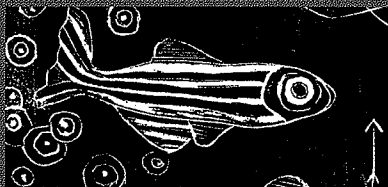


A PERSONAL HISTORY OF
THE INSTITUTE OF MOLECULAR BIOLOGY
AT THE UNIVERSITY OF OREGON

LOTTE STREISINGER

*from the
sidelines*



from the
sidelines



George Streisinger

(1927–1984)

BORN IN BUDAPEST

George's distaste for vegetables probably stemmed from his childhood. If he did not finish them at supper, he said, they were served to him again at breakfast (kohlrabi later became a particular bugaboo in our family).

George's mother Margit seems to have been the moving force in the Budapest household. When she married his father, Andor Streisinger, the marriage record listed his occupation as clothing manufacturer, but in time she took over the management of the business and he handled the finances. Eventually, they specialized in neckties and children's clothing; family lore has it that Margit once even designed a dress for a child of royal parentage. As for the neckties, on the rare occasions when the adult George wore a tie (for instance when he was marching for peace in the anti-Vietnam War days), it would be one of the old Hungarian ties.

Unlike many molecular biologists who moved into the field from physics or chemistry, George's background was that of a naturalist. E. O. Wilson, the Harvard specialist on ants, writes in his memoir that

“Hands-on experience at the crucial time. . . is what counts in the making of a naturalist.” George, or Gyorgy as he was known as a child, was diagnosed with a heart murmur and prohibited from playing soccer or other sports; instead he went butterfly hunting with his older brother Ervin. His father raised pigeons on the roof of the Budapest apartment building in which the family lived.

By 1938 there was good reason to leave Hungary. The Hungarian government had aligned itself with the policies of Nazi Germany and passed a series of ever-more restrictive “Jewish Laws.” For Jews who had long and successfully been assimilated into Hungarian culture this required a total rethinking of their position and options. Many who were incapable of making this paradigm shift, in the short period between the promulgation of the anti-Jewish laws and the closing of the Hungarian borders because of World War II, perished in the Holocaust.

The Streisinger family were among those fortunate few who did pursue emigration. George’s older brother Ervin was the first to come to America in October 1938, followed by father Andor in November and Margit and Gyorgy in March 1939. I assume it was again Margit, (or “Anyu,” meaning “mother,” as she was called) who was the moving force. (My mother, too, was the moving force who managed to pry my well-established doctor-father, me, and my brother out of Munich, Germany, just in time, in 1938.)

Andor must already have been quite ill by the time Margit and eleven-year-old George docked in New York on board the SS *Manhattan*. On March 31, the day after their arrival, Andor was admitted to the hospital; he never left and less than two months later died of stomach cancer. (I owe knowledge of these details to my daughter Cory’s recent *Family History*.) The traumatic effects on Margit of family separation, emigration, and then her husband’s death coming one right after the other can hardly be imagined.

Ervin soon joined the American army. Margit supported herself and George with a drycleaning, alterations, and tailoring business. George became responsible for the family shopping and cooking at this early age. In December 1939 he turned twelve and arranged for his own bar mitzvah. In 1941 he was admitted into the High School of Science, then an all-boys magnet school in the Bronx, for which you had to take an entrance examination. There he joined the Herpetology Club, whose

members would go camping (without galoshes, to his mother's dismay) in the Pine Barrens of New Jersey to collect salamanders, lizards, and snakes. He also hatched spiders (black widows, so the story goes) in the closet of their New York apartment. While attending high school during 1943 and 1944 he worked as a part-time assistant for Dr. Myron Gordon, a fish expert associated with the New York Zoological Society. George was also "exceedingly fortunate in getting a job with Professor Th. Dobzhansky of Columbia University, during the summer of 1944 (on fruit flies)," he wrote in a short early resumé citing several publications which he had already authored or coauthored by the time he was twenty-one. Although he was clearly very bright and promising, he may also have been aided in getting these early jobs by the fact that the war was on, and the older men were in the army.

HOW WE MET AT CORNELL

Both of us were enrolled in an 8 a.m. genetics class. The lecturer, introducing the topic of *Drosophila* genetics, said, "We have a student in this class who has already published some research on this subject: George Streisinger. Where is he?" George was not there; he had overslept.

At about that time a boyfriend with whom I was severing relations remarked, "There is this crazy guy living in our house, George Streisinger. You would probably like him." "I've heard a lot about you," I probably said when we met. I had two tickets to a chamber music concert, which I had gotten for being an usher, and I invited him.

Cornell University is a combination of private and land-grant (free) colleges. I was enrolled in the College of Arts and Sciences, a private school (a very undetermined major, though I had tuition scholarships); George had arrived at the School of Agriculture a year earlier, at the age of sixteen. The Ag School was free, but, as he was to learn to his regret, required a payment in kind: farm practice. Most Ag students did their farm practice in the summers but George was doing research then. At last this requirement caught up with him and before he could graduate he had to spend a whole year on a nearby farm. I used to go visit him there. It was the coldest winter on record; at 15 degrees he was shoveling manure. Actually he was quite proud of surviving this and liked to tell the story.

Another obstacle in his academic path was the Reserve Officer Training Corps (ROTC), a requirement at the time. Opposed to the military, he refused to take it and a zero was averaged into his grades. All in all he flunked out of Cornell University twice, finally graduating a year behind me although he had started a year ahead. One effect of these early academic troubles was that as a faculty adviser at the University of Oregon in later years he went to great lengths to help those students, often foreign students, who had run-ins with the academic bureaucracy.

We started going out on early-morning bird walks. Roger Tory Peterson was resident in the ornithology department then; we used his famous *Field Guide to Western Birds*. Don't look in the index, George said; if you flip through the book, you will get to know the species. Our evening dates in the spring often ended in a swamp (well, a "wetland") where he would take me to observe the mating rituals of tree frogs and salamanders. During one last summer vacation I took with my family in Colorado, George sent me bananas and vials to trap the local fruit flies.

We were married the day before my graduation, in Sage Chapel on campus. We arranged our own wedding. A friend played favorite songs on the library tower bells, the party afterwards was in the garden of a faculty couple who had befriended me, and another friend from the dormitory sent an accordion player for dancing on the grass.

MANY MOVES

We moved eleven times between our first upstairs apartment on College Hill in Ithaca, New York, and the log house we bought for its beautiful view in Eugene, Oregon.

After Cornell George went to Bloomington, Indiana, to begin his Ph.D. work with Salvador Luria, a Jewish graduate of an Italian medical school. I stayed in Ithaca for the moment to work on my master's (in comparative literature). George came to visit often, hitchhiking back and forth.

Six months later when Luria moved to the University of Illinois at Urbana, George went with him and I joined him there. We lived in various apartments in the twin cities of Champaign-Urbana. The surroundings were not so beautiful (cornfields) but we made many close

friends among other graduate students. Some of these, particularly in the physics department, were very political. This is when George began the political activities that he was to pursue, with his special kind of passionate rationalism, at various times in his life.

It was the early 1950s and McCarthyism was rampant. Our friends rose in protest against textbook censorship; also they worked to desegregate barbershops, restaurants, and housing. The strategy involved two black people attempting, for instance, to rent an apartment that had been advertised. They would be told it had already been rented. Then two white people (including George) came, and the apartment was available.

In our first car we drove to Pasadena, where George was to be a postdoc with Max Delbrück at Caltech. I was pregnant with our first daughter, Lisa. On the way we had an accident on an icy road and the car had to be towed to Kingman, Arizona, a town forever fixed in my memory because no one would lend us cash to pay for towing and car repair even though we had a check waiting for us in Pasadena. When it came down to pawning the camera, George said, "Let's go have a good dinner." It was a typical response of his to trouble: going out to have a good dinner.

Three years at Caltech and many life changes for us: Both our daughters were born in the Pasadena Women's Clinic, a seven-bed low-income birthing place staffed by medical students, for which we qualified as poor postdocs. Manny Delbrück organized camping trips in the desert for the lab and the scientific visitors who came from all over the world.

At first the desert seemed so barren; later, when we learned how to look at it, it was not so barren. The Delbrück house – low and wide, open to the outside – embraced so many parties large, small, and costume; dinners; chamber music (Max played the recorder); play-reading evenings (*Shakespeare & Spaghetti*) with such ease and pleasure that it influenced us greatly when it came to expanding our own cabin-house later in Eugene.

Caltech at the time we were there (1953–56) was an international hot spot for scientists looking into life on the molecular level. Biologists, physicists, chemists – anyone who was then or would later be famous



George and Lisa, desert camping trip

in that line of work – was either resident or visitor, dropping into labs, halls, and lecture rooms, discussing experiments which were just then underway but would later take on historic significance. Max Delbrück and Linus Pauling had a friendly (or not-so-friendly) rivalry for post-docs and results. The communal spirit spilled over into political and social activities. George oversaw the cooking of a New Year's Eve suckling pig in the lab autoclave (it was a teenage pig, actually; maybe they suckle in the spring? It had to be cut in half; the cut was later artfully hidden by a wreath of camellias).

George got his first job at Cold Spring Harbor. We sent infant Cory to my mother in New York; she went by air, in a basket, with Max (does she need to be burped a lot? he wanted to know). We drove with Lisa in a crib in the backseat, taking the long way – stopping in New Orleans for a great lunch, of course.

Our years at CSH bracketed a wonderful Fulbright year in Cambridge, England, 1958–59. It was an exciting time for George to be there with Seymour Benzer, Francis Crick, and others of great current and subsequent fame, sharing crowded space in the Cavendish Labs – the place where just a few years earlier Watson and Crick had discovered the structure of DNA. Evenings offered so many stimulating events that we would sometimes attend different ones, wending our way among the black-gowned students flitting by on bicycles, and then meet later in an Indian restaurant which stayed open late. George and Seymour and some others formed a cooking-group: every once-in-awhile they would get us all together and prepare partridge or hare and other exotic foods. When we were returning to the U.S. George insisted



Motorcycle with sidecar, Cambridge

on bringing a haggis with him (this is a Scottish sheep's stomach stuffed with barley. Luckily it was taken away at customs). It seems our travels always included some baggage that had to be kept cold, or right-side-up, or was fragile, or forbidden.

High on the list of George's many enthusiasms was driving – anything that moved: In India

George drove an elephant, in Oregon there was a spate of horse-jumping; in England our means of transportation was a motorcycle with a sidecar for the children. He also applied himself with glee to punting on the river Cam.

One night we were invited to a dinner party at Francis and Odile Crick's. Did we arrive by motorcycle? It was how we got around. The Cricks had fashioned one house by breaking down the walls between two tall, narrow, neighboring ones, calling the result "The Golden Helix" (the houses all had names in Cambridge). I was very uncomfortable at the dinner. The conversation was over my head and loaded with innuendo: Someone would say, "Pass the butter" and all would giggle. However at that party I met a local potter (Odile knew people in the arts community). I ended up working at his place, Cross Keys Pottery, a couple of times a week. It was freezing, like every place in Cambridge (it took courage for me to plunge my hands into the cold clay) but I learned quite a bit.

We returned for another year at Cold Spring Harbor although we were ready for a situation with more diversity. A job at Brandeis presented itself and George went to look around the Boston area. It seemed alright and he also found a house he thought I would like. By the time we arranged for babysitting and both went to Waltham, Massachusetts again, the real estate agent had received an unconditional offer and sold the house. We stayed for several days, looking around and getting more and more discouraged about our ability to fit into that seemingly conservative upper-class area. George also began to have some misgivings about the department he would be in. We returned to CSH, not knowing what we should do. Had the house not been sold we probably would have made that move and our lives would have turned out differently.

Just about then Aaron Novick stopped by. Frank Stahl had suggested George; they had been colleagues at Caltech. Come out and take a look at Eugene, Oregon, Aaron said — I literally had to look it up on a map — so we went for a visit, staying with the Novicks.

None could have been better hosts than Jane and Aaron Novick. Applying the recruiting techniques I have already described, they took us horseback riding and arranged for me to spend a day in the studio of a local potter. Eugene seemed open, not set in its ways, and welcoming.

PROFESSOR STREISINGER'S MANY HATS

We moved to Oregon in 1960 and after a year in a rented house bought a log cabin beautifully situated in a saddle on Spencer Butte at the southern end of the Willamette Valley. Gradually the cabin expanded into a big house, and in the meantime we variously kept (not in the house) a horse, ducks, chickens, peacocks, guinea hens, and goats. Mainly goats. At its peak Cory's and George's goat herd included eight Nubians. They milked, made cheese, and separated cream by means of a fantastic contraption full of bells and whistles. George put a lot of energy into establishing a goat cheese marketing co-op which did not



George and friend

ultimately succeed but had very good potential. Once a new biologist, Bill Bradshaw, on one of his early visits to Eugene, was impelled to take off his jacket, roll up his shirtsleeves, and get right into helping to deliver a baby goat. George also became a certified goat judge and was in demand every weekend of the summer at little county fairs. (I would sometimes go along and draw the goats, sheep, and pigs.) This was an avocation that he kept quite separate from his University work.

Scientific summer visitors, local colleagues, and family members were often taken crayfish hunting at Indian Creek, between Eugene and the coast. George gathered up nets, buckets, and bait: fish-heads from a local store. These latter were attached via a wire through the eye socket to rocks in the shallow stream; the crayfish would swim upstream and be caught in the net placed between them and the bait. It was very easy – indeed child's play. However each person's bucket was strictly examined, and a large percentage of the catch returned to the river because they were too small and needed to be reserved for next year's crop. Back at home he cooked up the "big ones" and demonstrated how they were to be eaten (a little bite of meat in the claws and tail, and you can suck on the legs).

Few other than parents of young children knew of another of my husband's personae: George the Magician. On trips to big cities like Chicago and New York we would often stop at magic supply stores

where he bought baking pans with false bottoms, silk scarves to pull out of his sleeves, and such. He gave magic shows for birthday parties. Recently we found a list of eight tricks he was planning for such an occasion: #3 "Miser's Dream" involving silver dollars among the audience; #4 cut and restore rope and banana; #6 pretend to make cake – make guinea pig instead.

By all accounts he was a very good teacher. Certainly he expended vast energy in an effort to reach every last premed student in the back row. It has always been a principle at the Institute to have the senior faculty teach the introductory courses. George opted for the eight o'clock slot, so that he could have the rest of the day to do experiments. However he got up at four to prepare and by the time he had given his lecture he was wiped out. "My first year in the Institute, I was George's assistant for his honors biology course for nonmajors," Carol Gross recalls. "He had on a suit jacket, which lasted about five minutes because the sweat was running down his face by that time. . . . George spent a lot of time worrying whether the students were afraid of him and whether they should call him by his first name." He also fretted about whether his test questions could be misconstrued, and often had the postdocs and Frank take them first.

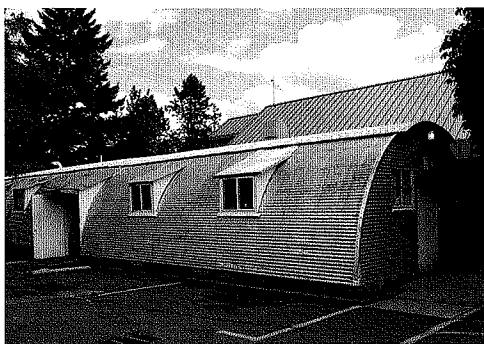
A famous lecture about protein synthesis involved collaboration with the UO Dance department. I had a small part to play in this performance. At the cue, "And of course it's dark in the cell when this happens. . ." he turned out the lights and I opened the back door of the lecture room to reveal the first, outstretched leg of a row of dancers, whose movements had been choreographed to demonstrate the molecular process of transcription and translation.

His office was a mess. He had a system though: He piled the overflow from his desk on a metal cart, of which the IMB seemed to have a large number, and when the cart was full, he pushed it out into the hall, and got another one.

In our house we had a beautifully backlit aquarium built under the stairs, and another kind of big-city shop we frequented was pet stores, to look at fish. However when, in the early 1970s, George shifted his experimental focus from bacteriophage to zebrafish, he began to neglect his aquarium. Eventually it looked so awful that I had to drape the front with fabric.

One motive for changing over to zebrafish may have been that the phage field was getting very crowded. More significantly, Carol Gross says, "George always wanted to do something 'big.' His goal was to study behavior. He considered a number of organisms. . . but settled on zebrafish because their biological properties facilitated the kind of experiments he wanted to do." Zebrafish reproduce fast, the eggs are fertilized outside of the female body, the embryos are transparent, they have short life spans, and they are cheap. He wanted to use them as genetic molecular tools to understand development, according to current IMB director Tom Stevens.

With his right-hand assistant, Charline (Walker) Durchanek, he began by moving a small number of fish tanks into a World War II-era quonset hut on the north part of campus near the Willamette River. The fish were fed on brine shrimp; keeping a steady supply was a constant challenge. They had to be kept at the right temperature; in hot weather the metal roof of the quonset hut was sprinkled with water to cool it. There were many crises. The supportive atmosphere at the



The quonset hut

IMB permitted the slow development (more than nine long years) of zebrafish as a laboratory animal. During this time, and to his regret, few graduate students and postdocs chose to work with George because this new line of research was just too iffy. One faithful and beloved postdoc, David Gröppwald (now at Utah), and Judith Eisen, colleague and

friend in the UO Neurosciences Institute, have written a historical overview article: "Headwaters of the zebrafish – emergence of a new model vertebrate" (*Nature*, Sept. 2002). "Thirty years after George Streisinger began his solo voyage," they conclude, "in June 2002 eight hundred scientists gathered at the Fifth International Conference on Zebrafish." George's first results had been published in a 1981 cover story in *Nature* picturing cloned (the first cloned vertebrates) and wild-type zebrafish embryos. The story elicited a media blitz, including even a cartoon in the *Chicago Tribune* featuring a fisherman bringing home a

string of scruffy-looking fish to his wife. "You cloned them, you clean them," she says. Pete von Hippel adds that George told him, "about several times that 'women's lib' people came to visit him," during the early days when he was trying to figure out how to make maternally homogeneous and diploid (two sets of chromosomes) zebrafish. "They were intrigued because he was triggering the development of unfertilized zebrafish eggs by a pressure pulse or with dead sperm, thus making the male part of the conception process irrelevant in their view," Pete says, "and to their considerable pleasure."

The popular media focused, of course, on the potential of cloning: food plants, larger animals, and human beings. In a 1981 interview George noted that "We've developed a vertebrate system for doing interesting genetics." The word "cloning" is sort of a fad word, he added; "It just hadn't occurred to us by any stretch of the imagination that our work would generate any of this. . . . There is a general worry among scientists, that overuse of cloning would lead to a loss of variety in food crops," he concedes; "but almost anything could be misused so it is very difficult to know at the time whether the good you get out of something will outweigh the bad." As for the cloning of humans, he says he has much greater, "very real, very immediate worries."

"Such as?" the interviewer asked.

"So now I step out of the arena of the geneticist," George replied. "I see the danger of global nuclear war as imminent. The use of poison warfare, the widespread use of chemicals that may be hazardous, the lack of any serious attempt to deal with population growth, the lack of any real concern about just incredibly unequal distribution of wealth." (As I write this more than twenty years later I am so sad that none of these problems have been resolved — indeed they have only gotten worse.)

George would however, I think, be truly amazed and pleased that today the University of Oregon is "Zebrafish Central," sending out stocks to labs all over the world from two large facilities, one in the basement of the neurosciences building and the other in a new, separate zebrafish facility, recently dedicated.