiscent of what digital computers do: process information, make decisions, learn from data.

But the brain is unlike any circuit ever built: if you could "see" each bit in your computer, you would see them furiously executing pre-programmed logic in a predictable fashion. Not so with the brain. Neural spikes often show irregular, unpredictable patterns. Herein lies a conundrum: brain activity is supposed to represent everything we see, hear, smell, feel, think. It *is* us. But how do these irregular, unpredictable patterns represent anything at all? Indeed, a variety of evidence suggests that the brain is likely "chaotic", i.e., a small change (say a bump in the voltages of some neurons) can potentially lead to very different subsequent activity. A consequence is when a brain region receives the same stimulus twice, it may well respond differently each time! Carried to an extreme, one might conclude when hearing the same song twice, your brain can think it's Mozart one time and Madonna the next. How can we reconcile the apparent sensitivity of the brain to small perturbations with the stability of thoughts and percepts?

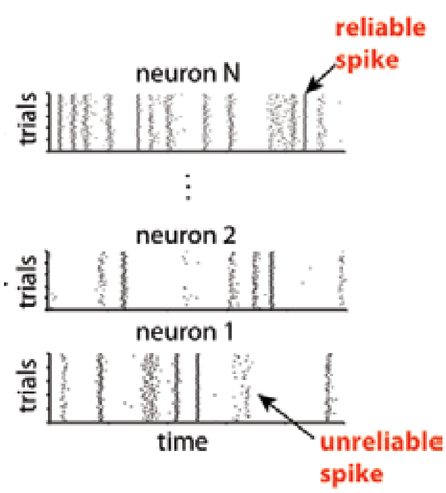
One possibility is that the spikes themselves are not meaningful, and only averages, like the mean number of spikes, are meaningful (because means are more stable than the spikes themselves). Over the past decade, using an area of mathematics known as dynamical systems theory, my collaborators and I have worked on testing a different view: that spikes themselves carry useful information despite chaos. We have recently shown that despite their chaotic dynamics, it may only be small groups of cells that exhibit chaos at any one time. Further, by averaging the outputs of even a relatively small number of cells, a downstream "decoder" cell can reliably extract information from a chaotic network. (Averaging over a larger number of cells leads to more reliable decoding, but biology places a limit on this number.) Of course, much remains to be done to connect our theoretical work to biology, but we now understand, at least, that chaos need not imply spikes cannot carry useful information.

***Kevin Lin** has long been fascinated by questions at the interface of dynamical systems and computation. As an undergraduate at MIT, he began studying these topics at the Artificial Intelligence Laboratory. After a Hertz Foundation Fellowship at UC Berkeley and an NSF Postdoctoral Fellowship at the Courant Institute of Mathematical Sciences, he joined the University of Arizona faculty in 2007.*

Contact him at **klin@math.arizona.edu**

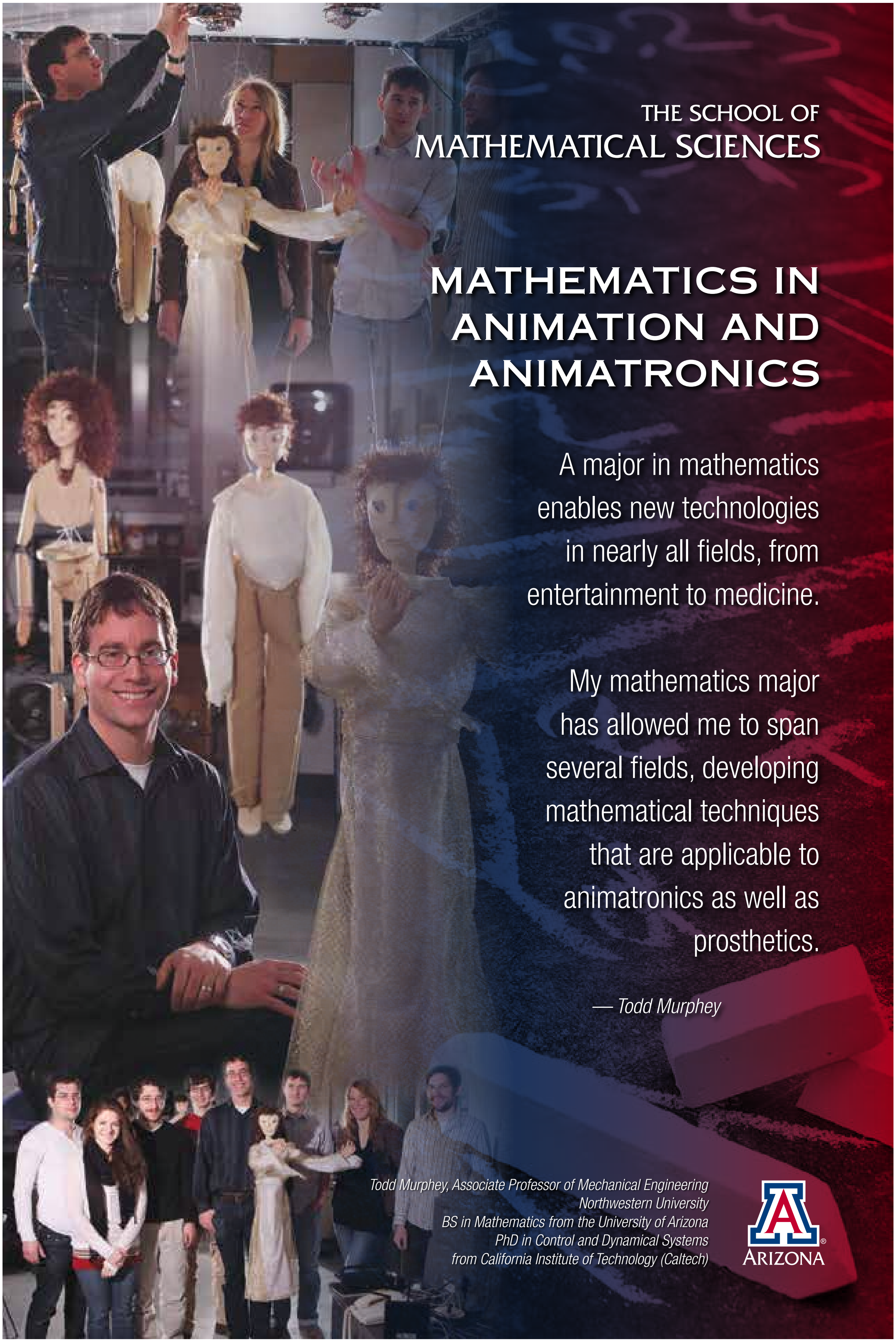


Original figure by Robert H. Wurtz Using perturbations to identify the brain circuits underlying active vision Phil. Trans. R. Soc. B 2015 370 20140205; DOI: 10.1098/rstb.2014.0205. Published 3 August 2015. This figure has been modified. https://commons.wikimedia.org/wiki/File:Brain_circuits_for_visually_guided_saccades.jpg



G. Lajoie, K. K. Lin, J-P. Thivierge, and E. Shea-Brown, to appear in PLOS Computational Biology (2016), arXiv:1604.07497v1

Figure. Top: All our sensations and thoughts, e.g., visual information, are represented by electrical "spikes" in nerve cells. Bottom: a number of (raster) plots showing that chaos affects only small groups of cells at a time. The vertical axes represent repeated trials in which the network receives the same stimulus but starts in a different state. We see that despite chaos and different initial states, most cells are reliable most of the time.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MATHEMATICS IN ANIMATION AND ANIMATRONICS
A major in mathematics enables new technologies in nearly all fields, from entertainment to medicine.
My mathematics major has allowed me to span several fields, developing mathematical techniques that are applicable to animatronics as well as prosthetics.
— Todd Murphey
Todd Murphey, Associate Professor of Mechanical Engineering
Northwestern University
BS in Mathematics from the University of Arizona
PhD in Control and Dynamical Systems
from California Institute of Technology (Caltech)
ARIZONA

BIOGRAPHIES

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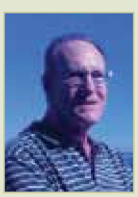
Matthew Wheeler is from central Pennsylvania. He earned his bachelor's degree from Bucknell University, and he recently received his Ph.D. from the University of Pittsburgh. His research focuses on the study of geometric structures and employs techniques from algebraic topology and differential geometry. He also enjoys skiing, playing soccer, and running.

Amanda Young is originally from Woodland, California. She completed her Ph.D. at UC Davis in the summer of 2016, before moving to Tucson in August. Her research interests are in mathematical physics, specifically in analyzing spectral properties of quantum spin systems. In her spare time, she likes to read, play soccer, and swing dance.

Staff

Mark Barnard was born and raised in Salt Lake City, Utah. He earned a B.A. in History from the University of Utah in 2014. His academic interests include French Language and History of the French Empire in Africa. Since graduating college he has worked in the hospitality industry, but has come to Tucson with a partner who is pursuing a Ph.D. in School Psychology. He is excited to be in Arizona, and excited to be starting a new adventure in the UA Math Department. Mark's personal interests and hobbies include cooking, traveling, and painting. He is a huge fan of nature and the outdoors which has influenced him to join the Tucson Herpetological Society. Outside of work, Mark is often found in the Tucson Mountains looking for lizards, snakes and tortoises.



Bob Burton, an IT Support Analyst, is originally from Portsmouth, Virginia, but spent most of the past thirty years oscillating back and forth between Northern California and Phoenix, working as a design automation engineer for Intel, Cadence, General Instrument, and, most recently, Medtronic. Bob and his wife Jean have spent a lot of time in Tucson over the past decade (she and both of their daughters are alumni), and have often thought about retiring here. While cleaning the debris out of his Phoenix pool following the third major dust storm of the 2015 monsoon season, it occurred to Bob that if he found a job in Tucson, they could move before the 2016 monsoon season and he'd never have to remove four inches of mud from the bottom of that swimming pool again. He is thrilled to be working for the departments of Mathematics and Computer Science, delving into the mysteries of Linux system administration and someday hopes to understand where your documents go after you hit the print button.

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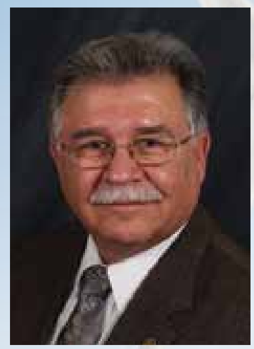
The UA Undergraduate Mathematics Major: Just take one more math course

William Y. Velez



The undergraduate mathematics major program is a vibrant component of UA Mathematics. Our seven math major options illustrate to our undergraduates the applicability of mathematics and prepare them competitively to pursue careers in their chosen field of study. We ended the 2015-16 academic year with 665 mathematics majors and 768 mathematics minors. More than half of the mathematics majors had another major; 30% were female and 22% were under-represented minorities.

The versatility of a mathematics major means our majors are highly sought after by top corporations upon graduation and choose careers in a variety of fields: some work as engineers, others enter the actuarial profession, or work for consulting companies. Our graduates who choose to become high school teachers are immediately offered teaching positions upon graduation. A quarter of our graduates pursue post-graduate education with half going into programs in the mathematical sciences and half pursuing graduate programs in other areas at many elite universities.

Much of the success of our large and active math major program came about through the vision of Distinguished Professor Bill McCallum, who created the Math Center over 25 years ago. Built exclusively to manage the mathematics major program, the Math Center recruits and advises mathematics majors and provides a central hub for opportunities for enriching the mathematics major experience.

In 2003 Nick Ercolani, then department head, asked me to take over the directorship of the Math Center, a request that signaled the department's continued support of Bill McCallum's novel vision for the undergraduate mathematics major program. Counting at the time with about 250 mathematics majors, the Math Center directorship presented a great ***inreach*** opportunity: instead of reaching out to high schools to convince students to declare mathematics as a major when they enrolled, I prioritized reaching into our own mathematics classes where we had captive audiences. Why not encourage the students who are already taking mathematics to pursue a major so tremendously beneficial to their future careers?

The first couple of years, I only sent email messages to students enrolled in upper division courses: "You only need 6 more mathematics classes to complete the mathematics major. You should strongly consider it!" Later, I

I would have never dreamed that my mathematics degree would have helped me get a job so challenging and exciting.

I encourage anyone who has an interest in mathematics to pursue the degree. It will allow you to be versatile and will lead you to a variety of different jobs and opportunities.

— Britt Reiman

I use the electronic data that we all create in our daily lives to understand how people and groups behave. I push forward the ability of computers to help people understand extremely large amounts of data.

Mathematics allows me to work on the leading edge of what is possible; it gives me a say in how society deals with powerful new technologies.

— Keith Schon

expanded my target group and I was soon sending out 5,000 emails per term. Though the Math Center is at the forefront of efforts to encourage students to take more mathematics, it is the teaching staff that bring this goal to fruition. Our researchers have also given generously of their time to support student research.

A few years ago, I added an outreach component to the ***inreach*** process. In March and April each year, the Math Center sends about 15,000 emails to incoming UA students (and their parents, if possible) suggesting they enroll in a mathematics class and consider adding a mathematics major to their program of study. I begin advising these students even before they arrive on campus, as they reply to the invitation email to take on the study of math.

The Math Center is now a complex enterprise. Under the outstanding coordination of Laurie Varecka, these ***inreach***/outreach "just take one more math course" efforts have been institutionalized into the operations of the Math Center. In 2011, our center was recognized by the American Mathematical Society with the AMS Award for an Exemplary Program or Achievement in a Mathematics Department. UA Mathematics can be justifiably proud of the work we have all done.

In May 2017, I will retire after 40 years in the department and step down as Director of the Math Center. The Math Center, however, will continue to be a vibrant part of the department. It will reaffirm its commitment to producing a mathematically literate workforce under the new directorship of Jason Aubrey. Aubrey and I are working together to continue encouraging students to "just take the next math course."

***William Yslas Vélez** is a Distinguished Professor of Mathematics at UA, the same institution from which he earned his doctorate in 1975. He has traveled extensively around the country and the world giving lectures, and has served as a President of SACNAS, the Society for the Advancement of Chicanos and Native Americans in Science.*

Contact him at: **velez@math.arizona.edu**

For more information on our graduates' pursuits and the 2011 AMS award go to: http://math.arizona.edu/academics/undergrads/careers/alumni, http://www.ams.org/notices/201105/201105-full-issue.pdf

BIOGRAPHIES

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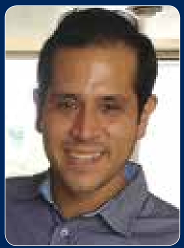
Nellie Rios works as an assistant for the UA Math Center and other academic support programs at the UA Department of Mathematics. Nellie grew up in Douglas, Arizona, studied at Cochise and Pima community colleges, earned a degree in paralegal studies, and was a member or the Phi Theta Kappa Honor Society. Nellie first joined our department in 2000 and worked for the graduate program office until 2003, when she decided to dedicate more time to her growing family. In 2013, she was extremely pleased to get a new opportunity to join the department once again. She began working for the program in Applied Mathematics before taking on her current role. Nellie is mother to two daughters, the oldest one of which recently celebrated her "Quinceañera" (15 year old birthday). She is very involved with her daughters' extracurricular activities and has recently become a wellness coach and an independent distributor of nutrient supplements.

Appointed Personnel

Guillermo Uribe graduated with a Ph.D. from the UA Applied Mathematics Program in 1993. Since then, he has had a long career at the University of Arizona. He worked for the University Learning Center (now The Think Tank) and eventually became its Director. In his previous assignment, he worked as Assistant Director at The Office of Institutional Research and Planning Support, where he was responsible for producing official statistics and predictive models that aid in the running of the university's operations. He recently contributed a stochastic model to predict demand for seats in undergraduate courses and an enrollment projection model that informed the institution's strategic planning process. His duties within the department include predictive analytics, systems design and, of course, teaching. His two daughters are also alumnae of the Department. One is now a Biostatistician at the University of Iowa, the other is a researcher at Sandia National Labs. He, his wife, and their daughters are avid martial artists and swimmers.



Since high school, Professor Velez constantly encouraged me to 'take the next math class'. This advice eventually compounded into a PhD in mathematics. Over the years, I've greatly benefitted from his continued guidance and academic scholarships. I'm contributing to this endowment so that future students have access to both mentorship and funding. I firmly believe that education leads to a healthier and productive society. –**Ivan Barrientos**

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Doctoral degrees

Whitney Berard. Explicit Serre Weight Conjectures in Dimension Four.
- Advisor: David Savitt.
- Employer: Mills College, Oakland, CA.
- Position: Adjunct Assistant Professor.

Tova Brown. Asymptotics and Dynamics of Map Enumeration Problems.
- Advisor: Nicholas Ercolani.
- Current status: participating member in the Program on Combinatorics and Interactions, Institut Henri Poincaré, Marseille/Paris.

Erik Davis. Consistency of Modularity Clustering on Random Geometric Graphs.
- Advisor: Sunder Sethuraman.
- Employer: University of Arizona, Tucson, AZ.
- Position: Postdoctoral Fellow.

Stephen Trefethen. Non-abelian Composition Factors of m-Rational Groups.
- Advisor: Pham Huu Tiep.
- Employer: The College of William and Mary, Williamsburg, VA.
- Position: Visiting Assistant Professor.

Ronnie Scott Williams. Level Compatibility in the Passage from Modular Symbols to Cup Products.
- Advisor: Romyar Sharifi.
- Employer: The University of Central Oklahoma,Edmond, OK.
- Position: Assistant Professor.

Alex Henniges. Kisin-Ren Classification of Pi-divisible O-modules via the Dieudonné Crystal.
- Advisor: Bryden Cais.
- Employer: Raytheon
- Position: Sr. Software Engineer

Ding Ma. Relations Among Multiple Zeta Values and Modular Forms of Low Level.
- Advisor: Romyar Sharifi.
- Employer: Duke University, Durham, NC.
- Position: Postdoctoral Research Associate.

Master degrees

Amy Been. Teaching View of Mathematical Modeling.
- Advisor: Marta Civil.
- Current status: Ph.D. student in the College of Education, University of Arizona.

Photo: Guada Lozano