

Serendipity in My Life

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I've often thought about what distinguishes scientists from everyone else. It's not our gender, our race, our political views, our religious adherence, our hobbies, or even the food we like. It's nothing about our physical characteristics or our behaviors outside our

work. What distinguishes scientists is how little we leave to chance in our work. We hypothesize and test those hypotheses carefully. We calibrate, measure, monitor, analyze, and repeat experiments until we are sure we've determined a result that is real. We compare our theories to known behaviors and to results others have presented. In short, we aim to minimize serendipity in our work.

Yes, there have been accidental discoveries in science. Most people learn in grade school that penicillin was one such discovery because Alexander Fleming went away on vacation in 1928 and returned to find a moldy fungus growing in one of his petri dishes with no bacteria in that specimen. And there are a handful of less well-known but very important serendipitous discoveries.

Matchsticks were invented in 1826 when John Walker accidentally scraped a stick coated with chemicals against his hearth and it burst into flame. William Perkin was looking for a synthetic substitute for quinine, used for malaria treatment, and came up with a purple glob, mauvine, that we now know as the first synthetic dye. In 1878, Constantin Fahlberg, a laboratory worker, went home for supper but neglected to wash his hands before eating (yuck!). Everything tasted sweet so he worked backward to determine that he had discovered a new sweetener, saccharin. Safety glass was invented in 1903 when Edward Benedictus accidentally knocked over a flask in his laboratory and noted that the glass cracked but didn't shatter. Similarly, Patsy O. Sherman invented Scotchgard in 1955 when she accidentally spilled chemicals in a flask onto her shoes. She noticed that the shoes didn't get dirty where the liquid landed. X-rays, Teflon, superglue, microwave ovens, pacemakers, and Post-It notes were all serendipitous discoveries.

But these exceptions to the rule don't disprove my assertion that scientists work to minimize chance. The fact that I can name a dozen accidental discoveries over 200 years hardly eclipses the millions of discoveries that occurred in that time that were methodically sought out. Furthermore, in virtually all the accidental discoveries mentioned here, the discovery resulted in weeks, months, and sometimes years of deliberate scientific research to yield commercial products.

So, if we scientists work to remove chance, what role does serendipity play in our lives? It is in the human interactions we have in our work and nonwork lives that serendipity is important. It is in the accidental meetings that lead to a conversation that changes the course of our work, the opportunities seized on the spur of the moment, and the unexpected things we see and hear that serendipity affects us. There are a few serendipitous events in my life that have been important.

When I was finishing high school and thinking about where to go to university and what to study, I decided to pursue a music degree at the University of Rochester (UR), Rochester, New York, which has a marvelous music program in the Eastman School. However, my parents were not supportive. They foresaw me requiring lots of financial support, not just for the college years but for years of postgraduate life trying to scrape by as a musician. We had many heated arguments about my future, and in the end, I agreed to be a Bachelor of

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Arts in Music student, which meant I'd take academic subjects on the UR main campus and music courses at Eastman.

Off to Rochester I went. My first term I signed up for one of the special, small-enrollment courses that the UR offered to freshmen, the "Physics of Music." I signed up for this as a lark; other small-enrollment courses that interested me were already fully enrolled. I also started piano lessons with one of the Eastman professors, a woman who terrorized me. She yelled at me for saying "hello" to her daughter, who would regularly show up outside her mother's office just before my lesson. I was told by my teacher that her daughter was there to do her homework and not to socialize. By the end of the first year, I had switched to a physics major, based on my love of the "Physics of Music" class, and dropped piano lessons so I could avoid my horrible piano teacher. Had I not taken that freshman course, I would never have found my way to acoustics.

My decision to pursue a physics degree was aided by another chance happening. My freshman-year roommate was a graduate of one of the local Rochester high schools. There were a fair number of other students from Rochester who I met as they stopped by to visit. One of them was Ethan Vishniac (see bit.ly/4g2ERAs), who hadn't exactly graduated high school. He had been given permission by his parents to skip his senior year and head off to college as long as he stayed local so they could keep an eye on him. (He remains a high-school dropout. His school district said they would award him his high-school diploma if he finished two terms of English, and he could stomach only one course.)

Ethan was a physics major and as our relationship matured, moving into a physics major seemed to be a natural decision for me as well. Meeting Ethan, my future spouse, clearly changed the course of my life. At the time, it also changed the nature of my relationship with my roommate, as she eventually figured out Ethan was visiting to see me and not her.

The next major serendipitous event that shaped my life happened with my first academic job. After the UR, I went to the Massachusetts Institute of Technology (MIT), Cambridge, to work with Dick Lyon while Ethan completed a PhD in astronomy at Harvard University, Cambridge, Massachusetts. Next, we moved to New Jersey, where I assumed a postdoctoral position at Bell Laboratories, Murray Hill, New Jersey, and Ethan scored one at Princeton University,

Princeton, New Jersey. When the postdocs ended, we moved to Austin, Texas, and began academic appointments at The University of Texas at Austin (UTA).

Starting the first academic job can be quite a challenge. For those of us who enjoy working collaboratively, success relies on finding the right partner. I was fortunate in that UTA had a strong acoustics program when I arrived. David Blackstock and Elmer Hixson were generous with their time and filled me in on their current projects, but their areas of research didn't overlap my interests or talents. I was also introduced to the folks at the Applied Research Laboratory (ARL), a large research laboratory affiliated with UTA. Mostly their work at the time was focused on acoustics problems for the Navy. Again, it was not really aligned with my prior work, but it was interesting.

I was not sure how to find a collaborator and was considering a move out of acoustics to an area with greater representation in my home department when a serendipitous happening changed my research directions. I was approached by Robert Culbertson of ARL and told that he was advising a graduate student but could not continue to do so as his UTA appointment had expired. He wondered if I would take over as advisor on the funded project. I agreed and had my first graduate student, Yves Berthelot.

That chance transitioning of a student had several impacts. It introduced me to a new area of work, as the problem Yves was working on was laser generated sound underwater. It started my academic career with one of the best students I have ever had. Yves was self-motivated and very talented as an acoustician and a musician. It kept me in the acoustics fold rather than seeing me migrate to system dynamics. It also got me started with Navy funding to pursue interesting acoustics questions, an area of research I pursued for many years.

I left UTA in 1998 to join Johns Hopkins University (JHU), Baltimore, Maryland, as the Dean of Engineering. One of the attractions of JHU was their affiliation with the Applied Physics Laboratory, much like ARL at UTA but larger. Universities have all sorts of hierarchical structures. At JHU, the deans were the most powerful people, having complete control of their budgets. The President, Provost, and Vice President for Research had hardly any budget and thus needed the support of the deans to do anything requiring significant funding, in other words, to do anything.

SERENDIPITY IN MY LIFE

I was not the only female dean because the College of Nursing also had a female dean, but I was the first female dean of engineering at JHU, the first female dean outside of Nursing, and only the third female engineering dean in the country. Not surprisingly, I got to know the other JHU deans but also took time to get to know the other women leaders in the administrative ranks. A group of four of us got to be very friendly. The group included a vice provost, the deans of engineering and of nursing, and the chief information officer (CIO). We'd get together a handful of times a year for dinner and socializing.

In 2003, having grown increasingly frustrated by the sexism displayed by the JHU top leaders and at the end of a full term, I stepped out of the dean position to return to teaching and research. Normally, a university administrator returning to regular academic duties shifts their research area as new work in their original research focus area has passed them by. The idea is to have a fresh start in a challenging area. I had managed to convince Jim West (see bit.ly/3YZibuL) to come to JHU, so I had a collaborator ready to rock and roll.

As I was renewing my teaching, continuing my work on diversity issues in engineering education, and restarting my research, a great opportunity fell into my lap. Serendipity was at work again. I was contacted by my CIO friend who asked me for help. At JHU, all the top administrative leaders with responsibility for anything related to the hospital system are asked to adopt a hospital unit. The CIO had adopted the Pediatric Intensive Care Unit, the PICU, at Johns Hopkins Hospital. She rounded with them once a month and tried to identify any opportunities to intercede to help them resolve issues. The PICU at the time had an L-shaped geography that made communicating difficult. The incessant noise from the medical equipment also hindered communication. What the CIO wondered, was whether I could help the PICU staff resolve the noise and communication issues.

Jim and I agreed to meet with the nurse administrator of the PICU and to tour the unit. We were frankly certain that we'd be able to find work done on hospital noise and connect the JHU folks with the experts in the area, but when we went looking for papers, we couldn't find any acoustics experts on control of hospital noise. Thus, Jim and I began our work on hospital noise control. We had the blessing, and even some funding, from the President

of Johns Hopkins Hospital, who agreed that we could publish what we found uncensored.

As another happy coincidence, the president of the hospital had recently had an overnight stay there and couldn't sleep because of the noise. Our work led to a series of papers including what is now my most cited published paper (Busch-Vishniac et al., 2005). Over the next decade, we convinced others to work on hospital noise, and it remains an active research area in the Acoustical Society of America (see Busch-Vishniac and Ryherd, 2019). We have been credited by many acousticians with establishing this important subfield of research.

In each of the serendipitous experiences I've mentioned, the benefits have come from the accidental connections to opportunities that changed my direction. In the first case, the course I took in part because it wasn't fully enrolled and the chance meeting with my future spouse led me to change my major to physics. In the second case, I inherited a fabulous PhD student who led me to work with the Navy on several interesting acoustics problems. In the third case, a request for assistance from a friend and colleague led to the work I did with collaborators on hospital noise.

The strongest learning I've taken from these experiences is to be open to new opportunities. You can never be sure when they will arise or which ones will alter your life's work or nonwork directions. Additionally, as my serendipitous events have come from personal contacts, I've learned that it is critical to develop a network of collaborators, colleagues, and friends who share their problems and successes with you.

References

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