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An Interview with Mathematics Professor and Former Department Chair Jonathan E. Rubin

Neil MacLachlan and Lark Song

Department of Mathematics, University of Pittsburgh, Pittsburgh, PA
E-mail: pimr.editors@pitt.edu

Neil MacLachlan/Lark Song: *Professor Rubin, we were wondering if you could talk a little about how you found mathematics and how your journey from childhood experiences to the present may have shaped your path to math.*

Jonathan E. Rubin: Math was always something that came easily to me when I was quite young. Through a test that was administered to students, I was selected for a relatively advanced program...run in our county, Howard County, Maryland, which has a very strong public education system. I was placed on an accelerated math track, which led to my taking trigonometry in my first year of high school and calculus in my second year.

I always enjoyed the puzzle aspects of math, but I never viewed it as a passion while growing up. I wasn't immersed in it. I wasn't going to the library checking out math books. I was checking out Hardy Boys and other books to read for fun, like science fiction.

I did not go to college intending to study math, and I never had a special math mentor throughout my early education. In high school, after taking calculus, I was kind of out of things to take. There was one teacher who agreed to do a one-on-one independent study with me in differential equations. Unfortunately, while he was a very nice guy, [I found the experience to be] extremely boring. So I just could not wait to get out of there, sitting there one-on-one with this guy.

I was on the Math Club in high school. It was just a local, county-wide math competition, but I did enjoy that a lot, in terms of the more puzzle-type problems that were outside the regular curriculum. It just never occurred to me to go beyond that and start looking for that stuff on my own.

[NM/LS]: *Was math your only major in college?*

JER: That's interesting. I went into college thinking I might be a biology major. But I couldn't stand the labs. In the meantime, I had taken intro chemistry, which I enjoyed. So I switched to thinking I'd be a chemistry major, but then I couldn't stand those labs either. Bio lab felt like I was always looking under the microscope and just seeing bubbles. Chemistry lab was like cooking in a kitchen following the recipe.

So I was like, forget this stuff, I'm switching to psychology because then it's close to biology, but you don't have any labs. However, I found the psychology classes at my institution to be...just not sufficiently challenging. In one course called "Theories of Personality", there was one very short unit about behaviorism. It was about predicting behavior, and they included some very simple mathematical principles trying to come up with...a linear combination of motivation factors to represent the next behavior. And I thought, that made it into a textbook and it's [a] simple linear equation, I can do better than that! So I got excited about that possibility and also realized that the common element I enjoyed in all of these classes was any time things got especially quantitative.

So, halfway through college, I just immersed myself and took essentially only math classes from that point on. And that was my math major.

[NM/LS]: *So it was more that you were interested in science, but the aspects of science that you really enjoyed a lot were the quantitative ones. And you were always good at them and had a lot of exposure to it, but it didn't particularly fascinate you.*

JER: That's right. Again, I do not come from a family or an upbringing where math is front and center. So it didn't even really occur to me that math could be a career other than being something like a teacher. I didn't really think about being a math major until this realization halfway through college.

[NM/LS]: *And then what came out of that when you started taking more math classes? Did you have more contact with mathematicians and probably engage in research in applied mathematics?*

JER: So, I went to the College of William and Mary, where a lot of the research in the math department was related to matrix theory, operator theory, linear algebra, and similar topics. Charles Johnson[1] was there, as well as many other prominent people in that area. So I was able to do an REU there where I worked on a problem that eventually became part of a paper. My first paper is in *Linear Algebra and its Applications*, based on my undergraduate research.

Once I was immersed in math as an undergrad, I did have opportunities to do research and go outside the curriculum. I did an honors thesis on communicable disease modeling, like SIR models and these type of things that have been all over the news with COVID.

[NM/LS]: *So you made this transition in the middle of college, and you started getting involved with math research, more in the applied but somewhat theoretical realm?*

JER: My REU experience was completely theoretical. The thesis was a little more applied.

[NM/LS]: *Also in college, what extracurriculars were you involved in?*

[1] Charles R. Johnson, the author of the textbooks *Matrix Analysis* and *Topics in Matrix Analysis*.

JER: Yes, I started off trying to basically continue what I had been active with in high school, which was playing the trumpet in band, and soccer. Unfortunately, I broke my ankle playing soccer the summer before college. So I was just getting back to running when college started. I had planned to actually try out for the varsity team as a walk-on, but I couldn't do that in that condition. So we ended up starting a soccer club, because the school didn't have one. We went and played against the University of Virginia's club team and some other local club teams.

At some point, I was in the psychology club, but that was somewhat brief - I was motivated by my girlfriend at the time. We ended up starting a math club, which our school did not have, and I became an officer in that.

[NM/LS]: *Then you went to Brown for the applied math program. Could you talk about that experience and what graduate school was like?*

JER: Yes. So by the end of college, I realized: A) I had just touched the tip of the iceberg in terms of math knowledge and I wanted to know more, and B) I did want to try to put together math and either psychology or biology. At that point, I was maybe thinking more about biology, aiming to make models that could reduce the need for experiments or help guide experiments. So I wanted to go to a graduate program where I could study mathematical biology.

At that time, there weren't any websites. [To get information, you would] write to the school, they sent you their information or lists of faculty members with their research interests. Based on my reading of various schools' faculty lists and descriptions, I decided Brown could be a good place because they did have a specific division of applied math, separate from the math department. It seemed like there were some people doing mathematical biology there, but that turned out to be false...so that ended up having to wait.

But I went to grad school. At Brown, many of the students were from Europe and had taken more math courses at that stage in their lives than I had. So there was a bit of a small feeling of catching up, although it never felt too bad. The professors assumed that we had a very strong background and encouraged us to go into fairly advanced courses from the outset, relative to some other programs. But I really fell in love with my dynamical systems course right away in the first year. By the end of the first semester, I had no doubt in my mind that I wanted to work with Chris Jones[2], who was teaching that course. He ended up being my advisor, and I did my thesis in dynamical systems.

[NM/LS]: *So your graduate training was focused on dynamical systems. And you didn't actually dive into mathematical biology research until after you were a postdoc?*

JER: Right. Chris knew that I was interested in applications in biology. He went on

[2]Christopher K. R. T. Jones, now a Domain Scientist in the Renaissance Computing Institute at the University of North Carolina at Chapel Hill.

sabbatical around the time that I was looking for a thesis problem. He arranged for me to visit the group of Nancy Kopell[3] at Boston University each week, which was great. So I learned a lot about mathematical neuroscience. Well, I take it back – I did not learn a lot, but I got an exposure. And I would have loved to find a thesis problem through that route, but it didn't happen. So, in the end, we agreed that I would work on something in nonlinear optics, which was one of Chris's research interests at the time. He was able to connect me with a problem that involved coupled reaction-diffusion equations, which is not the standard class of equations in nonlinear optics. But he knew that was something that would also potentially be relevant in mathematical biology. So, relative to other problems in optics, that was a good fit.

[NM/LS]: *What was the experience of visiting that math neuroscience group? Because I know it's a really strong group.*

JER: Yes. It was an adventure because I would hop on the bus and then the T, having these very long commutes on public transportation to get up there each week, in all sorts of weather. Nancy was very welcoming. Typically, she would meet with me along with some of her students. We talked about some papers and open problems, and then there would always be a seminar. There were often visitors because...lots of people wanted to come visit that group.

I also interacted with Tasso Kaper[4], as well as other students and postdocs there. I felt very welcomed and it definitely opened my mind. And I actually met David Terman[5] there, who ended up being my postdoc advisor later. So it's serendipitous in that way as well.

[NM/LS]: *Was your postdoctoral position at Ohio State affiliated with the Mathematical Biology Institute?*

JER: There was a Mathematical Biosciences Institute, one of the national institutes, there, starting in 2000 or 2001. But I had finished there before it started. So I was a postdoc in the Math Department. I had a teaching load. I did research with David Terman. I applied for and was awarded an NSF postdoctoral fellowship, which allowed me to stay there and stop teaching, just focus on research. And then I was able to bring the final year of the fellowship funding with me to Pitt when I took the job here. So [OSU is] where I started learning about mathematical neuroscience - applying dynamical systems to neuroscience, which I've been doing ever since.

[NM/LS]: *Any memories of your advisors Chris Jones and David Terman?*

JER: Chris was a hands-off advisor when it came to the research stage. He was a

[3] Nancy J. Kopell, now William Fairfield Warren Distinguished Professor at Boston University.
[4] Tasso J. Kaper, now Professor of Mathematics at Boston University.
[5] David Terman, now Emeritus Professor of Mathematics at the Ohio State University.

dedicated teacher, and I loved his geometric perspective on dynamics. We would have topics seminars with just him and his students, maybe some visitors. When it came to research, it was pretty much like "come meet with me when you have some results." Also, I was working in directions that were different from the other students working with him at the time. I definitely felt like I was on my own a lot on the research side. At Ohio State, I found David Terman to be an easy guy to get along with – very supportive and encouraging of my taking the time to learn new things in mathematical neuroscience. Both Chris and David made the point that at some point, you really need to just get involved, get deep into a problem. Just kind of learning on its own at some point doesn't really stick. It's when you dive down into a problem and realize that certain things are going to be important for helping you get a result - that's when you really start to learn certain things. So that was nice advice from both of them.

Dave was really down-to-earth, in a very positive and helpful way. There was no issue that you sometimes hear about, like egos or hierarchies, or feeling like you were lesser because you were early in your career or anything like that. So I really liked that experience.

Being a postdoc is, I'm sure many other people would agree, a really great time. Because you don't have the pressure of completing a thesis anymore, and you have the opportunity to explore and get involved in, potentially, multiple projects. On the other hand, you don't have the service and committee-type responsibilities that come up later on, and you're not well-known enough to be asked to do lots of things for societies, refereeing papers, or this type of thing. So it really is nice in many ways.

[NM/LS]: *Was that postdoc for four years, from 1996 to 2000?*

JER: Right. Because of the Ohio State appointment plus the NSF fellowship, I was there for four years. Then I was hired here. I could have come [to Pitt] in the fall of 1999, but I deferred for a year, spending that final extra year at Ohio State.

[NM/LS]: *What initially drew you to Pitt?*

JER: Partly, there is that happenstance, like, where is there a position that fits my research directions? Partly, it's the fact that, thanks to Bard Ermentrout, mathematical biology was already established in the department. Carson Chow[6] was also here at the time. And there was a lot of biology and especially neuroscience between Pitt and Carnegie Mellon. It was a really nice environment for interdisciplinary opportunities.

At Ohio State, I basically did not attend any neuroscience seminar in four years. Any talk like that was pretty much medically oriented. And there was no community to circulate information about these talks. Here, I was immediately part of the Center for Neuroscience at Pitt and the CNBC (Center for the Neural Basis of Cognition). I was

[6]Carson C. Chow, now Senior Investigator and Section Chief of the Mathematical Biology Section at the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK).

finding out about seminars and meeting people from other departments. So that was really nice. The location was a plus; I grew up in Maryland. It's a reasonable distance from Pittsburgh, and the climate is already kind of familiar to me here. And I had met several Pitt professors at various conferences. So I knew there were people in the department I could get along with.

[NM/LS]: *Now, from the perspective of a professor, what study advice do you have for undergraduate students?*

JER: I think there's more than one approach; there is no one-size-fits-all. From my experience, staying on top of the material by making sure to go back over notes from class and comparable sections in books – to ensure you have a clear picture of the latest material – is a good starting point. Then, as the semester goes on, try to assemble these pieces into more of a big picture, so you see how things fit together. If you can do that, chances are you're doing a good job learning the material. From my perspective, class attendance is really important. I almost never missed a class, and anytime I did, I ended up regretting it. It just feels much more comfortable knowing what was covered in class, not being surprised by something I missed by not being there.

[NM/LS]: *Do you have any advice for undergraduate researchers or those preparing to do undergraduate research for the first time?*

JER: One piece of advice is to always bring something to write with, such as a tablet or paper, when meeting with your mentor or advisor, and ensure you take notes. When working on your research, maintain thorough records and stay organized with what you've tried, what happened, and what your next steps will be. Also, try to think about not just the immediate tasks but the big picture: Why are you doing it? What are you really aiming for? Often, undergraduate researchers don't necessarily understand why their topic is important or interesting, seeing it more as a set of steps that they've been asked to do by a professor.

[NM/LS]: *This journal is also targeting graduate student readers. What do you think makes a good graduate student?*

JER: It's probably not so different. I think that one element I didn't mention earlier is persistence. Being open to trying different approaches to solving problems and being creative about trying something different are important. But also, think about the problem you really want to solve. Don't lose track of that. The transition to research as a graduate student is challenging. Developing some independence can be hard, and there's pressure. So, having some mental strategies to deal with that is important. It's a cliché, but there's a saying: research is 99 percent frustration and 1 percent inspiration. In my experience, that's not quite the balance, maybe because I work in applied directions where you can turn to some numerical experiments and adjust the inspiration to frustration ratio a bit. But any result is something, right? Feel free to celebrate small advances. I have a favorite quote, “Inch by inch, life’s a cinch; yard by yard, life is hard.” If from day one of your research in graduate school, you’re already thinking about “Where am I going to get a job?”, it’s going to be a really painful experience. However, setting lots of short-term goals can be helpful.

Let me share one other thing. A fellow student and I were walking down the street when I was in grad school, and I was complaining about how I had followed a certain path in my research and was totally confused. And he said, “Congratulations!” I was like, “What are you talking about?” after complaining to him for the last half hour. He said, “When you’re confused, that’s the first step towards making progress. You have to realize what you’re stuck on.” That conversation has stayed with me. In some sense, confusion is a sign of progress, because you’ve gotten into the meat of things.

[NM/LS]: *So, as you gained more experience in teaching and mentoring, how did you actively improve as a teacher and mentor? In what ways did you learn?*

JER: I was really lucky to participate in Project NExT as a postdoc, a program run by the MAA (Mathematical Association of America). It brings in new faculty for several conferences throughout a year, offering special sessions on best teaching practices and other topics related to transitioning to faculty roles. It’s somewhat rare for a postdoc to join this program, but perhaps it was early enough that demand was a little lower, or for some other reason, they let me in. My department at Ohio State was also willing to provide the necessary funding, which was very fortunate too.

Through this program, I was immediately engaged in discussions with leading educators who emphasized exploring various teaching approaches beyond the traditional lecture method. This included thinking about how to tailor classes to be particularly beneficial for students and accommodating different learning styles. I was introduced to those types of ideas very early in my career, making it natural for me to always think about how to teach material most effectively or how to help students learn most effectively, not just automatically to teach one way or another.

Another thing is keeping organized. For me, I have to be really organized about how I think about the material in a course. Then I try to help students understand this organizational structure that I have in mind. Again, this is because I believe getting a comprehensive view of how the pieces of the course fit together is crucial for the learning process. Depending on the course, I’ll give out handouts, which include lists of learning objectives for each week. I’ve never fully confirmed whether students find this helpful, but as a student, I used to make my own lists like that. It’s helpful for me in thinking about how to organize the course.

[NM/LS]: *What part of teaching do you enjoy the most?*

JER: There are a couple of parts. I think one is coming up with interesting exercises, projects, labs, and interacting with students as they grapple with them. That's really fun. It's clichéd, but seeing that "Aha!" moment of students really getting over a hurdle and understanding how something works. In pretty much every course that I've taught, there are topics in the material that I really enjoy. And it's kind of fun to have an excuse to think about all of these different math areas and play with them myself while I'm getting ready to teach students.

[NM/LS]: *So you've been a mentor for summer programs for a while, including Painter (undergraduate research fellowship), TecBio, and possibly other programs as well. Could you talk about that a little bit?*

JER: Yes, I think originally I became involved in supervising undergraduate research partly out of gratitude because I had those experiences and they were really helpful for me. And partly because the demand was there. Students were coming and saying, "How can we do research? Are there research opportunities?" I don't like to say no to something that seems reasonable. At this point, I've mentored over 40 undergraduate researchers. There have been all sorts of different experiences. It depends very strongly on the students and the problem.

With undergrads, a nice thing is it gives you an opportunity and the student an opportunity to just work on something that may be very different from what you normally would think about. Like Maddie McCrea recently did a project with Dr. Ermentrout and me on firefly synchronization, which turned out amazing. That was a really fun experience...and Bard and I both were able to go to the Pennsylvania Firefly Festival this year, which is super cool. So that's not something I necessarily would have worked on without an undergraduate project to sort of drive it...When I think back on the best projects, there were some, even at the beginning, that were like this – just a cool thought experiment. We decided to play with it and see where it goes.

[NM/LS]: *Let's zoom in on your research now. If I understand correctly, your background is in dynamical systems, and you've long been interested in biology, chemistry, and psychology. So, all of these disciplines converge in what's known as mathematical neuroscience. However, it appears you've also done work external to that field. Could you briefly describe your research and what drew you to it?*

JER: Yes. At this point, I do have a fairly wide variety of research projects and interests. I've always found it very helpful to think geometrically about dynamical systems. Interestingly, in my thesis research, one of the aspects was that there were multiple time scales represented in the problem. There were quantities that evolved at very different rates, and there are techniques that you can use to decompose systems into several lower-dimensional systems that you can study separately, and then sort of bring back together. Once you've done that, that actually fits really well with my perspective on dynamical systems. Because from the geometric viewpoint, it's helpful to have lower-dimensional systems to think about. So, I found it very inspiring and exciting to work on those types of problems.

And it turns out that you can generate some really interesting forms of dynamics with somewhat simple systems of nonlinear ordinary differential equations that have multiple time scales. So, I've been fortunate to sort of be working on these directions as some developments about these interesting forms of dynamics have taken place. And I've been able to contribute to [our understanding of] those things, like canards and mixed-mode oscillations.

Even in the realm of neuroscience, especially originally, a lot of what I liked to do was to think about multiple time scale neural models and what types of interesting dynamics they could generate. A twist that comes up when you start thinking about neurons is when you begin coupling them together, there are certain other forms of decompositions that you can also do. I'm not going to go into any detail, but it turns out some of the same principles, at least the way I think of it, that apply to multiple time scales, also can help when you study coupled neurons and how they produce rhythms. So, that drew me to work in areas like respiration, like how we generate respiratory rhythms, locomotive rhythms, because these have a lot of these sort of features of multiple time scales and alternating phases where different neurons are active.

But then, I would try to take my results and present them at some conferences that weren't just mathematical, like computational neuroscience meetings, and start talking to people that were coming from more of a neuroscience perspective. And I realized the [large] gap between the biology and some of these models. So that set me on a path where, with some of my research ever since then, I've been getting more and more biologically detailed in my modeling and worrying more and more about explaining some biological phenomena. Even in cases when you just have to resort to simulations, and you can't prove anything mathematically or really build a strong mathematical argument. So, I have directions in my research that are like that.

Over the years, various other projects have sort of just come up, and some stick and some don't. So, I have a variety of other things that I work on. I have worked with Dr. Swigon for several years, including co-advising a couple of PhD students, on parameter estimation and uncertainty quantification, which comes up quite a bit in biology. But our directions there have been separate from neuroscience. It's fun to work on a variety of different things, trying to answer some mathematical questions and some biological questions.

[NM/LS]: *How have you navigated collaborating across these interdisciplinary lines as a mathematician?*

JER: Yes, I think, as I said, part of what sent me on this path was having conversations with people from other fields and realizing a gap existed. I think I'm kind of better at listening than talking. So, it's been really helpful to just go into conversations with biologists, with neuroscientists, with an open mind, and say, "Tell me about your research," and try to really engage with them and understand what they're doing, even if it's completely outside of what I've been trained in. So, by listening and having these conversations, I've become aware of what types of issues are important to people in other fields and what types of questions are interesting and how to communicate effectively, even when I want to talk about something more mathematical, once a collaboration is underway – to be very clear on how I explain things and making sure we're on the same page with our objectives. I've been really fortunate, I would say, to be able to meet and work with a lot of people from many other fields who actually value mathematical modeling and the insights that we can provide and who are willing to put in the time to build a collaborative relationship.

Over time, I've gone to more and more biological meetings in some of my specialty areas. So, I've been at many meetings now where maybe I'm one of a half-dozen computational people at a meeting of several hundred, which is both daunting and super exciting, because if anyone wants to talk to somebody computational, you're very visible, right? It's not like you're lost in the crowd of computational people.

[NM/LS]: *So, both of these fields of mathematical neuroscience and dynamical systems have been active for quite a while, yet they're also experiencing significant evolution. There are intriguing prospects for the future in both fields. Could you discuss perhaps either or the synthesis?*

JER: Yes. There's an obvious component to the response, which is machine learning and big data, right? There are major directions now related to the dynamics of artificial neural networks, trying to actually understand how they achieve their performance. Looking at aspects of optimization, and deriving dynamical systems from data - that is, deriving representations of processes where you have maybe lots of data, but you don't actually have a good model. I think those directions will stay active in dynamical systems. Although they're far from the only directions in the field; I think [the field will] stay broad and active. And keep in mind, while these are applied directions of dynamical systems, there are also much more pure directions, which may be slower to change.

In neuroscience, obviously, the data explosion is also having a big impact there. There are a lot of factors lurking in the background that people haven't traditionally paid that much attention to, like neuromodulation – the release of certain chemicals in the brain that modify the processes going on there. There are more glia and astrocytes than there are neurons in the brain, but relatively speaking, that's hardly been touched by computational people.

And there's more and more thinking about trying to do whole brain or large scale models. There are older efforts like something called the Blue Brain Project that tried to build a cortical column with every biological detail included in the model. The current sort of whole brain modeling is more like trying to model EEG (electroencephalogram) and other sorts of macroscopic data that reflect activity taking place over a large brain area. I think there's interest in being able to model those things better and convert the insights that we get into some therapeutic directions. So more of an interaction between the basic science side and medical side in different ways, like non-invasively stimulating the brain to deal with certain pathologies and that type of thing.

[NM/LS]: *So, based on that, with data-driven dynamical systems, there's this kind of interesting discrepancy between computational neuroscience and mathematical neuroscience. There are data-driven dynamical systems and more conventional dynamical systems. What do you think? I believe that many of these areas offer different things in an interesting way, and people might be missing out on some aspects when they come from a certain background within that field. How do you see this existing, I guess, and how does that overlap occur?*

JER: I don't believe in hard lines between these areas, but I totally recognize that there are different approaches. For instance, computational neuroscience might build a fairly complicated model to simulate activity in some brain area. And they're happy because the model produces outputs that resemble the data closely. Meanwhile, someone in mathematical neuroscience working on the same project might be more interested in creating a reduced or minimal description that may not capture as much of the biology, but focuses on mechanistic explanations, and ideally, deriving – at least with some level of rigor, maybe not fully rigorously – conditions under which the model behaves in a certain way or exhibits certain properties. That's one distinction I can recognize.

[NM/LS]: *Okay. Then we move on to service.*

JER: (Laughter) Going through all the tenure criteria.

[NM/LS]: *Before the chairmanship, what kinds of service did you perform for the department and for the university?*

JER: Very early in my time here, I think already in my first year, I got involved with Carson Chow to start the Integration Bee. Carson stepped back shortly after that, so I ran the Integration Bee for, I don't know, like 17 years. That was kind of a signature event. I was also a faculty advisor for the Mathematical Contest in Modeling for a while. Dr. Vainchtein and I started a High School Integration Bee. I was on the Undergraduate Committee for many years, and then I became the undergraduate director jointly with Dr. Gartside for a few years before becoming chair. I was the PI on [an NSF] Research Training Grant in the department among several faculty members. In practice, we were really Co-PIs, working together on various projects. That involved organizing many workshops, supervising a lot of undergraduate research, which I think really helped to boost undergraduate research in the department. That award also led to the founding of the Mathematics Research Center that we have now. A lot of people contributed to that. [The award] sort of started the tradition of having postdocs in the department. And then, several of the same group of us worked on developing the Mathematical Biology major and the Math 1370 and 1380 courses that go with it. There were other smaller things, but those are some of the bigger things that come to mind.

[NM/LS]: *Okay. Moving on to the chairmanship. When you became the department chair in 2017, what were your goals in mind?*

JER: So, it was not initially my goal to become chair. The opportunity came up, and I decided that, with the department's approval, I would take the position.

I think I tried at the beginning to do a very full survey of where we were short of where we might want to be. In practice, it takes a lot of work to make progress on any front, and it really takes people to step up and be willing to put in the time. So, as chair, I [spent a lot of energy trying] to improve lots of things in small ways and to keep things running. You don't realize it when you're not chair, but just keeping things running, staying on top of all the deadlines, staying aware of all the things happening in the university, and communicating what needs to be communicated to your colleagues, that in itself is a lot more work than I would have thought.

I definitely want to credit Dr. Gartside with starting MathFest, which was a really nice addition to the department during the time that I was chair. I credit Dr. Lewicka for being the faculty advisor for our AWM (Association for Women in Mathematics) Chapter, which is another really nice addition to the department. In things like the AWM and MathFest, in a way, one of the biggest roles that I've played, I think, is just trying to support when somebody has a good idea and has passion for something, just making sure that I'm of assistance to that, not an obstacle to that, trying to do whatever I can to help support people's good ideas.

Recently, I've been really pleased to see how active the Math Club has been and people like you guys, and becoming the advisor for this new journal PIMR (Pittsburgh Interdisciplinary Mathematics Review) as part of that same spirit of...when there's an idea that has energy behind it that I think will add to the community – let me try to support that. We had faculty wanting to do some flipped classroom experiments, so I made sure to support that too. But again, these are things people in the department pushed for. And I just did my best to support them.

I guess most recently, there was obviously a big chunk of time where everything was interrupted due to COVID. It was very draining to just try to keep everything moving along, to get the department restarted after all of that. We also had a huge staff turnover. So there was a lot of staff hiring and kind of helping to get the department going again in that area.

And after that, we completed a strategic planning review, which is our first one in more than ten years. So that was a major focus towards the end of my chairmanship. Now we have a really nice road map of next steps, some of which we've done and others of which will be hopefully be guiding some of our near-future directions.

[NM/LS]: *Could you tell us a little bit about that strategic plan?*

JER: It might not be suitable to include in this interview, but there were a few things we've already done, like making changes to the prelim exam structure. One of the things that might be most relevant to you is, based on the feedback we received from an undergrad focus group with external reviewers, we want to try to establish a "4 + 1" program, where you basically have a relatively streamlined path to graduate with a master's degree alongside your bachelor's. Since there are students who are already taking some graduate courses, it would be beneficial to leverage that into a master's degree. That's an example of something on the plan.

[NM/LS]: *What efforts did you make in fundraising for the department as chair?*

JER: Being chair is not a major fundraising position, at least not the way I administered it. That's much more like alumni relations in the Dean's Office. However, we did decide to push very hard with events like the Pitt Day of Giving. We were able to raise quite a bit of money each of the last couple of years during the Pitt Day of Giving, which has been nice, especially to support undergraduate programs. Additionally, we were fortunate that the Painter family provided their donation, so now we have the Painter Undergraduate Research Fellowships during the summer.

Another initiative we focused on, unrelated to fundraising, was organizing various alumni talks and career panels. For example, Mel Currie, an alum, came and gave a talk related to a book he had written. This event was jointly sponsored with the German department because, even though he was a math major, he went on to teach in Germany for a while after his time at Pitt.

[NM/LS]: *What would you say are the most important skills for being a chair?*

JER: Before I comment on that, I just want to say that the graduate directors and the undergraduate directors worked really hard on their respective responsibilities and portfolios. I'm extremely thankful for the time they all put in.

As chair, one attends a lot of meetings and does a lot of writing. So, I think being a fast and effective writer is a very important, maybe under-recognized skill, part of being a chair. Again, staying on top of lots of deadlines and keeping lots of information organized, and just doing a lot of effective writing to request hires, to request new positions, to request permission, to hire specific candidates, to argue in favor of people's promotion cases, all of that, is a really important part of the job.

[NM/LS]: *How many hours did you average in a day as a chair?*

JER: I won't give a specific number, but I definitely feel like I've managed to balance teaching, research, and service. Although I was only required to teach one course a year, I chose to teach one every semester because I enjoy teaching. I wanted to maintain closer contact with the students than teaching just one course per year would allow. Additionally, I've been really fortunate to work with many productive and excellent students and postdocs. Their help enabled me to keep more research projects going than I otherwise could have.

[NM/LS]: *We also wanted to learn more about your non-math-related interests, like playing the trumpet.*

JER: Yeah, I played the trumpet through the end of my first year of college. Then I put it down for a little over 25 years, not touching it once. And then I decided it was time to pick it back up again. I was kind of inspired by my kids who were learning to play various instruments and having a lot of fun with that. Then I came across the Eagleburger Band a couple of times at events. My wife happened to meet someone through Facebook who was in the band, and I thought it would be a lot more fun to play in a group than play by myself. They were really welcoming, and it's been a wonderful part of my life ever since. We practice over at Schenley Plaza most Tuesday nights and play around the city.

I've been playing soccer since I was six years old. It was always my favorite sport, by far my favorite activity growing up. I played on my high school team all four years, and when I went to college, I played club soccer. I was very active, though not intensely competitive, playing in town leagues and such throughout college. At Ohio State, I was on a men's team, and at Brown, their open men's league was very ethnically grouped, and I ended up on the Armenian men's club team. I even played in something called the Armenian Olympics in DC where clubs from around the country came to compete against each other, and they had to pass me off as Armenian. It was really cool playing against teams like the Portuguese and Italians. Once I turned 40 and decided I wanted to run a marathon, I stopped playing competitive soccer because I didn't want to risk injury after all that marathon training. Then I realized I didn't really miss being on a team. So since then, I've just played with friends and sometimes with the department intramural team, mostly against 19- and 20-year-olds in that league. But that's fun too.

So those are two of my biggest hobbies outside of work.

[NM/LS]: *What's your favorite food?*

JER: That's a really hard one. There was a time in my life when I would have said ice cream. However, I can't really eat ice cream now because of the lactose. I reached a certain point where it just doesn't agree with me. So I'm very excited about the new lactose-free and even vegan ice creams. They've gotten a lot better, but I can't say they're my favorite.

I think I'm going to mention two: A really perfect ripe peach or nectarine, and chocolate mousse.

[NM/LS]: *Do you have a favorite theorem?*

JER: When I'm teaching I always say the implicit function theorem, because it's useful, but I can't say that I feel a surge of joy from that.

Maybe actually, the invariant manifold theorems are pretty hard to compete with.

[NM/LS]: *Does your band have a show tonight?*

JER: We're having a practice at Schenley Plaza. Actually I have to go – it's about to start. Sorry to run!

(The interview took place on July 25, 2023, in Pittsburgh, PA)