

and then realizing that in a big department there are always multiple people facing significant challenges each year, often in private. As chair, it was especially important to Will to find mechanisms to help people through these periods.

Changing Research Direction

I asked if the participants had any experience or advice for people who felt like they wanted to branch out into new areas after tenure. Rachele said that since she has a good community of collaborators and there are publication requirements for promotion to full professor, she has not been interested in changing her research area.

Julianna and Will both described using teaching as a way to explore new research areas. Julianna coauthored two publications in biologically inspired combinatorics after developing a topics course for majors. As a part of this process, she started reading papers of a long-time friend from graduate school, and they ended up working together.

Will (whose training is in algebraic geometry) just received a grant to develop a data science curriculum at the Naval Academy. He talked about a gradual process of dipping his toe in the waters of data science by teaching new courses.

The group also enumerated several programs that support faculty wishing to change directions. Resources for faculty through PIC Math—Preparation for Industrial Careers in the Mathematical Sciences—include a 3-day summer workshop and their Spring Semester Research Course, which provides faculty with content for a course built around solving problems from industry in teams. REUF—Research Experiences for Undergraduate Faculty—holds workshops at AIM and ICERM to support faculty who want to do research with undergraduates or re-engage or change their own research program. At DIMACS Project Reconnect offers week-long themed workshops to introduce faculty to areas of current research that are appropriate for an undergraduate curriculum. Through Project NEXT (New Experiences in Teaching) the MAA provides curricular development workshops for faculty traveling to the JMM or MathFest.

What Lies Ahead...

I chose these four mathematicians because I am familiar with some aspect of their work and admire what they have accomplished so far. So what is next for this group? Ravi described his future goals as “proving better theorems than I have proved so far.” Rachele is focused on making the mathematical community more inclusive, having seen some people turning away because they don’t feel that they fit in. Will is interested in keeping up current research collaborations while at the same time getting more involved in interdisciplinary conversations around campus. Julianna knows that she will be continually re-evaluating what is on her bucket list and is looking forward to life as a new full professor and former department chair.



Jessica Sidman

Credits

Author photo is courtesy of Jordan Tirrell.

Anxiety Attacked Me, But I Survived¹

Ken Millett

Coming from Oconomowoc High School, my undergraduate experience as a wannabe engineer at MIT was marked by some serious obstacles. I was not prepared for life in a large city, not aware of MIT’s reputation or its intense academic environment, nor was I prepared for the intellectual level and preparation of my classmates. My parents drove me to my cooperative residence in Boston. There, I was greeted by classmates who questioned how many 800s I had on the SATs. I was paralyzed. Not only did I not imagine that a person could get an 800, but I was astounded that the measure of success was “how many.” It was clearly impossible to get back into my parents’ car and say, “Take me home. I’ve made a big mistake.” It was like being on another planet with no hope of escape.

As I progressed in the pursuit of my bachelor’s degree, I continued to be plagued by a feeling of inadequacy which had one highly unfortunate effect: it made taking exams nearly impossible. One of my more memorable experiences was a three-hour exam during which I only managed to put my name on the paper and sit terrorized by a giant ticking clock on the wall for the entire exam period. Fortunately, MIT was stronger than me and did not let me give up. With the encouragement of housemates and with many months of counseling and work, I learned enough to survive examinations, though often barely. I learned to have a meta-awareness of situations I’d find myself in—for example, becoming paralyzed during an exam. I learned how to stop, step back, breathe deeply, close my eyes, and imagine myself in a favorite place—such as hiking the peaks in New

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Hampshire's White Mountains—until I calmed down and was able to restart work on a problem.

While I was working on a construction crew during one hot, humid summer to pay for tuition, I resolved to return to MIT and to ask all my dumb questions so that my professors would have to help even dumb students like me. Of course, I eventually learned that my classmates had the same questions that I did, and—bless their hearts—the faculty and staff never seemed to give up on me. They gracefully answered every one of my questions and more. For example, from my advisor Dan Kan (with whom I had to meet when I proposed to leave MIT for a less demanding school), I learned how to organize my efforts to optimize my learning. For example, he taught me: “Don't try to learn when too tired.” He proposed a daily schedule that included a mere ten hours per day of school work, eight hours of sleep, time for meals and, believe it or not, time for “fun.” I tried this for a month or so before final exams one semester in my second year, and I had the most surprising experience. I had more fun, and my grades in EVERY CLASS increased by at least a letter. This advice, with small refinements, still informs my daily schedule.

Nevertheless, I still managed to create occasions for MIT to work hard to help me overcome my weaknesses. Exam anxiety was never entirely conquered and, as a consequence, I almost didn't graduate with my class in 1963. As a senior math major, I had to complete all my courses before graduation in June and get a job to support my family. The pressure and anxiety increasingly overwhelmed me to the point that I was struggling quite a bit to get *anything* done. In the end, I got confused about when my last final exam would be held. I showed up, but nobody was in the room at the appointed time, and I had to find my professor to find out when the exam was going to happen. Alas, it was the day before! Fortunately, MIT and my professor, Isadore Singer, were up to the challenge of helping me graduate. Professor Singer got MIT to allow me to take an oral exam in order to pass the course and graduate with my class. I have been—and continue to be—deeply grateful to MIT and its faculty for all that I learned. They made it possible for me to prepare for a career in mathematics and support my family, despite all the trouble I had along the way. As an undergraduate, mathematics was never easy for me, but it was really, really interesting.

After graduation, I was offered an excellent job with a generous salary at one of the military research support companies. I was assigned to a team working on developing and testing communication and sensing systems in support of governments funded by the US. After only a few months, I realized that the work I was doing was in conflict with my beliefs and ethical principles. Despite needing to support my family, I had to resign. Fortunately, with the assistance of my parents and letters of recommendation from my MIT professors, I was able to return to Wisconsin where the mathematics department was willing to admit me to

their graduate program, albeit on probation. They gave me a chance to earn a master's degree and find a job that was more compatible with my pacifist beliefs and ethical principles. To UW-Madison and its faculty and my MIT recommenders I owe this opportunity to enter a program where, finally, I was successful.

The expectations of a doctoral program, I learned, consisted of things I could do and that I really enjoyed. The depth of understanding expected, the daily adventure of learning amazing things, and the fellowship of so many other students who were similarly confronting confusion made my anxiety seem quite normal and well within a range that I could conquer. From my research advisor, Edward Fadell, I learned so much more about doing mathematics, teaching, and working with students. It was as a graduate student in 1964 when I started teaching that I first recognized myself as a “mathematician.” This made it clear to me that I was on the right path. Now, more than 50 years later, I look back to MIT and UW-Madison and their faculties and feel very grateful for all that they did to allow me to have the opportunity to become a mathematics teacher (my job) and researcher (my pleasure) and give back to our mathematics community for all that I have received.

This “giving back” has been an important part of my life. After joining UCSB, my first years were focused on my own professional growth, but I soon began working with minority STEM students. With the help of the Equal Opportunity Program staff, I created and found funding for a new, two-week summer residential program for 15 female and 15 male admitted STEM students who were first generation in college, from underrepresented minority groups, or from socioeconomically disadvantaged communities. My dream was for these students to be prepared for success, to find friends like themselves, and to have a support system of graduate students, staff, and faculty to whom they could turn for advice. The experience was amazing. These students became campus leaders. They not only graduated—a rare outcome for such students back then—but many went on to graduate school and found their homes in STEM professions. This program, the Summer Institute in Mathematics and Science (SIMS), continues under a new generation of leadership and with ongoing campus funding. Over the years, I continued to try to give back for all that I had received. I served as the regional director of the National Science Foundation (NSF) supported California Alliance for Minority Participation (CAMP), and I created the California Mathematics and Science Teacher (CMST) program.

Thinking back, I feel I should share an important regret relevant to these efforts. At some point, I was directing three very intense programs as well as supervising PhD students. I felt that I did not have enough energy to continue work on these three programs while having my own research be supported by the NSF. I decided to reduce my stress level by no longer seeking research grants from the NSF. I was not actually reducing my research effort, but at least I

didn't have to question whether my research was of high enough quality to be funded by the NSF. I was wrong to not request NSF funding for two reasons. First, and very importantly, I eliminated the opportunity to financially assist the students and postdocs who were working with me and my colleagues. Second, I should have left the funding decision to the NSF and its review panels; they might not have had the same opinion of my productivity as I did. And what's the worst thing that could have happened? My research wouldn't have been funded, and I'd be right back where I started. I am reminded of my father's admonition: "If you are not failing every once in a while, you are just not trying hard enough." And, of course, there was my grandmother, who would tell me, "If you want to dance with a 'pretty girl,' you have to ask her." Even though I was twelve at the time and her advice was given in another context, her words continue to ring in my ears when I consider my choices in life.



Ken Millett

Credits

Author photo is courtesy of the AMS.

Should I Quit Mathematics?²

Francis Su

"Should I quit mathematics?" This was a difficult question for me to answer for all sorts of reasons, most of which had very little to do with mathematics. I was in my fourth year of my PhD program. I had already been a disappointing student to two PhD advisors—one who was mostly absent for the two years I worked with him, and the second who was difficult to please and quite unkind, letting me know that a "real mathematician" wouldn't do the things he felt I was doing. He was implying, of course, that I didn't belong in that category.

I had come to graduate school less well-prepared than my peers, and I had a rough transition, in part because my

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mother was dying of ALS and I had a hard time focusing on my work. I was also meeting, for the first time, people who were supremely talented mathematically, and I felt I didn't measure up. Moreover, I wanted more life balance than I witnessed my professors having. All these factors contributed to a crisis of self-doubt that was slowly stealing my joy.

I had dreamed of becoming a mathematician, but I also did not want to continue in a day-to-day reality that felt oppressive. So, three-and-a-half years into a PhD program, I began asking whether I should leave and do something else.

If you're asking this question like I did, I want to affirm that asking the question is not a sign of weakness, but a sign of strength. You are taking control of a situation that has, until now, felt out of your control. Each of us who ask the question may ultimately answer it in different ways, but I want to share some of the good things that came out of wrestling with the question.

First, I realized that my dignity did not have to come from getting this PhD. Somehow, I had made it the ultimate marker of whether I was a worthy human being. And yet, when I reflected on my experiences, I saw instead that my most joyful moments of feeling loved and accepted came from people who didn't care whether I got a PhD. I also began to imagine other careers that I might pursue, and just doing that exercise felt freeing.

Second, I realized that comparing myself to other people was always going to be self-defeating, no matter what career I pursued. There will always be someone more skilled at things I feel I am skilled at. Becoming more centered in who I was (e.g., the things I love and why I love them), rather than what I could accomplish, has helped to free me from the pressure to compare myself to others.

Third, I realized that graduate school can give you a pretty skewed view of what being a mathematician is like. You are training at a research university where research is prized above all else. But there are many other important facets of being a scholarly mathematician: being an excellent teacher and communicator and mentor of mathematics is, I believe, equally important. In speaking with mathematicians outside the research bubble, I saw that it was possible to have a life balance that doesn't prioritize research over all else.

Now, having gone through this soul-searching has brought benefits. When I experience failure, it rattles me less than it used to. When I experience success, I don't cling to it too tightly. Because I know it's not where I get my dignity.

I'm also more willing to take risks—like sharing with you all that I have self-doubts and admitting that I have weaknesses—because I don't get my dignity from appearing successful or talented or having it all together. I also know that success or failure in a worldly sense has very little to do with talent, and that worldly success is truly not as important as the kind of human beings we are to one another.