



April 25, 2019: Zion National Park

Dear friends and loved ones,

We've spent more than our share of time this year contemplating politics, public service and the differences between the two; and experiencing climate change first-hand. Many or most of you probably have, too. So let's pause and give thanks for what's good in our lives.

Health: good, with a few glitches, but nothing serious. Careers: still up and running nicely, keeping us engaged and off the streets (always a good thing). Family: all doing well and making us proud and very happy. Friends: We've enjoyed old ones who are the fabric of our lives and made new ones we've been lucky to meet and share time with. Extracurricular activities: all good and satisfying. Time spent watching talking heads and reading on-line news feeds: too much, but understandable.

So – all in all, a very good year for us, with a few notable adventures and misadventures. It started with a special weekend in January with Bob's brother Ed and his wife Barbara, to celebrate my 70th birthday with dinner, the Art Institute and a symphony (and, of course, Chicago weather). We spent ten days in Berlin in May and ten days in Rome in November. My best friend from the fifth grade (also something to be grateful for) joined us. Bob taught mathematicians about biology while my friend and I ran around Berlin and environs. In Rome, Bob taught more mathematicians about biology. We were lucky enough to have an apartment located a few blocks from the Colosseum and the Victor Emmanuel monument, with ruins filling the fields between the two landmarks (and competing for second looks). While Bob taught, I gawked shamelessly at the ruins and shopped at the local market. It had floor-to-ceiling shelves of olive oil, among other delicacies. And prosciutto and salami in the meat case.

In April, we shocked friends and family by going to Las Vegas, the last place anyone who knows us would ever expect us to go. We went, quite simply, to watch the fountains at the Bellagio. We'd seen them on a travel show and both of us instantly said, "We're going." So we did. We made fish out of water look comfortable, but the fountains were spectacular.

We wisely planned an antidote to Las Vegas: a few days in Zion National Park, our first visit since our honeymoon. On Bob's birthday, while walking on a perfectly flat and stunningly beautiful trail, he cried out and pitched forward. His leg had given out.

The cause was a ruptured Achilles tendon. I'm still teasing him about getting his first athletic injury on his 77th birthday. He wore a moon boot for four months, had physical therapy and was a scrupulously compliant patient. Now, eight months later, he has a tiny bit of a limp, but is healing much faster than the doctor predicted. As maladies go – or could go – this was straightforward to deal with. And, as all changes do, it helped us learn more about ourselves and each other: Bob couldn't drive with the boot on, so I took over his errands, like shopping. I learned that I really hate to shop, but I can do it if need be. We both learned more about giving each other support through the vagaries of getting older, even though we don't feel THAT old.

We had good family time this year, too. We took a road trip to St. Louis with grandsons Alastair and Henry and their mother Jill. We also took a road trip with Bob's son Ben to Gettysburg, PA in October, and met up with granddaughter Chris. She moved to Maryland in March for her first job. (Actually, we were chauffeured on the road trip, because Ben generously did all the driving.) A special treat for me was visiting Boise friends and family four times, once with Bob. He and I also took a short road trip to Hells Canyon and Eastern Oregon during our Boise visit – so different from Zion, but stunning in its own way. Happy holidays and a great 2020 to all of you!

From Bob: “Bob taught in fun places”, Berlin and Rome, as Ardyth mentioned, with a single message:

Biology can be simpler than physics and math, if you ask the right questions. Biological systems have all that complexity so they can do something specific. Nerves are devices, just as much as a switch on the wall is a device. If you ask sensible questions about a switch, you get sensible answers. But the properties of the switch depend on what it was built to do. Its structure is as important as the properties of the elements it is made of. Biology is like that. The complex structure of biology is not much more than the complex structure of a computer, even of one of the integrated circuits in the computer. Even the structure of a switch is not that simple. It would be hard to capture in the partial differential equations my math colleagues study. Biology is made of a hierarchy of structures (think ion channel proteins, in membranes, in cells, connecting to each other and to muscle, etc.) So I try to teach how to ask biological questions in a sensible and productive way using the immense skills and knowledge of my colleagues in physical, mathematical and chemical sciences.

Along the way, I try to do something new. Visits to Weishi Liu and Hamid Mofidi in Lawrence, Kansas included wonderful side trips to the Nelson Atkins Museum, one that makes the public art collections of the west coast (indeed all others west of the Mississippi river) look meager; visits to Independence, MO to see the extraordinary Mormon sites there and the Truman Museum, and good tastes of the local barbeque, my favorite style, at ‘Joe's Kansas City Bar-B-Que’.

Visits to Toronto and San Jose with Huaxiong Huang, Shixin Xu, Yi Zhu and colleagues produced a paper on water flow in the lens of the eye that synthesizes so much of what we did decades ago, with the first proper derivation of the equations that brought John Pappenheimer to television and me to his feet (when I was fourteen or so), fitting beautifully with the work of Rick Mathias, who was my student and post doc at UCLA, faculty colleague at Rush, and has done so much wonderful work at Stony Brook. Interactions with Chun Liu at IIT are a continual joy, as are the personal ones with Chun and his wife Yang Zsxiao. Chun, Yiwei Wang, and I are showing how chemical reactions can be embedded in the theory of complex fluids (think shampoo or egg white) that allows ‘everything to interact with everything else’ and shows how enzymes localize reactions (into networks) because they catalyze them so dramatically. Not yet finished, but more exciting, for that.

Of course, I continue to learn from Maxwell: most recently finally understanding why ions move through channels. Mostly electrical forces of course, but rather amazingly—but obviously, if you think about it: where else can the current go, *in one dimension*? There are no \vec{B} fields in 1D— the ions fluctuate enormously

in time and space in number density and position, but electrical current does not vary in space at all, because the channel is a one-dimensional series system. This is why computer circuits can work in $1e-10$ sec (decimal point and ten zeros, for nonscientists), in which time light moves only one inch or so! Analysis of channels has ignored this reality of current equality, for the most part. Much of my own work has too, but some of our work has this right. Consequences, theoretical and practical, remain to be discovered. What fun to struggle with that challenge in the next years!

For family fun, we went with 'the boys' (Alastair and Henry Trowbridge and mom Jill) to St. Louis to learn of Dred Scott, and see the Gateway. We had lots of fun with a fascinating visit to historic and impressive Knox College on the way.

A visit to Las Vegas showed why we had avoided it in the past, followed by a glorious time in Springdale, UT (Zion National Park) until my Achilles Tendon decided to separate (on my birthday, while on a flat path, nothing extreme, nothing notable except the glorious view; separation confirmed by MRI). The tendon is repairing on schedule without surgery, but with frustration on my part. (The surgeon said his athletes working with a personal trainer many hours a day still take 12-14 months to recover. I am not an athlete as you all know quite well. I am a biologist and cannot imagine why the repair takes THAT long!). Cataract surgery was easier but until tears were allowed to accumulate (by putting plugs into tear ducts) results were disappointing. Now they are OK (but then again I have never seen well since Mrs. Levin in third grade noticed I could not see the blackboard. I did all right when the multiplications were on paper).

Next year brings trips to Taiwan and Suzhou, China, and a two-week stay with Yoichiro Mori at Penn in Philadelphia which should be a fun mixture of teaching and doing and a chance to spend time with Brian Salzberg (with grandkids is the plan). Invitations to Shanghai/Suzho, Zhuhai, Perugia, and Israel are generous and tempting but cannot all be accepted, I am sorry to say. The spirit is willing but the flesh is aging. Tendons, etc. are 77 years old!



Berlin Bear



Barbara

Ed

Bob