UCLA

We are Mathematics

NAVIGATING A NEW LANDSCAPE

BY MARIO BONK
Professor and Chair, UCLA Department of Mathematics

By early March of 2020, the deadly novel virus, now known as COVID-19, had spread worldwide. Community transmission occurred in California one week before winter finals at UCLA. In response to higher education guidance from the state's Department of Public Health, Chancellor Gene Block instructed all UCLA departments to immediately transition to remote instruction and exams. After some deliberation, Department faculty were advised to give students up to 24 hours to complete their finals in order to fairly accommodate this extraordinary situation.

Anticipating continued disruption, the new policy was imposed on all University of California campuses for the spring and summer quarters, tasking the Department with moving 100+ math courses online. Faculty and teaching assistants had to swiftly adapt to virtual classrooms and employ new teaching modalities.

Online tools, such as the online grading platform Gradescope, along with the web- and app-based video conferencing service, Zoom, became crucial to the success of the new protocol. While these tools existed pre-COVID, sole reliance on them for instruction, discussion and even office hours, was challenging. Workshops were organized within the Department to help faculty and teaching assistants effectively use these resources. Fortunately, the majority of instructors were already technologically proficient and adapted very quickly.

We developed written guidelines for remote learning, which we will continue to improve. For faculty, they include recommended electronic platforms, optional examination and grading schemes, ways to proctor exams, reminders about privacy issues, and expectations in terms of online commitments and student contact. Faculty members, themselves, have implemented strategies to enhance and maximize students' online experiences; for instance, opening classes 15 minutes early to allow students to meet and chat with each other and using more graphics, including animation, to help students with key mathematical concepts.

Behind the scenes, the Department's student services staff and IT team developed and implemented the logistics necessary to get instructors and students set up at home. They established a virtual computer lab accessible through a browser within 16 days, secured e-books for the majority of required texts, and purchased hard-to-come-by supplies, such as iPads and Apple pencils, for instructors. At the same time, everyone managed their overflowing inboxes, which were inundated with questions and requests for help.

Unfortunately, most celebratory year-end events, like Department awards and commencement ceremonies could not be transformed by digital reinvention and were cancelled. A video tribute featuring math graduating students, and including staff and faculty, was released for the class of 2020.

"I commend everyone for working tirelessly over the last months, deliberating the many issues facing them and providing direction to students and to each other."

We are pleased to say that a highly functional virtual learning environment was delivered for the summer session, and several administrative and support programs – the fall graduate student orientation, summer graduate boot camp, and student advising services – successfully moved online. Faculty and staff are ready for off-campus classes in the fall. I commend everyone for working tirelessly over the last months, deliberating the many issues facing them and providing direction to students and to each other.

Although many of us felt uneasy as we began grappling with the challenges of the spring quarter, the general consensus about our accomplishments, now that it is over, is upbeat, and there have been benefits. For example, the search for classroom space was suspended, a hurdle that almost every UCLA department has to manage because demand has slowly outstripped the available physical space on campus. To address this longstanding issue, the Department has been expanding class schedules over the last decade. In 2011, the latest classes were scheduled to start at 2 p.m., but approximately 150 courses have been added since then in order to sustain increasing student enrollment. In 2018, the latest classes were scheduled at 5 p.m.

While COVID has tested the Department's resilience, it has served as a laboratory for new teaching strategies, which may present opportunities going forward. One innovation is "flipped classes," which involve pre-recorded lectures uploaded to students prior to class, thereby reserving class time for interactive discussions on Zoom. The pre-recording makes learning more accessible for students in different time zones and at different stages of comprehension. The Department has not offered this strategy before, but we will continue to experiment with it going forward, based on student feedback. Students reported that the pre-recorded lectures were extremely helpful with reviewing material, and they felt relieved to just listen and bypass the note-taking that is *de rigeuer* for in-class lectures.

Overall, students reported that they were comfortable working from home. However, they have had to function more independently and take on greater responsibility for their coursework. While stressful, these additional requirements may help prepare them for work and career where independence and responsibility are key ingredients of success.

One interesting phenomenon we found with distance learning was students' expansion of their own course schedules. Perhaps, anticipating that they would have more time, students opted to add more units to their course loads. However, the downside of larger classes, for both students and faculty, is more limited one-on-one consultation.

Moving into another academic year, it is unclear how long the pandemic will affect colleges and universities, but a happy byproduct of this crisis may emerge – new, viable strategies to help lead us into a new age of higher education, strategies that can translate into more fulfilling and effective curricula, ones that can level the playing field for students who are struggling with college, and possibly ones that expand access to world class institutions. However remote teaching unfolds, the Department will adapt and continue to deliver the very highest quality education.

FOR THE LOVE of Teaching

Will Conley launched his UCLA teaching career in 2012, lecturing undergrads in general mathematics. It didn't take long for him to build a university-wide reputation. For two years running (2013 and 2014), he was named the highest rated instructor by the student review website, bruinwalk.com. One student exclaimed, "You won't find another professor who will sacrifice his free time to have four-hour review sessions outside of class, and hold extra office hours on the weekend before an exam."

More recognition reflecting this no-holds-barred commendation followed. Will was awarded the Department's Robert Sorgenfrey Distinguished Teaching Award in 2014 and received the My Last Lecture Award in 2016. The "Last" lecture is organized by the UCLA Alumni Scholar's Club to honor professors who have made a positive impact on students in the classroom and answers the question: "What would you tell your audience if you had but one lecture to give – your last lecture on this earth?"

Will explains that his teaching philosophy emphasizes the importance of collaboration over competition in the classroom. Students value his ability to communicate difficult math topics clearly and concisely while keeping them engaged through classroom participation. "I try to create an environment where everyone feels like they can speak up and ask questions. I view the classroom as a forum for discussion rather than a setting where I am the only one talking. It's pretty simple; I put myself in the students' shoes, then I attempt to make math relevant to them." In contrast to this enlightened mindset, his exams are not known to be easy, however, the general consensus by student review is that they are fair.

Will's signature teaching technique is to create graphical representations of the math he teaches, especially for his lower division courses. While he thinks that visualizing the problem can be the key to introducing complex math, he admits the difficulties of this method. "It's time-consuming to prepare examples of complicated graphs and then animate them in a way where we can all interact with them." This academic year has been particularly challenging with the transition to online classes due to the pandemic. Says Will, "I spent a ridiculous amount of time, working something like 80-hour weeks, but at the end of the day it was worth it."

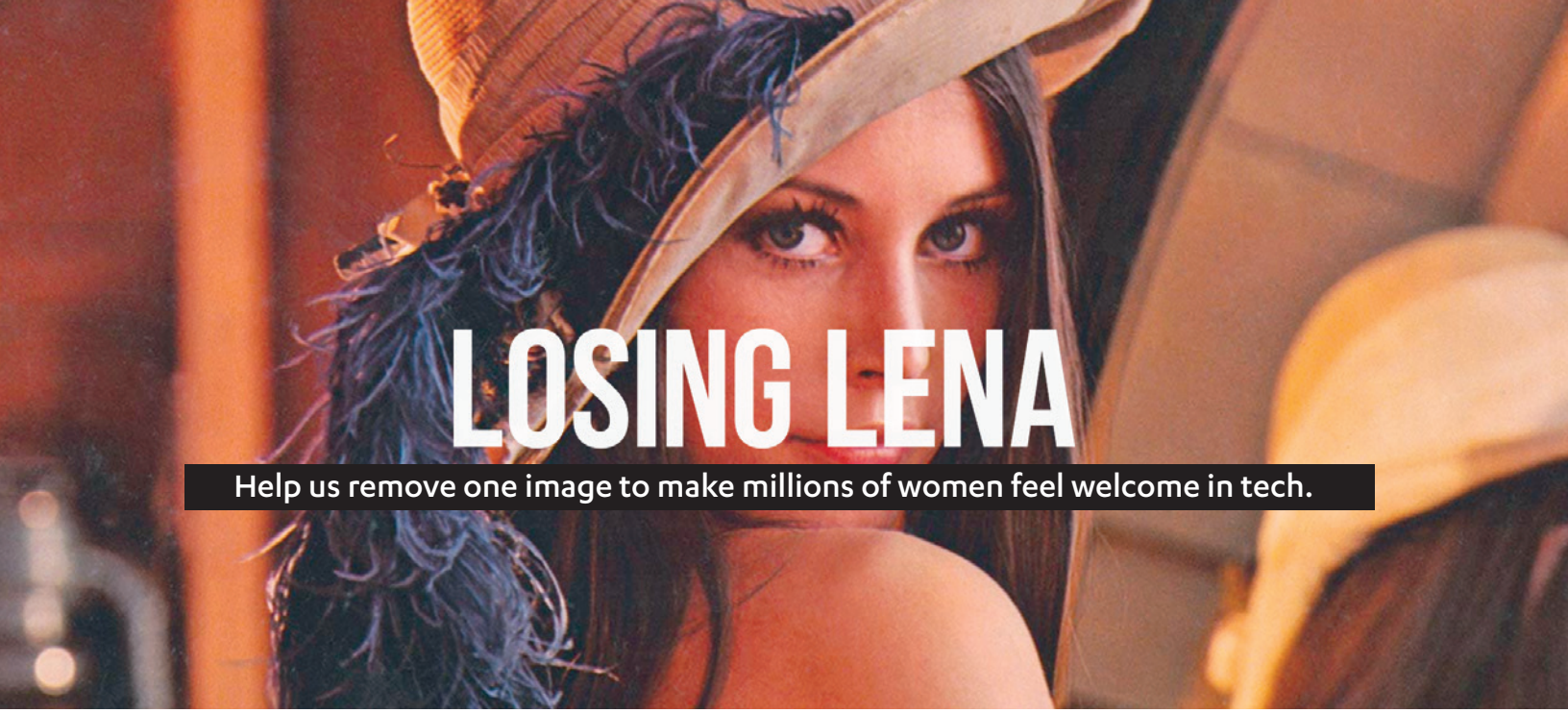
As a high school junior, Will gained a deep appreciation for mathematics during his calculus class. He credited this newfound sensibility to his teacher's approach to the subject, which was lighthearted and made learning fun. After graduation, he completed his bachelor's degree at Virginia Tech, combining his interest in math and physics by majoring in engineering, like his father. However, halfway through the program, it became clear that his favorite part of engineering was mathematics, so he remained on campus and earned a master's degree in math.

As a graduate student at Virginia Tech, Will discovered his true vocation through an appointment as teaching assistant. He realized that it was both exciting and fulfilling to explain math concepts in ways that allowed students to enjoy learning. Following his master's program, Will was invited to attend UCLA as a PhD student in mathematics. He earned his doctorate in 2010. While he was influenced by many of his professors in the Department, he was particularly impressed by Richard Elman's fast-paced, energetic teaching style. Says Will, "He gave you everything you needed, but just the bare minimum, so you still had to do the work. I always try to emulate that approach in addition to my own techniques."

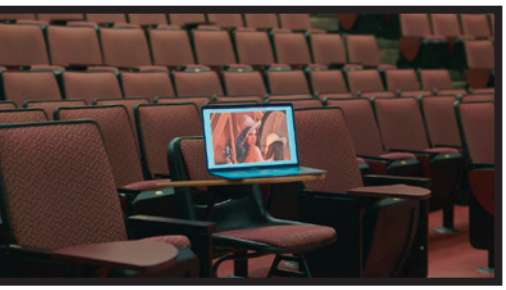
Upon receiving his doctorate, Will was recruited to teach in the Department. His appointment is part of the recently established "Lecturer with Security of Employment Series," which provides extended job security to lecturers and meets the long-term instructional needs of University of California campuses through recruitment of highly qualified faculty whose careers are committed to teaching vs. research.

In April of this year, Will received yet another award. He was recognized for "demonstrating the ability to create a learning environment in which diverse students can succeed" with the Inaugural Physical Science Centennial Excellence in Education Award for Senate Faculty. The award is based on nominations by UCLA physical sciences departments. Nominees must demonstrate broad impact on classroom inclusivity and learning excellence – in other words, the love of teaching.

"You won't find another professor who will sacrifice his free time to have four-hour review sessions outside of class, and hold extra office hours on the weekend before an exam."



A WINNING DOCUMENTARY



When the Swedish Playboy model, Lena Forsén, posed as the Miss November centerfold in 1972, she had no idea that her photograph would become the standard test image in computer science classes and be used almost exclusively for this purpose in business, industry and academia for the next 50 years.

Lena's fame began inconsequentially in the hands of a few male engineers at the University of Southern California, who in 1973 were laying the foundation for what would later become the JPEG. Bored with stock photos, which they needed to test their algorithms for converting physical photos into digital bits, they extracted the top third of Lena from the centerfold and used that image instead.

While this extracted picture of a beautiful woman is still consistently employed by the image processing community today, it is not without controversy. The practice has been relentlessly criticized for reinforcing gender stereotypes in male-dominated fields, such as math, the sciences, engineering and computer technology. Lena has become an example of the long-term and negative impact of small, seemingly innocent actions of many individuals. For those leading diversity efforts in STEM fields, specifically with regard to women, it is perceived as an obstacle. They believe that the time has come to retire the image.

To explore and publicize this ubiquitous industry practice, FINCH (a film production company) in partnership with Clemenger BBDO Sydney (a marketing communications firm), both based in Australia, produced a documentary titled *Losing Lena*. The project was developed for Creatable and Code Like a Girl (a program that helps prepare young women to work in technology and champions female innovation in tech fields). The filmmakers show how Lena's photograph has become the foundation of all the images we've likely ever seen on websites and other digital productions. They proceed to use this historical thread to explore the challenges and biases that women have experienced in STEM fields around the world.

As part of the film launch in 2019, the Department co-hosted a screening and discussion of the documentary, one of a number of events organized by FINCH and the PR firm, Porter Novelli. Following the screening, a panel discussion featured UCLA faculty and influential women in tech fields together with Francesca Walker from FINCH and Greg

Attwells, co-founder of Creatable. Panel members spoke about their experiences facing gender stereotypes and posited solutions for creating a more inclusive environment. The event was free and open to the public, with a successful turnout of nearly 100 attendees, including UCLA faculty, students and alumni.

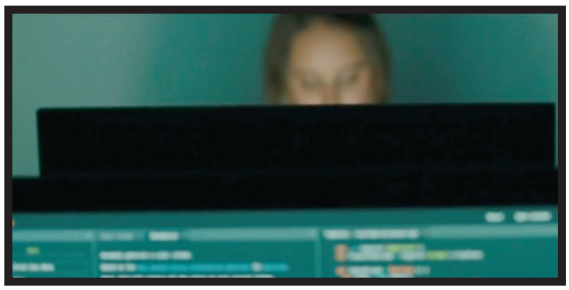
For UCLA math professor Deanna Needell, who was featured in the film and served on the panel, the Lena image symbolizes a stereotype that minimizes women's potential in STEM fields. In the film she states, "The beautiful young woman in this photograph is not the woman doing the coding or writing the algorithm." Catherine Clarke, a UCLA professor in chemistry, and Jane Margolis, a senior researcher in the UCLA Graduate School of Education and Information Studies, joined in the discussion as part of the panel. Jane was also featured in the film.

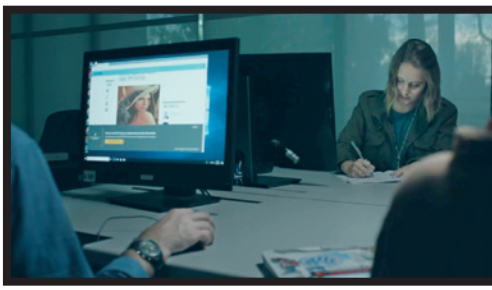
Ironically, as the film demonstrates, women played a major role in early computing and were the original computer programmers for the military and NASA. However, in the 1970s, men were deemed more suitable for this kind of work, and women were pushed out of the industry. The film is not a finger-pointing exercise, though it questions the tenets of the tech industry, considering that few have committed to retiring Lena, even in today's more enlightened society where at least half of college students are women.

In the film, Deanna ventures: "I think we have everything to lose if we don't get more diversity. And that's not just gender, that's in all the senses of the word. Without diverse ideas, we will not progress as a society in any scientific means."

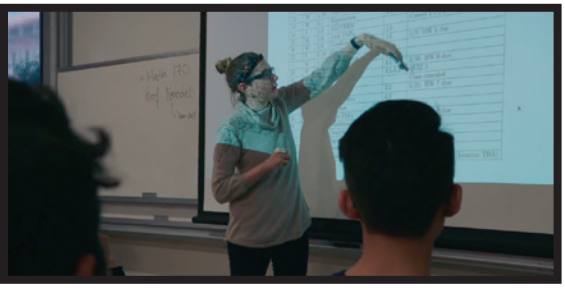
The film is a visual vehicle for the campaign to retire Lena (www.losinglena.com), calling on members of tech industries, businesses, universities and other organizations to commit to this simple action and identify substitute images that can be used for image processing testing. UCLA mathematics has pledged to support retiring Lena's image.

Losing Lena has been shortlisted for PRWeek's 2020 Purpose Awards for Best Equity and Inclusion and is currently available to view on Facebook Watch, Facebook's video-on-demand service.





"THE LENA IMAGE SYMBOLIZES A STEREOTYPE THAT MINIMIZES WOMEN'S POTENTIAL IN STEM FIELDS."



The Collatz Conjecture

by TERENCE TAO
Professor and The James and Carol Collins Chair
in the College of Letters and Sciences

If I had to describe my research in one sentence, it would be understanding the dichotomy between structure and randomness. Keeping that in mind, objects can be broadly classified into three types across mathematics: structured objects, random objects and some mixture of both. For instance, when looking at sequences of natural numbers, an arithmetic progression (such as the odd numbers 1, 3, 5 ...) would be extremely structured; there are obvious patterns in the sequence, and given some portion of the sequence, it is easy to reconstruct the next few elements of it.

At the other extreme, a sequence such as the digits of Pi 3, 1, 4, 1, 5, 9 ... exhibits no obvious pattern; it is not actually random (no dice are rolled or coins flipped to generate Pi), but it is strongly believed to be "pseudorandom"– indistinguishable from a random sequence of digits by any statistical test.

Then there are the prime numbers 2, 3, 5, 7, 11 ..., which appear to be a fascinating blend of both structure (for instance, almost all primes are odd) and randomness (given some portion of the sequence of primes, there does not seem to be enough of a pattern to be able to predict the next prime).

THE RIEMANN PRIZE

Terry Tao is the first recipient of the Riemann Prize in Mathematics, awarded by the Riemann International School of Mathematics (RISM) in Italy. The prize was established in 2019 on the occasion of the 10th anniversary of the RISM as a tribute to Bernhard Riemann (1826-1866), among the greatest mathematicians of all times, whose work served as a crucial tool in Einstein's development of general relativity. The prize will be awarded every three years to outstanding mathematicians aged 40-65, who have made breakthrough achievements.

$$f(n)=\begin{cases}\frac{n}{2} & \text{if n is even}\\ 3n+1 & \text{if n is odd}\end{cases}$$

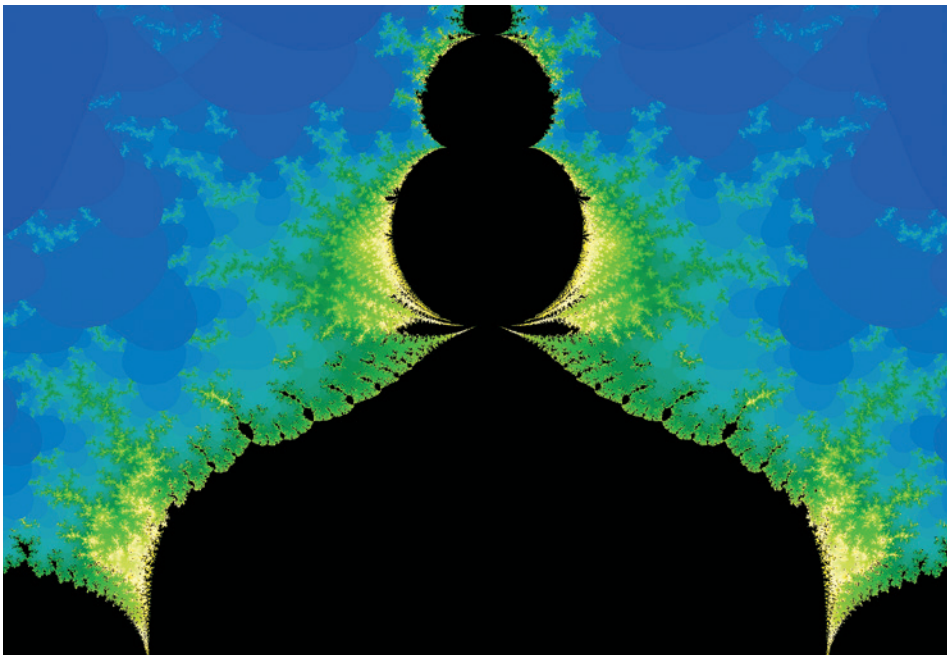
Several longstanding open problems in number theory, such as the Riemann hypothesis or the twin prime conjecture, can be viewed as questions as to precisely how random the primes are. We're still a long way from solving these problems, but my collaborators and I have been able to narrow down the possible ranges of behavior for the primes and other number-theoretic objects of interest, to the point where we can answer some questions about them. For instance, many years ago Ben Green and I showed that the primes will contain arbitrarily long arithmetic progressions.

Last year, I spent some time on the Collatz conjecture, a notorious problem that has an extremely elementary statement but is believed to be beyond the capability of current mathematics to fully resolve. The conjecture is as follows: start with any natural number. If it is even, divide it by two. If it is odd, multiply by three and add one. Repeat this process indefinitely. Is it true that this process will eventually reach the number 1, regardless of what number one starts with? It is widely believed that the answer is "yes." For instance, we know from computer searches that every starting number up to a hundred quintillion or so (10^20) eventually reaches 1. The trajectory of this process resembles the random fluctuations in the fortunes of a gambler, who repeatedly plays roulette at a casino; lots of up and downs, but in the long run, the house always seems to win.

But the problem is, again, the dichotomy between structure and randomness. While the Collatz process appears to be random, there is still the possibility of some supremely "lucky" choice of initial input that keeps defying the odds and "beating the house," trending upwards forever and never reaching 1. None of our current methods are able to rule out this highly implausible scenario.

Recently, by using tools from probability theory and Fourier analysis, I was able to show that for randomly chosen initial inputs, the Collatz process will at least get extremely close to 1. For instance, if one starts with a randomly chosen number of size about N for some large N, I could show that almost all of these inputs will dip below log N (which is a much smaller quantity than N). Almost all of those inputs will get even smaller and reach log log N; and so forth. So, the Collatz Conjecture itself remains unfinished – I don't think my method will get all the way down to 1 – but at least we know it's possible to make progress on this seemingly intractable problem in the future.

From Mathematics to the Canvas



Midnight in Moscow

Sunflower Field

Growing up in Los Angeles, Ray Balbes didn't like math very much and had to go to summer school one year because of problems with subtraction. But he ended up a triple Bruin with bachelor's, master's and PhD degrees in math. He credits a large part of this achievement to his parents. "My folks didn't have a college education, but they knew that going to college was important. We would take rides along Sunset Boulevard, and when we got to UCLA, my dad would say, that's where you're going."

Things turned around for him in high school. "I took algebra, and it was so easy and so much fun. In my senior year, I wanted to go to UCLA and major in engineering, like many of my friends." However, Ray missed the engineering exam. The UCLA admissions office suggested he pick another major, like math.

"I didn't know that there was such a thing as a math major, but that's what I did, and I decided to go as far as I could." He went all the way, earning his PhD in 1966 with a research focus on lattice theory. He met his future wife, Thelma Levine, who was majoring in chemistry at UCLA, on the steps of the math building. They have two children, five grandchildren and one great-grandson and are celebrating their 58th year together.

After graduation, Ray was recruited to the newly established University of Missouri at Saint Louis (UMSL). He and Thelma thought they would stay for three years and then return to California; however, it would take 37 years for this plan to unfold. During his long tenure at UMSL, Ray pursued his research in lattice theory, served as department chair on three occasions and started the PhD program in applied mathematics. He also became an artist.

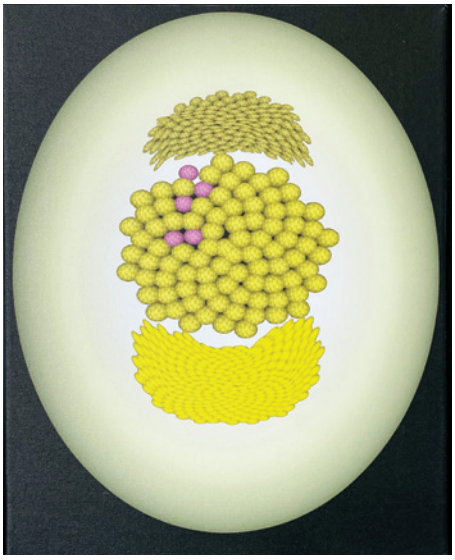
"My art career started in 1979 when I bought an early Apple II computer," he explains. "I used it to develop the first software for computer animation and special effects on a personal computer for use in television broadcasts." He subsequently partnered with a company that created an application package for PCs with operating systems compatible to the IBM model. For this venture, Ray received royalties from sales, as well as from updates, over the course of several years. It was a profitable undertaking, and interesting for a time, but he eventually became bored and decided,

"Got to move on." At that point, which was in the late 1980s, he started writing software for himself, creating digital artwork, and that was a lot more enjoyable.

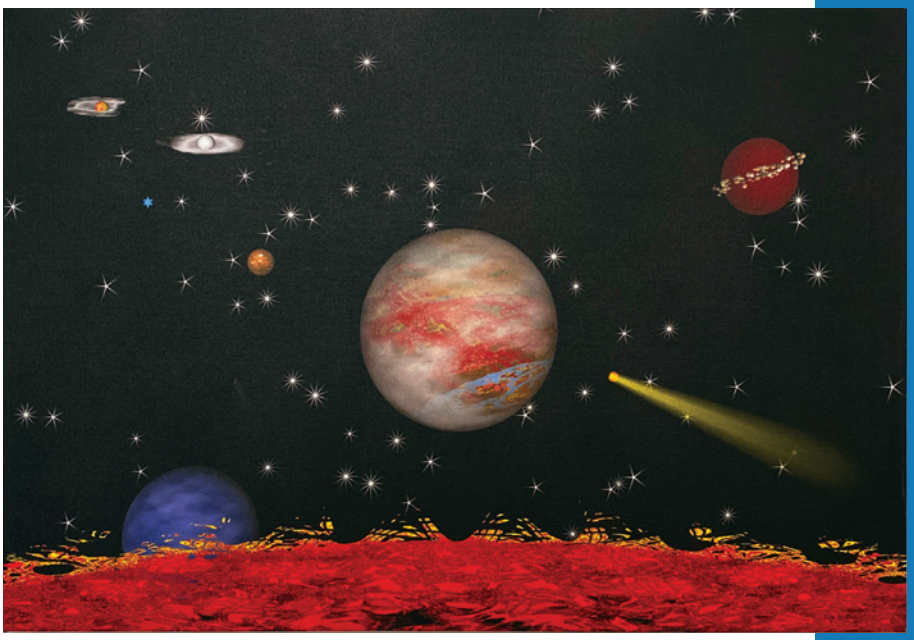
In the mid-1990s, energized by USML's purchase of a huge, new printer, enabling large-scale artwork that could be printed, Ray began creating pictures using mathematical fractals, noise, phyllotaxis and other mathematical algorithms of his own design. He and his wife successfully sold these pieces at art shows around the country, and the resulting recognition brought in commissioned artwork. He says, "For the first time, I realized what it was like to be an artist and have someone like your work so much they were willing to pay cash for it." In 2002, Ray retired from USML and moved back to California, settling in Carlsbad.

This year, Ray and Thelma made a donation to the UCLA math department, earmarked for female graduate student scholarships, because they believe that women need a boost. "For my entire academic career, three-quarters of the lower division classes up to, and including, calculus were taught by women whose academic preparation was limited to a master's degree. Of the 10 to 15 in-rank PhD professors at UMSL, we were lucky to have one or two women. Thelma and I would like to be able to change that dynamic and increase the number of women with doctorates in mathematics."

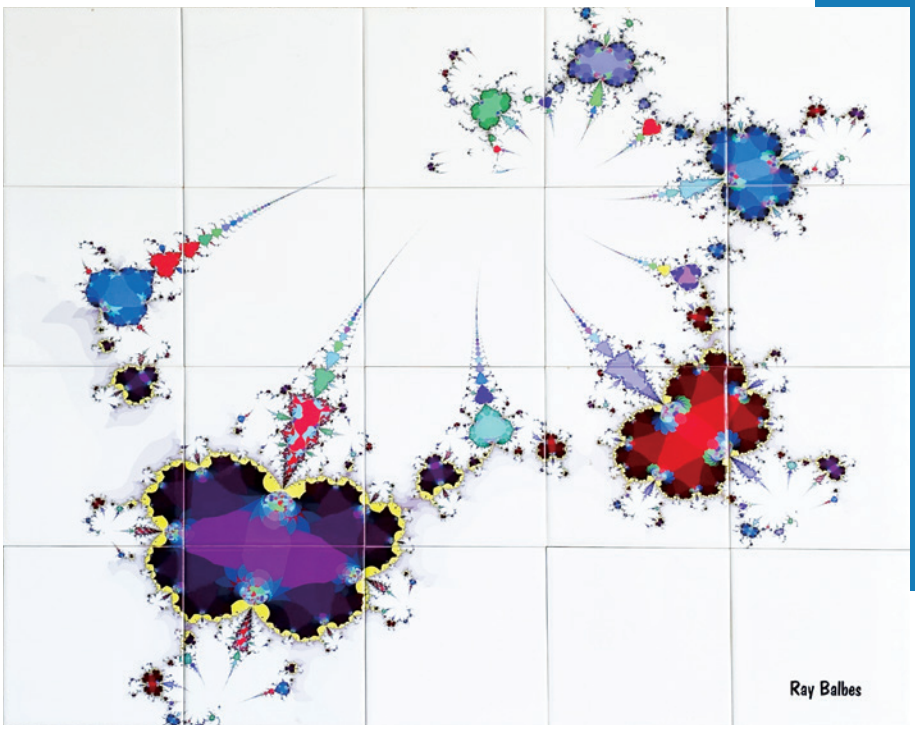
For more about Ray and his artwork, including a gallery of pictures, go to his website at www.balbes.net.



Fertility



Galaxy 3000



Butterflies on Tile

"For the first time, I realized what it was like to be an artist and have someone like your work so much they were willing to pay cash for it."

MOVING TOWARD A SOLUTION FOR COVID-19

In early 2020, as the coronavirus epidemic began to take American lives and threaten the nation's economy, the Department's applied math faculty came together to discuss how mathematics and data science might assist with containing the virus.

To start things off, Deanna Needell polled her colleagues to determine the level of interest in this kind of collaboration. Word spread quickly, with overwhelmingly positive feedback both within and outside the Department. A grant award from the National Science Foundation (NSF) provided critical funding and enabled members of the applied math group to initiate new investigations. In a short period of time, especially as measured by traditional academic progress, Department faculty made meaningful progress on COVID-19 research – including well-received studies and scholarly articles – and organized a substantial educational undertaking.

"If distancing and shelter-at-home measures had not been taken in March and April, it is very likely the number of people infected in California, New York and elsewhere would have been dramatically higher."

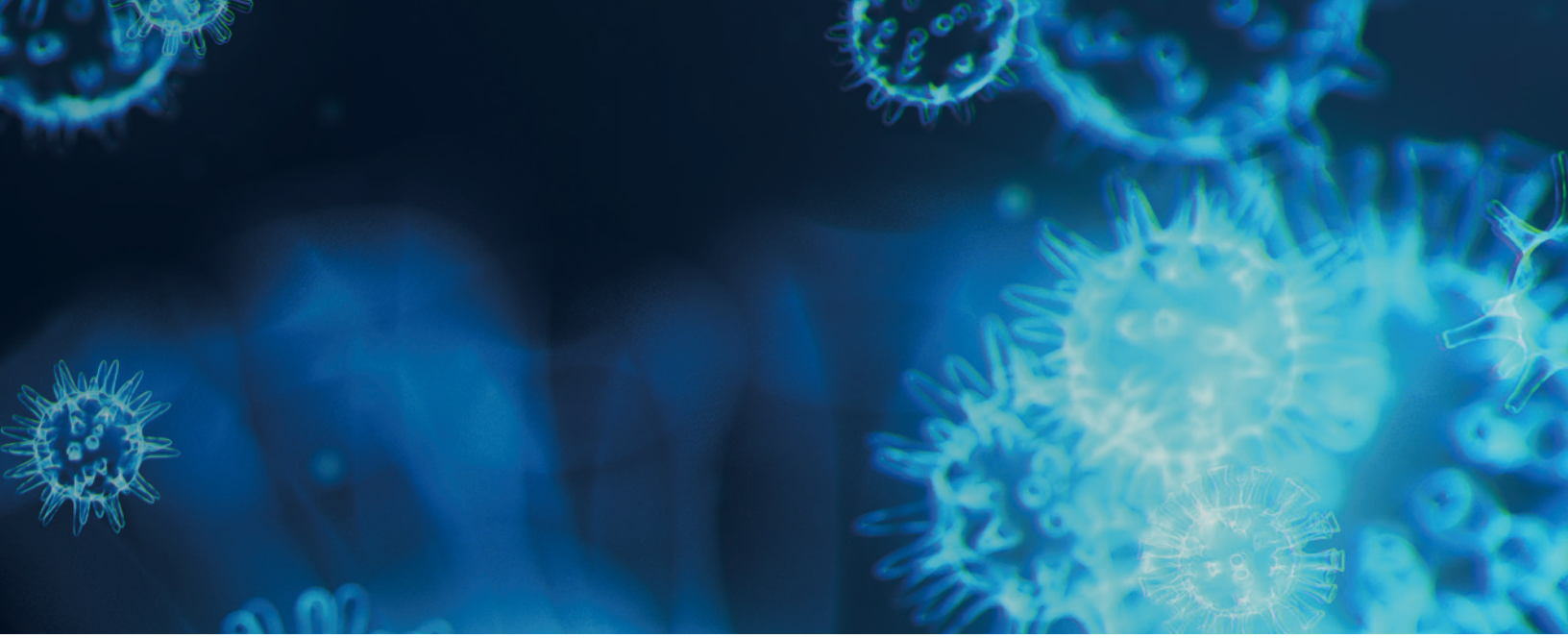
ANDREA BERTOZZI

RESEARCH

In April 2020, research teams led by Andrea Bertozzi and Mason Porter launched collaborative studies aimed at helping to contain the coronavirus. These investigations were funded by a "rapid response" NSF grant.

Andrea and her team completed a study comparing the results of three related mathematics models of disease transmission using data from local and national governments. They focused on a measure called the *dynamic reproduction number*, which indicates the average number of susceptible people who are infected by one previously infected person. Their investigation suggested that prematurely ending precautionary measures, such as physical distancing and stay-at-home directives, could have the same results as a situation in which no precautionary measures had been taken at all. Some of their research has been published in the July 2020 issue of *Proceedings of the National Academy of Sciences*, and more is ongoing.

Mason and his collaborators conducted two studies. One team, examining the spread of the virus among disabled people, found that contact limitations among disabled populations were only marginally effective unless caregivers consistently practiced safety regimens, such as mask wearing. This research resulted in a white paper, posted in August, called "Networks of Necessity: Preventing COVID-19 Among Disabled People and Their Caregivers." With a different set of collaborators, Mason wrote an article called "Disease Detectives: Using Mathematics to Forecast the Spread of Infectious Diseases," which has been accepted for publication in *Frontiers for Young Minds*.



EDUCATION

In the spring quarter of 2020, the Department offered two graduate courses focused on COVID-19, and in collaboration with UCLA's Institute for Pure & Applied Mathematics (IPAM), led a summer workshop for mathematicians and scientists. All programs were conducted virtually.

The graduate course, "Mathematical Epidemiology in the Age of COVID," attracted national and international participants. Students learned modeling methods and grappled with problems taken directly from news headlines. They were shown how to measure and understand differences in the spread of the virus across and within the states and in other countries, as well as differences in mortality rates in men and women. Effective strategies for controlling the spread of the infection in nursing homes, a dire and immediate issue across the U.S., were explored based on epidemiological studies and actual practices as reported by the press. Marcus Roper, who co-taught the course with Andrea, said, "I think for many of us, it was a kind of therapy, allowing us to use math to really interrogate the stories that we were all obsessively reading in the newspapers every day."

The graduate seminar on various data-driven COVID topics, led by Deanna, included a number of student research projects on the coronavirus, including literature clustering based on topics; exploration of x-ray imaging as a tool for virus detection; and modeling for prediction and mapping using different type of variables, such as demographics and neighborhoods, to examine more specifically how and why the virus spreads. The last project is ongoing.

In August, Andrea and Mason co-organized a virtual three-day workshop, "Mathematical Models in Understanding COVID-19," for mathematicians and scientists offered through IPAM. The program focused on the interactions between mathematical modeling, public policy and communication of the coronavirus response. A panel of experts included officials from the Los Angeles County Department of Public Health, scientists from The Bill and Melinda Gates Foundation, and the medical director of the National Basketball Association. Says Mason, "One of the issues we needed to discuss was how to influence government policies and human behavior to encourage mask wearing and physical distancing."

Research and education will continue to advance and illuminate our global understanding of this infection as we strive to contain it. Exacting investigations by Department faculty will stay abreast of leading-edge discoveries with new studies and publications in the upcoming months and years, followed by educational programming to share results and expertise. Says Deanna, "The questions one can pose in this pandemic are nearly endless, so mathematicians may have a lot to contribute."

"Research and education will continue to advance and illuminate our global understanding of this infection as we strive to contain it."


Andrea Bertozzi


Mason Porter


Marcus Roper


Deanna Needell

Olga Radko

1974 – 2020

"She acted on her conviction that even the youngest kids could think rigorously about mathematical ideas."

MARCUS ROPER

"Olga was an amazing and multi-talented person," describes her husband, Dima Shlyakhtenko, "but her most distinctive characteristic was kindness. She was the person who friends went to with their problems and worries. And they walked away encouraged, usually with some good advice. She is greatly missed by so many people already."

What some might not know about Olga is that in addition to her giving spirit and her passion for math and teaching math, she was an excellent pianist and musician, surprising many professionals with an encompassing knowledge of music. One of her favorite activities was playing a 1960s electronic organ equipped with a full pedalboard, which she bought from The Salvation Army and restored.

As a child growing up in Moscow, USSR (Union of Soviet Socialist Republics), Olga was supported and encouraged by both her parents and grandparents. She participated in a national academic enrichment program, promoted by the government, called "Math Circles." Every weekend, she traveled to Moscow State University and along with other young, gifted students, studied math problems for fun. It was this experience that Olga relied on when she founded the Los Angeles Math Circle (LAMC) at UCLA in 2007.

Olga graduated with a gold medal from one of the top high schools in the USSR, Moscow High School No. 2, in 1991, and was subsequently accepted into an elite university now known as Moscow Institute of Physics and Technology (MIPT). Initially attracted to the field of physics, no doubt influenced by her father, who was a physicist, she later changed her academic focus to mathematics, writing a master's thesis on differential calculus on quantum groups. Unfortunately, her academic preparation at MIPT coincided with an era of rapid collapse in prestige and funding for science in Russia, with students facing untenable poverty and adversity. Many, including Olga, felt they had to leave the country to continue their education.

Olga was accepted into the graduate mathematics program at the University of California Berkeley in 1997, where she started researching Poisson geometry under Alan Weinstein, who became her dissertation advisor. In her notable thesis, she gave a complete classification of a large class of two-dimensional Poisson structures. These are now known as Radko surfaces. Other mathematicians have expanded on her work, creating the thriving field of log-symplectic or b-symplectic structures. In 2002, she received her doctorate and was appointed as an NSF VIGRE (Vertical Integration of Research and Education) assistant professor in the Department. She spoke of her years at UC Berkeley as the happiest in her life.

Olga met Dima shortly after arriving in the U.S., and they married in 1998. Her first son, Victor, was born in 2002 and a second son, Robert, in 2005. While working and homeschooling her children, she educated herself in the ways that mathematics was being taught in U.S. schools and decided to enrich that experience. LAMC was the result. She grew this unique and cherished math teaching program for elementary, middle and high school youth throughout the rest of her life. It was her academic mission, her passion and a labor of love. She believed students needed to "live through a problem" to deepen their understanding and see the beauty of mathematics, and that became the basic tenet of the program.

The only entrance requirement for LAMC is an avid interest and talent in math, and that was determined by Olga herself during interviews with children and parents. Classes take place on campus at UCLA on Sunday afternoons. The children receive an introduction to the day's topic and then spend the rest of their time solving problems related to the lesson. The program is free of charge for participating students, and class materials are made available on the organization's website to anyone who is interested.

"Olga saw potential in me even when I didn't. From the first time we met, she consistently believed in my ability to succeed."

CHYNNA SWIFT, former LAMC student and instructor

Instructors are drawn from UCLA undergrads and graduate students. Even some UCLA math faculty found it hard to say no to Olga, including Sucharit Sarkar and Marcus Roper. One day, she invited Sucharit and Marcus into her office and within half an hour had persuaded them to co-teach a class that was missing an instructor. She also solved, on the spot, a recreational math problem that had stymied Marcus. He reports, "Being an instructor in LAMC was one of the best teaching experiences I've ever had!"

The task for instructors is to help the students individually while they are working on problems in the classroom, so there is a high instructor-to-student ratio. This format creates an engaging environment for learning new concepts and enables LAMC to accommodate students of different ages and learning styles. The intent is for students to leave each class understanding how to solve a math problem, as opposed to solving as many problems as possible through memorization and repetition.

Initially starting with less than 20 high school students in 2007, LAMC rapidly grew, becoming available to children at all grade levels, including kindergarten, by 2011. The program is currently offered to over 350 youth annually.

After joining the program in 2011, Olga's colleague, co-author and friend, Oleg Gleizer, remarked, "Almost instantly, I realized how much work it took to run what is basically a one-day school, every week, with students in every grade. The dedication it took to build such an enterprise from scratch and to run it smoothly is enormous."

Friend and colleague Daniel Hoff adds, "The more I worked with Olga, the less I understood how it was possible for one person to accomplish so much and at such an incredibly high level. Constantly discovering entire new realms of her contributions to the program, the Department, the community and her family, I eventually just satisfied myself knowing that their extent would always defy my understanding."

What never failed to impress everyone who worked with Olga is her encyclopedic knowledge, not only all of her students' names, but their individual mathematical strengths, weaknesses and needs. She remained in contact with many of them long after they grew out of the program, a testament to her influence over so much of their lives and a clue to how profoundly she changed those lives.

By 2015, Olga saw the need to expand beyond the UCLA campus, so she developed an informal satellite platform, which current or former LAMC students can use to build their own math circles. Student-instructors in the satellites vary in age. Middle schoolers might teach elementary students, and high schoolers might teach middle schoolers. Olga explained, "Not only are the children benefiting, but the student-instructors are learning essential job and life skills. They grow in terms of speaking in public, setting realistic goals, managing projects and leading."

LAMC alum Ellen Kulinsky is an example of how the program has played a decisive role in directing children's passion for math. Ellen enrolled as an elementary school student in 2008. She later became a student-instructor and led her own satellite group. Her commitment to math, and specifically to teaching math, resulted in acceptance to UC Berkeley's undergraduate math program as a distinguished Regents' and Chancellor's Scholar.

Olga was diagnosed with ovarian cancer in early 2018. The diagnosis came as a shock. Like many women who get this disease, Olga thought that the usual periodic exams screened for such cancers. They do not. Despite nearly continuous treatment, her cancer proved to be unusually aggressive and continued to spread. Olga was working almost to the last day, even after being hospitalized. She died on June 29, 2020.

Olga leaves a legacy of caring and achievement to her two sons, Victor and Robert. Victor has inherited his mother's love of music, winning multiple piano and composing competitions and performing in professional concerts. Robert has reached the rank of chess FIDE Master and is competing at the national level.

Many of the people Olga touched in her life have stepped up to preserve LAMC, and a team of UCLA math faculty are working hard to ensure that the program continues to thrive.

UCLA Olga Radko Endowed Math Circle

To recognize and continue Olga's love of math, the UCLA Division of Physical Science has established an endowment to transform the math circle into a self-sustaining program as it moves into the future without its beloved founder and leader. Dean Miguel García-Garibay has committed the division to a matching gift for every donation made in Olga's honor until June 30, 2021, up to $250,000. Please contact Sharon Chang at schang@support.ucla.edu with questions or to make arrangements for large pledges. With a significant commitment from math alum Sierra Chen '93, the math circle has been renamed the "UCLA Olga Radko Endowed Math Circle."

Math Students Go Home Again

KRISTI INTARA

Undergraduate student
Financial Actuarial Mathematics

Kristi Intara's college days used to begin in the Sproul Cove dorms, followed by classes and study time. In the evenings, her activities might include a meeting of the Bruin Actuarial Society (BAS), her student organization, or Wushu martial arts practice, at the John Wooden Center. Her life was productive, even exhausting at times, but happy and fulfilling.

When UCLA shut down at the end of the winter quarter as a response to the pandemic, Kristi's first concern was her finals. Feeling anxious, she packed up and flew home to Daly City, California. "As it turned out, taking finals there was pretty comfortable," she remembers. Since then, her student life has been structured around home and the computer.

Following a hectic spring quarter, Kristi worked remotely through the summer as a full-time intern with Pacific Life Insurance Company. She was also deeply involved in the Bruin Actuarial Society (BAS). Kristi's charge as incoming president was to ensure a widely accessible online portal for the club. BAS officers began reaching out electronically to the actuarial program's incoming freshmen and transfer students, and they planned for online activities and events, including virtual résumé critiques and mock interview workshops via Zoom.

While Covid-19 brought uncertainty to her college experience all those months ago, Kristi feels more confident moving into her senior year knowing what to expect from remote instruction. She admits that at times she feels disconnected from her peers, but she plans on enjoying the time she would normally spend with her friends on campus by making the most of what could be her last year with her family. BAS has been a bonus, giving her a way to stay connected and make a difference in this strange, new university life.

VAN LATIMER

Doctoral student
Random Matrix Theory

Van was living in university student housing with his wife and two small children when the pandemic hit and he learned that winter finals would be given remotely. In addition to pursing his PhD, Van was working as a teaching assistant, so his charge was twofold – a challenge in a small, crowded apartment.

"With my family in the next room, it was really difficult," he recalls. "My wife was limited in terms of where she could take the kids and how long she could stay out of the house." After an initial struggle, he and his wife elected to move in with family, who were living in the Los Angeles area. Van was able to focus better on school and work in this larger, more supportive environment.

He is appreciative of the extra time he was able to spend with his children. "My one-year-old son just learned to crawl, and my daughter celebrated her second birthday. It's nice to be home for those important moments."

However, he believes that the downsides of distance learning outweigh the pluses. Teaching, in particular, was tough. "It's hard to gauge social cues when you can't see everybody in the virtual classroom, and a big part of my teaching job is making sure I don't get any confused looks."

While learning and teaching at a distance are doable, Van believes that the university milieu cannot be replaced. He misses his grad school environment, which for a doctoral student, can be a determining factor in building a career. Going into his fourth year of graduate study, he is hoping to return to campus life again soon, and he is looking ahead. After completing his PhD, he plans to work in the private sector or government where he can use his research interest in computational mathematics as well as his background in probability theory.

The Latimer family

INITIATIVES FOR Equity, Diversity and Inclusion

Beginning in May of 2020, massive protests erupted across the country over the killing of Black Americans by police. Through its leadership, UCLA quickly and unequivocally condemned the violence as reprehensible and configured virtual spaces for the pandemic-locked UCLA community to develop responses and solutions to this overreach by law enforcement. The Department responded by attesting to the widely held judgement that these killings were unlawful and caused severe emotional pain for Black Americans in particular, and for communities of color generally.

Recognizing that mathematics cannot be separated from the flows and upheavals of society, our faculty came together to address two major issues: how can we ensure inclusivity and social justice within the Department, and more broadly, how can we improve access to math education for women and communities of color? Unfortunately, the barriers to careers in in this field are particularly high for these populations. For example, only 3% of math doctorates were granted to African-American students in the U.S. over the last decade.

To ensure that inclusivity and social justice are acknowledged and acted upon within the Department, an Equity, Diversity & Inclusion (EDI) Committee was established in the summer. It will work toward the long-term goal of redefining and reshaping the mathematical community at UCLA. Consisting of students, postdocs, faculty and staff, the committee will examine the Department's climate, admissions and student support, as well as its hiring and professional development processes. It will serve as the point of contact for anyone who wants to bring forward concerns or make suggestions for improvement. The committee's first action was the appointment of faculty member Inwon Kim as an ombudsperson to serve as a mediator for any EDI-related grievances in the Department. EDI-related concerns may be sent to ombuds@math.ucla.edu. General feedback and suggestions for the committee can be submitted anonymously via this link on the Department's website: https://ww3.math.ucla.edu/feedback/.

To help high-potential students of color in their applications to mathematics graduate programs, UCLA and local California State University (CSU) campuses collaborated on a pilot program in the summer. The CSU system has a strong mandate for accessibility to students of color and is a key source of doctoral candidates for UCLA across many fields. The Department hosted six CSU math students virtually, who successfully completed the in-depth Math Bridge Summer Program. Faculty mentors will remain available to them for advice and assistance and to help them navigate the application process for graduate study. Student feedback was positive, and in addition to feeling more prepared for their efforts to advance academically, they reported forming new and valuable peer connections for the future.

To promote and nurture women faculty, grads and undergrads locally, the Department has joined Women in Mathematics in Southern California (WiMSoCal) and elected to host the 2021 WiMSoCal Symposium. This annual event is attended by over 100 women and features plenary talks, special sessions on a broad range of research in pure and applied mathematics, and poster sessions for students and new grads. It not only nurtures research collaborations for women mathematicians in academia, it provides a framework for mentoring and an exploration of issues for all women pursuing careers in math. The event will be held in early spring quarter.

Matching Gift Program in Support of EDI

One of our ambitions is to create an endowment that will fund efforts to promote and expand opportunities for women and students of color within the Department. To advance this ambition and those of other UCLA departments, the Division of Physical Sciences has set up a Matching Gift Program to address social justice priorities and the critical need to increase the diversity of our faculty, staff and student body. The fund is a way for alums and other donors to increase the value of their cash gifts and pledges to new or existing endowments during the academic year ending June 30, 2021. For more information, please reach out to Joy Kruger at jkruger@support.ucla.edu to discuss details.

Mathematics is as much a human endeavor as any other field of study.

RIGHT WHERE I BELONG

by JUAN CARBAJAL, ALUM '20
UCLA Department of Mathematics

"It took a community to get me into UCLA math, and I built my own community in order to thrive there. I've learned that it's not a matter of being smart. It's being able to appreciate hard work, and equally as important, knowing when to ask for help."

My journey to UCLA math started when I was an infant. My parents left Mexico and everything they had to give my family a chance at a better life in America. Their struggle and sacrifice motivate me in everything I do.

In the fifth grade, I was identified as someone with the potential to excel in mathematics. Like many math students, I fell deeply in love with the subject at a young age, although I would be lying if I said my path was easy or straightforward.

Growing up undocumented in northeast Los Angeles, I considered a university education to be out of reach, let alone majoring in applied math. I witnessed firsthand how my older brother struggled to make his way through an associate's degree at our local community college. At that time, undocumented students like us did not qualify for in-state tuition. My brother had to work full-time while in school in order to afford out-of-state tuition. Nonetheless, seeing him finish his schooling taught me that I could gain access to higher education if I worked hard, regardless of how certain laws (or lack thereof) created challenges.

By the time I reached high school, I was determined to gain acceptance into a university. I knew I was on the right track, but uncertainty and doubt followed me. I could not seem to escape this idea that I was not ready to study college-level math. I spent time trying to think about what else I could study or what other possible routes I could take. I am forever grateful to my math teacher, Ms. Mejia, for giving me the confidence I needed to pursue my degree. She taught me how to appreciate mathematics. In 2016, I was accepted into the UCLA math undergraduate program.

Walking into my first class (Math 31B), I experienced imposter syndrome, and I felt like I was just a very small part of a much larger set. By my junior year, I knew I would need to be vulnerable and reach out for help with my classes. My two main support systems were my classmates and my professors. It was incredibly motivating to work through problems with classmates, and it was really helpful to receive one-on-one guidance from professors; for example, discussing coding with Professor Hangjie Ji, who specializes in Python Programming. I also accepted a student worker position in the math department, which helped me feel comfortable and made it an even friendlier place for me. This all turned out to be a great way to build my own math community.

Last summer, I was approached by a startup called Teens Exploring Technology (TXT), which uses coding as the catalyst to turn young men of color into technology leaders. With my newfound passion for coding, I was excited to share my expertise and mentor other teens from low-income communities. I led a team as they built their own product/application in TXT's 10-week Summer Coding Leadership Academy. Now I have officially joined TXT as their tech lead for the program.

It took a community to get me into UCLA math, and I built my own community in order to thrive there. I've learned that it's not a matter of being smart. It's being able to appreciate hard work, and equally as important, knowing when to ask for help. It's rare to be a "Terry Tao," but I know that if you seek guidance, build relationships and stay dedicated, you can overcome the doubts and challenges you may encounter and find yourself right where you belong – at a university, a startup or anywhere else you want to be.

In 2020, Juan received his bachelor's degree in applied mathematics with a specialization in computing.

Alum's Heartfelt Thanks

Ernest M. Scheuer has made a gift to the Department in honor and memory of his mentor, Frederick A. Valentine, and his advisor, Paul G. Hoel, two distinguished UCLA math professors who greatly impacted his graduate education. The Department will use the gift to defray fees, tuition and living expenses for outstanding math students. A portion of the donation went to eight undergrads this year.

Ernest grew up in Portland, Oregon, following his immigration from Germany with his parents in 1936. After earning a BA in math from Reed College in Portland and an MS in statistics from the University of Washington, Ernest met Fred Valentine at a Reed College alumni event in Los Angeles. In a conversation there, Fred encouraged him to pursue a doctorate in math at UCLA and graciously accommodated Ernest's work schedule by meeting him at the campus on a Saturday to discuss the opportunity. Fred is especially remembered by colleagues for his gentlemanly demeanor and his excellent teaching record. His sincere invitation was the beginning of an extraordinary level of kindness and friendship that Ernest enjoyed while studying in the Department.

"It was a wonderful experience," remembers Ernest. "I found the UCLA Department of Mathematics to be a very congenial and supportive place." Ernest received his doctoral degree in 1960 after completing his dissertation with a specialty in mathematical statistics under Paul Hoel, who was UCLA's point of contact at that time for all things statistics. Paul contributed seminal work on design theory across two decades, and his approaches to teaching statistical theory led him to write his classic book, *Introduction to Mathematical Statistics*. Ernest and Paul kept in touch after graduation and met for social events, on and off campus over the years.

Following his PhD, Ernest divided his time between the Southern California aerospace industry and teaching at California State University, Northridge (CSUN). In 1970, he became full-time faculty there. During his long tenure, he was visiting professor at the City University, London, in the 1977–78 academic year and at what is now the UCLA Anderson School of Management in 1983-84. Currently, he is professor emeritus of management science and of mathematics.

Ernest married Mary Jean Arlington, a professor in finance at CSUN, in 1972. She excelled in the field, meeting the challenges of working in a mostly male area of study, and was an accomplished and highly regarded teacher. The Scheuers' daughter, Audrey Arlington, remarked of her mother, "Perseverance is her middle name." In addition to his generous gift to UCLA this year, Ernest established the Dr. Mary Jean Scheuer Endowed Professorship in Finance at CSUN. It is the first endowed professorship there named for a woman.

Ernest turned 90 this year. "Reflecting back," he says, "I remember that the math professors at UCLA were really excellent people. The Department had a huge influence on my career, and I wanted to acknowledge that."

"It was a wonderful experience. I found the UCLA Department of Mathematics to be a very congenial and supportive place."

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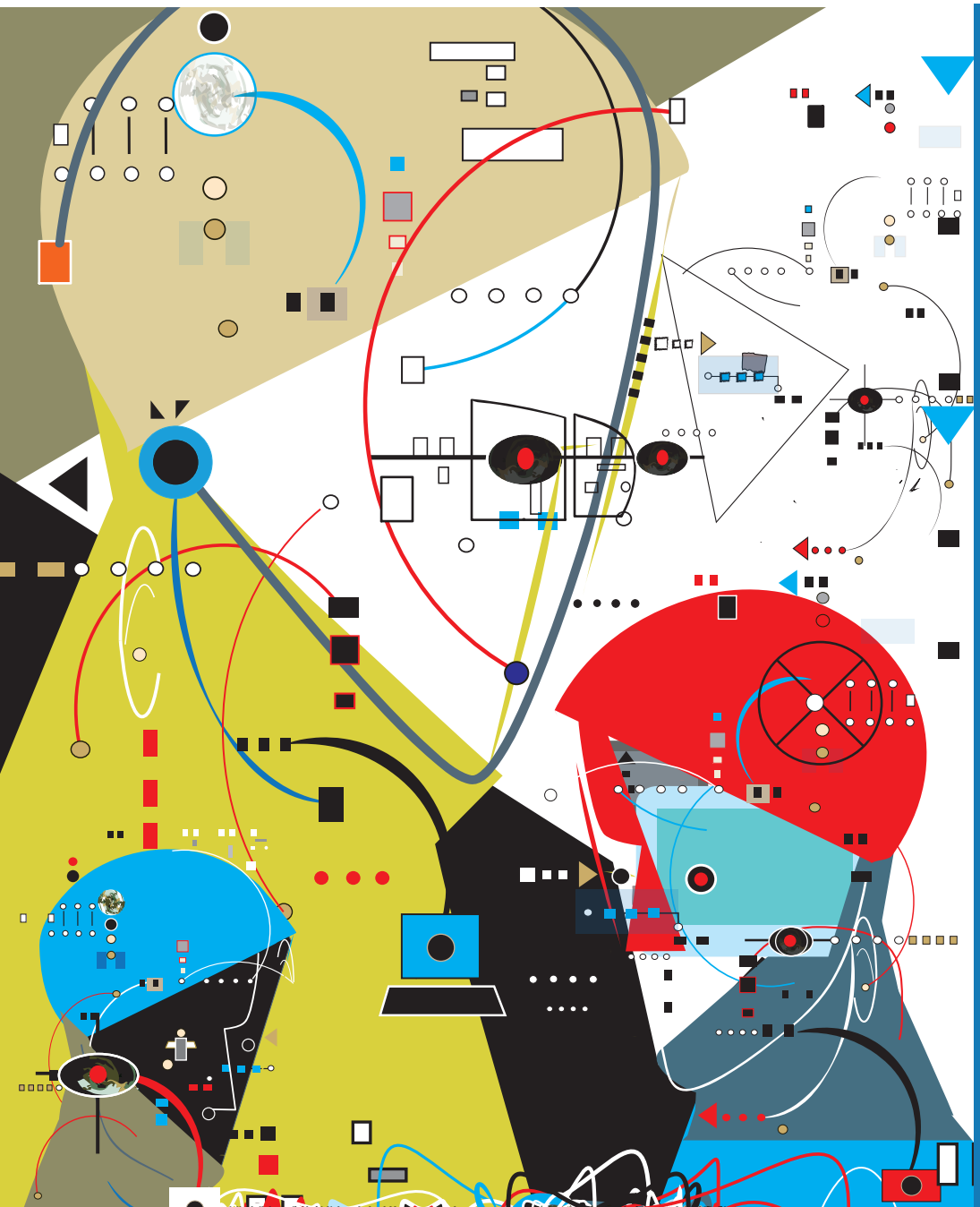

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FALL 2020

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