Maurer/Stier 2009 Annual Letter

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Steve writes. My first annual letter was from fall 1973, the first semester of my postdoc in Canada. I was very invested in every aspect of the letter that year, even buying many denominations of Canadian stamps to mix and match on the envelopes. For many years after that, I was so eager about the letter that I devoted Thanks-giving vacation to writing it – that was the vacation for me. But in recent years writing it has gotten later and later. Last year I was the last to write my part (Jan 10); this year I was first (Dec 28), but I didn't feel particularly inspired to write – it was simply easier than grading more papers! In part, there is nothing particularly remarkable to write about.

Last year I was overwhelmed by math/stat chair work from day 1. I didn't really catch up until March. This year, through luck (or maybe because I haven't minded letting some things not get done) it hasn't been as bad. Like all colleges and universities that depend heavily on large endowments, we have been hurt. Not as badly as most others, because our investment policy was more conservative, but it doesn't matter whether you are cutting $1 million or $100 million, cutting anything is hard and puts departments in competition. The main way this is hurting math/stat is that we have a wonderful Latino postdoc who, in better times, would have been converted to a new tenure line already. But even vacated old tenure lines are currently frozen, so I have been fighting to figure out some way to keep him.

The real time sink has been my volunteer activity, MathPath. I explained last year that, in addition to being academic director, I had gotten involved in the financial end. It was nerve racking last winter, since we were heavily in debt and not sure, with the falling economy, whether we could round up enough students. In the end we got somewhat more students than the year before, and through cost cutting made a sizeable dent in our debts. More exciting than that, I think last summer in Colorado Springs was the best camp ever: the campers were really happy and productive. How do I know? Because 3 years ago I started collecting surveys and quotes, both from students and parents. The result is that we are trying to leverage that good buzz, and this has gotten me involved in even more aspects of running the camp. I am now a web content manager, brochure designer, publicist, direct mailer, grant writer, and chief goad to get everything out the door much earlier than in past years. (I do not claim I have done these things by myself, nor is it the case I did none of this before, but I am taking a leadership role that I didn't take before. Check out our website at http://www.mathpath.org.) I hope it all pays off. We are trying a new location, Macalester College in St Paul MN. Oh, did I mention that I am also a site visitor and contract negotiator, having negotiated seriously with 3 potential sites and negotiated some with several more. Not to mention psychologist, keeping our sometimes unyielding senior staff working together. Also a legal and tax consultant (with the aid of my brother Ed). MathPath takes up all my spare time, including thinking time in the shower. But it may be the best thing I have ever done.

Oh, I've become a political "designer" too. We live in what traditionally has been a very Republican county, although it has been turning blue. 4 years ago I offered to buy bumper stickers for Bryan Lentz, who looked like he had a shot running for State House against a Republican incumbent of at least 20 years. Turns out his staff weren't going to buy any stickers for a state race, but they were willing to let me buy them. They were a hit (250 were enough for the district), he won the election, and I repeated the donation in 2008. But those two times they just gave me their design and I passed it to the bumper sticker company I found online.

This time we must meet federal regulations about what must be shown, there was redesigning to do, and the campaign staff asked me to work with DemStore.com and also negotiate for some buttons as well as stickers. So I ended up co-designing the stickers and buttons with their contact person at DemStore.

Maybe I have a potential retirement career as a business or political consultant.

Yes, I am beginning to think about retirement – I'm 63 – and the fact that these new endeavors capture my shower thinking time may be telling me something. I am toying with the idea of doing something completely different in retirement. My earlier predictions (after my operations in 1994 and various newfound medical conditions around that time) that I wouldn't have to worry about much retirement because I wouldn't last that long – those predictions don't seem to be panning out.

Travel. No overseas travel this year. We had a chance to join my extended family on a Roots trip in June to Poland, but neither Fran nor I could fit it in. How ironic, since the trip was pretty much due to me. It seems I never reported on a major event in spring 2008 after I returned from Germany: I finally went page by page through the boxes of genealogical materials my father had worked up in the 1980s (stored in my attic since his death), and with the help of now available online resources was able to reconnect with some of his sources, push his discoveries a little further, and identify what would be useful to do onsite at various Polish towns and archives. My brothers and families were able to do some of this; Leon represented us on the trip and will report. Maybe I can write a longer report about my father's fascinating work in a later annual.

Anyway, with graduate students like Leon always spending most of the summer at school, and Aaron choosing to work the summer at Carleton, the best Fran and I could do was a trip to the Northwest, as follows:

1. I fly off to MathPath the end of June;
2. A few days before MathPath ends Fran flies to Madison, visits Leon, rents a car, drives to Northfield, visits Aaron, drives to Minneapolis airport and catches a plane to Seattle;
3. Meanwhile MathPath ends and I fly Colorado Springs – Denver – Seattle;
4. We spend a few days in Seattle, then drive to Vancouver BC;
5. We drive back to Seattle, where Fran catches a nonstop home;
6. I drive on to Portland, where I attend the summer math meetings and check out Reed College for MathPath. Then I fly home from Portland.

Well, it worked, but not smoothly. Due to fog in Denver, I missed my connection and was told there were no open rebookings until the next day. I eventually got on a flight on another airline that afternoon, but my luggage did not make it until the next day. On top of that, we hit Seattle in its hottest weather *ever* – over 100. Our host's house, like almost everything in the northwest, was not air-conditioned. Have I ever mentioned that Fran does not like heat – or late husbands?

Anyway, eventually everything worked out, but in terms of what we saw and did there was nothing we would both rave about.

Nonetheless, as usual let me recommend some personal highlights:

- The view from Quest University in Squamish BC – sharp-pointed mountains all around. I don't know any other college with such a dramatic location, though Colorado College is a pretty good second. Squamish is halfway up the Sea to Sky Highway from Vancouver to Whistler, where the winter Olympics outdoor events will take place soon.
- Cycling around the perimeter of Stanley Park at the tip of Vancouver, especially the part that goes under the Lion's Gate suspension bridge.
- Various views of Puget Sound from around Seattle.
- The public transportation system in Portland, including light rail and a cheap, simple payment scheme (all you can ride for 90 minutes). Also the wonderful brick Union Station – I was delighted to get there and find 3 long-distance trains in the station at once – train business on the west coast is picking up.
- The mouth of the Columbia, especially the Lewis and Clark markers, the long bridge

> across the mouth, and the views from the Astoria Column. Very long-time readers of this annual know that on my 1977 western solo trip, for a time I followed the path of Lewis and Clark, whose diaries I had read. But I never made it the last 50 miles to the coast from I-5. Now I did. They spent a miserable wet winter in Fort Clatsop, so fogged in that the resupply ship Jefferson sent around Cape Horn, though it got to the Columbia, never found them. For me in early August the weather was beautiful.

I've put some photos up at http://www.swarthmore.edu/NatSci/smaurer1/ family

Family. Looking back on the days when we had kids in the house to tend to, I don't know how I did it. These days I don't have much I have to do at home (except laundry and cooking 4 nights a week), and yet almost every minute is taken up with work or volunteer projects.

Closing thoughts. We just signed a deal for many thousand dollars to replace all the remaining original casement windows in our 1938 house. I love the look of the old casements with individual square glass panes, but they are rusted, drip in cold weather, don't close well, the panes crack occasionally, and of course they are not energy efficient. A few weeks before, we spent a chuck of money on a roof leak. After we get the windows in, it's time to paint the house exterior, and after that parts of our interior. Perhaps we will jump-start the economy. Since we are fortunate enough to have some money saved, I suppose noblesse oblige. Anyway, I wish for you and us a better world in 2010.

Fran's Part: It's harder than it used to be to get started writing. Years ago, I had 100pp or so a year worth of adorable diary entries about kids, and writing these annual letters was mostly a matter of (proudly) picking out the funniest bits.

Now, except for the 4-6 weeks/year that Leon and Aaron are home, there are only weekly phone calls (sometimes short) to go on. Steve and I are empty nesters with grown-up sons.

Leon continues as a grad student in physics at U Wisc in Madison – he passed his qualifying exams last spring. Lab time and problem sets took most of the last year—he's finished with coursework now, so it's just lab time. It's a fairly austere life.

> He wasn't sure when spring break was. I asked, wasn't he heading to FL? Cancun, maybe, he replied. In fact, he'll mostly sleep, and read physics papers. What abt wine, women & song, I asked? You always bring that up at around this point in the phone call, don't you, he replied. There's a weekend for prospective students coming up – that will at least provide wine.

He cooks large amounts over the weekend to eat over the week. One week it was plov, the Uzbeck national dish, featuring lamb, rice, and carrots. Uzbeck men gather and cook vats of the stuff. (who knew?). Another week was an Egyptian mix of lamb and okra. He tries not to tell me about the dishes using pork.

Most of the times he's home, the high point is a LAN party with friends from high school – he and his friends spend the night drinking Red Bull & slaughtering virtual enemies:

> L has a bunch of his friends over for computer & board games. We had dinner w/ them (they eating their chinese takeout, we eating our glops). One said his mother always bugged him about reading in the dark. "you'll strain your eyes". She's always giving him the same admonitions:
>
> "use a condom" (this constantly, since he was 16. Mom, if only… he'd reply)
> "Get a master's degree"
> "own your own business"
> "don't strain your eyes"
>
> Leon said that he'd been trying to convince me for years that I was a nagging outlier…

He has a huge fund of information on the history of technology. Did you ever hear about the Current Wars in the late 1800's, between Thomas Edison & George Westinghouse, over whether AC or DC was safer and more economical to produce & transmit? Did you know Edison electrocuted an elephant to try to dramatize the dangers of AC? I certainly didn't.

Aaron is majoring in history & math –& getting better grades. He'd been taking Spanish to fulfill Carleton's language requirement, but it wasn't going well and last winter he went through the language-aptitude testing to get exempted from the requirement.

He spent spring break in CA visiting Carleton friends. One kid's family welcomed Aaron because they could never manage to eat enough to meet the obligatory dining expenditures at their country club – he was glad to help—including after-dinner cigars (cigars counting as part of the meal tab).

He & his friend investigated the La Brea tar pits (which I wrongly thought had dinosaurs in them, instead of ice-age mammals, but he set me straight – it's our main source, since the whole food chain's there). Each link in the food chain saw entrapped prey and pounced, thinking: Dinner! And perished in turn.

Spring term, taking combinatorics, Byzantine history, and Japanese cinema, he liked all his courses; was working harder

> Byz history: Prof North has them write 3 short papers on whatever strikes them in the readings; A wrote a paper on a Byz emperor who, upon seeing a soldier drop his shield, ordered that soldier's nose cut off. Soldier's commander refused, so he had the commander's nose cut off. I expressed distress. A replied that was nothing; when Bulgarians rebelled, he ordered that 99 out of 100 have both eyes put out, and the remaining one have one eye put out (so they could lead the other 99).

He spent the summer in Northfield, working as assistant to the Math department computer specialist and renting a house with 4 friends. Departing friends left them well equipped:

> He's in a converted garage in the house he rented w/ 3 other young men & Kate. There are surpluses of some things (6 TV's, 4 sofas, 8 mini-fridges), and shortages of others (mattresses) – A's sleeping on a futon. Their kitchen is well equipped, between things that departing students left (rice cooker, 2 coffee machines) and the larder is well stocked because Kate scurried around all the student kitchens clearing out the cupboards of spices & staples before they got tossed.
>
> A had to clear out two sinks full of dirty dishes this morning – some of his housemates aren't cleaning up after themselves much…
>
> In addition to 8 mini-fridges and 4 sofas, they now have 2 gas grills (one from curbside, one from neighbors), a panini press, and 4 coffee makers (three of which are broken). Sam's parents, visiting, bought the functioning coffee maker & a load of food. It's hard to keep enough food in the house (what with 5 college students, 4 of them men).
>
> Aaron's enforced a dishwashing rotation, and is going to tackle getting his housemates to take the trash out. Of the people in the house, only he & Kate can cook much of anything.

He continues on the defensive line: was sidelined for several weeks by a sprained ligament in his knee and sat out the last couple weeks after a concussion. I of course was especially frantic with worry at the latter, but his Dr noted no ill effects.

Steve (of course) has related most of his own news, but I have to tell the saga of the Margined Blister Beetles. All through his month at MathPath, his most eager questions are for his garden plot. When he finally returned in August, he sent out this bulletin

Turns out I have an infestation of *margined blister beetles.* While most blister beetles prefer flowers, some (especially one subspecies) eat foliage.

Good thing I found out about them. Turns out they are medically dangerous. If any of their internal fluid gets on you, you get bad blisters. And if you eat them, you die. (Fortunately only adult blister beetles eat plants, and adults are pretty big, so we are not likely to eat them by accident, but dead blister beetles easily get into the cut hay for horses, and kill the horses.) Also, they swarm from one area to another, and they prefer tomatoes and beans (among the plants I grow), so if I just leave them alone they might migrate to my other crops. So I am figuring out what to do. I wonder why they latched onto the chard first?

Who knew?

Work has been stressful. We're flooded with consultants; no one really knows what the future holds. I set my computer desktop is a collage of tranquil hosta leaves, I listened to a lot of Mozart while working, I worried that my hippocampus was withering under a flood of glucocorticoids (see Why Zebras Don't Get Ulcers)

I do experience studies now, which is mostly about data problems. Files appended in the wrong order that don't trigger the logic to create death records. Software that won't work right. Plancodes in katakana (the Japanese alphabet used for foreign words) and hexadecimal representations of katakana and how to convert the hex to katakana. Early in the year, I spent a lot of time persuading colleagues to help me.

I had a fascinating session with XX (who can calculate hexadecimals in his head). I had long talks with YY (a contract programmer), and ZZ (the SQL server administrator), and then there was a long, surprisingly passionate meeting where the three argued about how best to get the files I worked with to show katakana. (the main point was, was it a problem of transmission, where the katakana got garbled as the files were downloaded, or were the katakana not on the main-frame to start with, only their hexadecimal equivalents).

They collaborated on a C++ program to do the conversion.

After a while, I began to understand the (badly documented) software that was supposed to do the studies, and could coax it to work. I learned to do some SQL (the files are so big we can only look at them in SQL server). I hired two bright people with much better systems skills than mine.

Synagogue life included some dramas we'd rather have done without.

The school director was let go midyear and left behind her vast quantities of themed stuffed animals, which we used for Martin Luther King Day, when we hosted families from local shelters bowling & lunch

She was huge on themes for the year – this year had been cars & the Power of Speech. There were toy cars & pencil cases & sippy cups and fuzzy blankets, all with cars. There were also many, many stuffed animals from prior years: frogs (leap into Torah), giraffes (stick your neck out), M&Ms (God knows). ALL BRAND NEW. AND, she had 4 years more stashed in the synagogue basement: cows, kitties.

EE .. pulled out the contents of 5 huge cartons onto the library tables, muttering there were codes in the DSM for this. The teens, the next day, were charged with arranging the loot and coming up with an equitable way to divide it among the Moms (I was afraid having kids in there would turn it into a free-for-all). In fact, our guests were amazingly orderly & sweet & the teen volunteers had a ball running their free store and many a child left clutching a fuzzy new animal.

The synagogue executive director, hired a year ago, turned out not to be honest and resigned. Almost everyone on the board had been on the search committee who had recommended either him or the school director (or our former rabbi, who also hadn't worked out so well); we all spent a lot of time looking back and trying to understand what we'd overlooked.

On the plus side, we now have a very smart, good new rabbi and cantor-school director, and they work well together. We're hoping for a less dramatic (but positive) year in 2010.

Me / us My favorite moment each week is Sunday morning, reading the New York Times on my chaise long, and looking at the trees & sky out the window. I love watching the huge world march by, from my safe, quiet corner.

I think Steve and I get along easier than before: the years have worn off a bit of abrasiveness; we have fewer ambitions and a keener sense of mortality. We cling a little more to each other.

Hoping the New Year is a healthy and peaceful and prosperous one for you all.

Leon writes. There's not a lot to report this year. I had full class loads spring and fall, and that kept me quite busy, as it did last year. I was a teaching assistant again last spring, for the same non-calculus mechanics class that I reported on last year. However, a different professor was teaching, and he was much more involved than his predecessor. This included writing quizzes, selecting problems for group work, and a number of other tasks that greatly reduced my workload, and allowed me to do a better job. My evaluation the first time TAing was "very good". This time it was "excellent".

Research was the big new thing this year. I started it last summer, and there's a good chance I'll still be doing it in four years (average graduation time is 5.5), so I'll use most of my letter to fill you in. In addition to research, I was taking classes last fall, which left me little time to do other things. However, I'm nearly done with classes now, so I hope to spend time doing more interesting things. Hopefully you'll get to read about it next year.

The research group I joined is run by a young professor, and the research is primarily focused on experimental quantum computing. The idea is that computers can be built to take advantage of the weirder aspects of quantum physics to do certain calculations much faster than normal computers can. In particular, there is – at least in theory – a way to factor numbers much more quickly. This may seem like a silly thing to get excited about, but it turns out that if you can factor large numbers quickly, then you can break the encryption most commonly used on computers. For that reason, there's a lot of government money being directed to the field.

However, there's currently little to fear. A quantum computer factored 15 in to 5 and 3 in 2001, but the record hasn't improved much since. There are a number of approaches to quantum computing, and each has something holding it back. That method could easily scale to handle 4 bit numbers (0 to 15) but not much beyond that.

Our approach is based around Josephson junctions – sandwiches of two superconductors with a thin electrical insulator in between. Although it doesn't sound like much, it exhibits some interesting behavior which I won't describe in detail. The result is that while the strange effects of quantum mechanics usually only appear in extraordinarily small systems (like an atom), we can make them arise in systems that are (barely) visible to the naked eye.

The story behind these devices is an interesting one. Their behavior was predicted by Brian Josephson, when he was a 22-year-old graduate student. He went on to win a Nobel prize, and left mainstream physics shortly afterwards. He busied himself with his "Mind-Matter Unification project," studying the paranormal, and researching how to bend cutlery with your mind. If you have the chance, check out an interesting interview with him in the July 1982 issue of Omni magazine.

There are a number of ways to use Josephson junctions in quantum computers. For example, an electrical current can be made to flow around a small ring interrupted by two Josephson junctions. Classical computers work by manipulating zeros and ones. Flow in one direction (say clockwise) would be a zero, and

flow in the other direction would be a one. However, instead of being restricted to just zero or one, a quantum computer can consider a mix of zero and one. That is a strange situation – you can't imagine simultaneously spinning clockwise and counterclockwise in an office chair, but that's similar to what happens. Our devices are similar in design, but the operating principle is more complicated (and I don't fully understand it myself).

The problem with this approach is short coherence times – you can't keep it in the strange moving-two-directions-at-once state for long. So little of our research is a direct attempt to building a quantum computer. About half is understanding the problems so that we can make one some day, and the other half is using the tools we have to do other things.

For example, our approach requires fast and accurate measurements of magnetic fields. Another Josephson junction based device (called a SQUID) allows this, and there is a medical physics student in our group working to use these in MRI machines. Because this detector is more sensitive than those currently used, it will hopefully no longer require the giant donut shaped magnet that's the most expensive and least portable part of the machine (at least that's my understanding – I'm not directly involved in the project).

All this may sound interesting, but I spend little time thinking about the physics I've summarized. Since I'm doing experimental – not theoretical – physics, I spend most of my time making things in the clean room or doing measurements and a little doing design work and computer simulations.

This lead to my first clean room experience. There was one at Dartmouth, but I never made use of it. “We like to think that this isn't a dirty room,” is how the area I used for research was described to me. A clean room may conjurer up images from movies of spotless laboratories and people fully enclosed in protective suits, but that's something else. I don't work with infectious diseases. Mostly, I just have to keep dust off my devices. Since they're quite small, a speck of dust could ruin them during fabrication. We do wear special suits, but they don't include any breathing apparatus, and the only thing special about them is the non-fibrous material they're made of. We do put on more protection when handling toxic or caustic chemicals, but nothing like the full suits from the movies.

Many of the tools we use are taken from the semiconductor industry – being able to call on its extensive knowledge is a big advantage to our quantum computing approach. For example, Intel donated a room-sized machine called a wafer stepper, and we use it to fabricate our devices (when it's working – it was made in 1992 and is very fussy).

Now that the background is out of the way, I'll mention the actual projects I've been working on. These are likely to change since my advisor is full of ideas, but the background will likely be the same as long as I stay with my group.

My first project dealt with the cause of the short coherence times. Evidence suggests that the main culprits are defects in the materials we make our devices out of. The materials are mostly crystals, but other elements that sneak in can mess up the structure – these are defects. I was measuring the properties of different materials to look for ones with fewer defects, and looking for a way to substitute one of them in to our devices. I was somewhat successful with the first part, and another student has taken over the second part.

I'm now working on a project to make SQUIDs optimized to be electrical amplifiers. We're all done with design work and just started fabrication. The first batch had some issues, but hopefully we'll get results soon.

The last project I'm working on is a collaboration with another professor (who is partly funding me). He works on a different approach to quantum computing, but we have some techniques and equipment in common. I'm working to make a better measurement circuit for his devices.

That’s research. While school has taken up most of my time, I do some other things. Of them, you might be interested in my hobby projects. My favorite is a key fob sized random number generator – useful for people who have trouble

making choices. That and some small software projects are linked to from my website:

https://mywebspace.wisc.edu/lnmaurer/web/

The last thing I want to mention was my trip to the Czech Republic and Poland last summer. The original impetus for the trip was genealogical research my Dad had done a couple years ago (a continuation of work by his father). However, while he couldn't fit the trip in to his schedule, his brothers and their families could, and I traveled with them. Every family has a different travel style, but the common influence for these families was clear, so I fit in and it was a lot of fun.

The heart of the trip was a several day stay in Biecz, Poland – where my ancestors who share my last name come from. This was a particularly special visit because we had a Biecz native and Holocaust survivor as a guide. That's a subject I've heard much about in Hebrew and regular school, but it's a different experience when someone can point to the basement they hid in or the place where a neighbor was shot. However, the same force that makes the experience powerful effectively prevents me from passing it on through writing, so I won't try even though I feel very privileged to have experienced it.

The rest of the trip focused on Prague and Krakow – both very nice cities, filled with tasty treyf food – I think I ate better in those cities than any other I have been to. The final highlight of the trip was a search for a relative's gravestone in a mostly unmaintained cemetery in Tarnow, Poland. We only had a pre-WWII picture to go on, and the cemetery was quite large, but we miraculously found the gravestone intact. A link to the picture is below.

http://tinyurl.com/ycxfuww