What Was *Your* Spark?

SIGMA XI

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THE SPARK

In early May, 2008, we wrote to all our members, nearly 60,000 strong, and asked them for their "spark." What was that spark you were hit with as a child or teenager that helped or made you decide that you wanted to be a scientist or an engineer? Was it a teacher at school? A visit to a local museum? A parent explaining why the sky was blue, or not knowing why the sky was blue? A magical book read under the covers at night? The ant that walked across your lunch one day or the snow flake that tipped your tongue?

And we told them why we wanted to know. We were wondering that if perhaps this information was collected in an anecdotal manner, and shared among our members, teachers, parents and grandparents, that perhaps your stories could create further opportunities for us "adults" to help generate our own sparks to catch the imaginations of the children we have contact with.

In asking we did indeed generate our own spark; the onrush of memories was significant.

Some members remember Sputnik as their defining moment. For another group it was receiving their first chemistry set, and they well remember the looks of horror on parents' faces as paint was removed from dining tables or loud explosions shook the house.

For a large number of members, supportive parents were extremely important, but none more so than that magical teacher who took just a wee bit more interest and made their math and science classes come alive. Literally, in some cases. And having a crush on the math teacher sometimes helped!

TV shows and books were often mentioned, Carl Sagan's 1980 TV series, *Cosmos*, being the most popular; as well as *The Book of Knowledge*, Paul De Kruif's *Microbe Hunters*, Victor Appleton's *Tom Swift Young Inventor* adventure books, and anything sci-fi related.

An excellent point to keep in mind was raised by **Peter Zilahy Ingerman** (1977), Ph.D., F.B.C.S., C.I.T.P., C.Eng., C.Sci. (pzi@ingerman.org), who wrote: "While a 'spark' may well be important in setting a person off on a life-path, the ability of the spark to do so, or the life-path that is ultimately followed, is very much a function of the psyche of the person involved. There are brilliant people who are simply not gregarious and hence are likely to pick professions that minimize the necessity of interacting with other persons. This is not a matter of being 'antisocial,' nor 'egotistical,' nor of being bored with people who don't care to understand what is exciting. It may well come from an inherent inability, such as a mild form of Asperger's Syndrome–a diagnosis that did not even exist before 1944–or even high-level-functioning autism. So, I suggest, that while the 'spark' is certainly interesting (and this is a wonderful collection of anecdotes illustrating exactly that point), it is also important to recognize that the resulting apotheosis depends very much on the nature of the individual involved."

Thus it is with great pleasure that we present the second edition of "What Was *Your* Spark?" If this anecdotal paper has the ability to raise your consciousness on how you may be able to generate that spark into science and engineering for a youngster, then we will have succeeded in our goal.

NB. The date in brackets after each member's name is the year they were inducted into Sigma Xi.

Other Resources

William C. Summers, "*Microbe Hunters* revisited", *Internatl Microbiol* (1998) 1: 65-68: http://www.im.microbios.org/01march98/09%20Summers.pdf

The Carl Sagan Portal: http://www.carlsagan.com/

The Book of Knowledge:
http://merecomments.typepad.com/merecomments/2006/06/the_book_of_kno.html
http://www.hstreasures.com/bookofknowledge.html

What Was *Your* Spark?

My interest in science was first piqued by my fourth-grade teacher in Hastings, Nebraska, around 1936. She called me her "museum boy" since I haunted the paleological museum at the college. Later on I was set on the path by Worth Fletcher, Dr. Stuckwich and Dr Clare Hannum at Wichita University. The first two were in organic chemistry and the latter in biology. The final impetus was in the service (U.S. Army Air Corps—Corpsman, Itazuke Army Air Base, Itazuke) where the docs were very much like the docs on MASH. They convinced me to go to medical school when I returned in 1947. Eventually I received a dual appointment in internal medicine and biochemistry, retiring in 1992—a truly joyous experience.

Robert T. Manning (1969)
Professor emeritus
University of Kansas School of Medicine

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It has always been a challenge to get students interested in science, mathematics, engineering, chemistry and physics. During my early education, I was terrified of all of those subjects. My parents, both being teachers, really inspired me to at least "try" all of the different disciplines as I went through my early education. They sent me to an "archaeology course" at the local community college. They challenged me with questions at home and outside experiments to pique my interests.

As I developed and moved into my high school education, it was Dr. Judy Mack and particularly Mrs. Elsa Hays who continued the teachings of my parents. I had each of these educators for biology and advanced biology courses. They were innovative with their classroom experiences and challenged me with some of the most difficult assignments and exams I had ever seen. I learned everything from cell structures and animal bioscience to chemistry and microbiology.

As I went on to college, I met Dr. Philip Mohr at The Pennsylvania State University. He was the most interesting, but most difficult professor I ever had through my higher education experiences. He exposed me to microbiology and infectious disease research through slide shows, case studies and experiments. It was at that time that I decided that this would be my career.

However, it was a personal note from Mrs. Elsa Hays that inspired me to keep learning in the field of microbiology. She told me that I had a natural curiosity and ability to learn in this field and to "run with it."

Indeed I did and I went on to earn a B.S. in microbiology, a minor in biochemistry and molecular biology, master's degrees in genetics, animal science and public health. I am currently finishing a Ph.D. in public health. If it were not for the influence of these people, I would not have found the courage and strength to persevere in such a difficult, but fun, subject.

Alison St. John (2000)
Researcher, National Biodefense Analysis and Countermeasures Center
Frederick, Maryland

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When I was in the seventh grade at St. Cecilia School in Hastings, Nebraska, in 1950, I had made a study of the Arabic people of North Africa. I noted that the blue dye used by many of these

people was indigo, the same dye used by ancient people of India and involved in the significant fall of much Indian culture because the 18th century British chemist William H. Perkin had learned to synthesize indigo from aniline from coal tar. One day I was sitting in the local Carnegie Library with my brother listening to Sibelius's *Finlandia*. I needed a book to look at while listening so I went to the shelves of what happened to be the chemistry section. I picked out James B. Conant's *The Chemistry of Organic Compounds* (1938 edition). I sat during many music sessions reading this book. During this period I became very interested in organic chemistry and set up a lab on my back porch. In those days I could buy just about anything I wanted. I even bought an entire pound of sodium amide from Fisher Scientific. I was already fairly well acquainted with the basics of chemistry, but had seen very little organic chemistry. It was so neat I could not put the book down. Then I came to the section on indigo and Tyrian purple. This was especially neat because I found that indigo is the dye used in Oshkosh Bigosh overalls and jeans, which almost all of us wore. In looking at the synthetic sequence, I thought that a useful polymer could be made by starting the method with para-diaminobenzene rather than aniline. I pursued this project until I was 17 and eventually won honors in the Nebraska State Science Fair and Westinghouse Science Talent Search of 1957. I was deeply committed to studying organic chemistry. I received B.S., M.S. and Ph.D. degrees from the University of Nebraska with Jim Looker and much encouragement from Norman Cromwell. My Ph.D. work was at the University of Rochester and Vanderbilt University under Stan Tarbell with encouragement from Lamar Field. I then spent a postdoctoral fellowship with Speed Marvel at the University of Arizona, working on ladder polymers, publishing papers on those prepared from tetra-aminoanthraquinones. Prof. Marvel suggested to me that I may have been the inventor of the ladder polymer idea with my high school indigo polymer project, which had become a very important research area for thermally stable polymers. I am now retired after a nice career in synthetic chemistry with Monsanto and teaching in several colleges and universities in the St. Louis, Missouri area.
Lawrence H. Brannigan (1968)

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When I was about 8 years old, my father gave me my first wristwatch for my birthday. As soon as I had it, I went in the basement of our house, took my father's hammer and destroyed the gift in a few seconds just because I wanted to see how it was made inside. Needless to say, my parents were quite unhappy with my initiative.

Also, I had a careless creativity when came the time to invent "scientific" experiments. For example, I had a small toy car that ran on two D batteries. After observing that the tiny motor of the car was revolving surprisingly fast with those two batteries (totaling 3 volts DC), I had the idea to take the motor out of the car, and connect it directly to a 110 volts AC power outlet... just to see how incredibly fast that motor would certainly revolve! So I found an old power cord, and connected the electrical wires (almost as thin as human hair) of the motor to the copper wires of the power cord.

I didn't even have the chance to plug that thing completely into the wall outlet. As soon as the two contacts of the plug touched the contacts of the outlet, a giant flame pulverized instantly the tiny DC motor with a noise that I can still remember. In the electrical panel of our house, the circuit breaker triggered violently and all the lights went off. I could hear my mother screaming because of the noise and the power outage, while I was desperately trying to vent the smoke produced by my "experiment."
Robert Boily (2005)
Inforex Inc.

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I had already declared myself a chemistry major at NYU when a close friend decided to transfer from NYU to West Virginia Wesleyan College, Buckhannon, which at the time had about 500 students. In the summer of my junior year, I was set to take my first course in organic chemistry at NYU, taught by Morrison and Boyd. My friend persuaded me to come to Wesleyan instead and take the course there. NYU agreed to accept the credits, and off I went. There I met the most wonderful and enlightening professor, Nicholas Hyma, who opened vistas to me I had never imagined. He showed me how organic chemistry applied to life in the most memorable and useful ways and I was "hooked." Instead of returning to NYU after that summer course, I transferred all my NYU credits to Wesleyan and graduated from that school instead the following May. Needless to say, I then went off to grad school for my doctorate in organic chemistry followed by an exciting career in the chemical industry.
Daniel Kruh (1960)

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The spark to my present interest/hobby, neuroinformatics (NI) = computational neurosciences, was generated some 50 years ago by the excitement in the USA (President Kennedy) to land men on the moon. After this kind of research was initiated at Caltech in the 1980s by leaders such as Richard Feynman, Max Delbrück and Carver Mead, a large part of their products assembled the leading Institute of Neuroinformatics (INI) (www.ini.uzh.ch) in Zürich. The mission of NI is to understand the structure and function of systems in the brain, and to use that knowledge to guide the design and construction of electronic chips and machines that solve real-world problems of perception, learning and action. The INI is striving to achieve such understanding and competence by interdisciplinary research.
Hans P. Eichenberger (1951)
Institute of Neuroinformatics
Zurich, Switzerland

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There were two big sparks sending me to science in my early life. After a couple of weeks in tenth-grade biology, my teacher said that I appeared to already know most of the subject matter. Therefore I could spend the class time in the back room, doing what science I wanted. My first project was to re-mount a badly prepared Gila monster. The second spark came when, after participating in a Saturday morning science program for high school students, I was invited to undertake some research of my own under the supervision of paleo-ornithologist Hildegard Howard. I worked on the injury marks of saber tooth tigers from the Rancho La Brea tar pits.
Werner Heim (1951)

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My path to a career in science never strayed far off course, as I always had a knack for numbers and curiosity about the world around me. But it took many small nudges to take me all the way to a Ph.D. and a career as a professor. The first came from my family. Conversations at dinner often ended with several volumes of our encyclopedia on the table as we learned "if you don't know the answer, look it up." We were outdoors a lot, and my parents demonstrated their own curiosity about nature and sought out explanations. I naturally followed. My aunt worked for

NASA and grew up with the space program. Although her work was largely as a technician managing data sets, she was an obvious model for me, and she encouraged my interest.

One high school teacher stands out, not for his interest in me in particular, but for his interest in science. He was a true naturalist, trained in biology, but self-taught in physical geography and basic geology. He taught from photographs, and trained us in the art of observation, sketching and note-taking. His classes were both entertaining and intellectually challenging. He introduced me to the geological sciences and spurred my initial career choices. I owe much to Mr. Leonard.

All the way through school, my enthusiasm and good work often brought encouragement. Still, in the 1960s few encouraged young women to enter the sciences as professionals. I was not allowed to take electronics in high school–that subject was for boys. I was steered toward teaching, and discouraged from taking the "hard" calculus. But finally one professor of geophysics asked if I'd considered pursuing a Ph.D. The question was all it took. I'd never even considered the possibility, but someone thought I could do it–and I did! I've never looked back.

Judith L. Hannah (1979)
Professor, Department of Geosciences - AIRIE Program
Colorado State University

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My interest in nature first appeared when I was very young. My early life was spent in upstate New York, and I remember catching wooly bear caterpillars so I could watch them crawl around the rim of a box. Most of my memories from this period center on the natural world, including salamanders, snails and birds, as well as the various arthropods I could find under rocks. My father moved us to Yuma, Arizona, in 1948 (a real culture shock!) supposedly in part because of my health. My unusual upbringing (my parents kept me out of school and tried to home school me, although they both lacked high school diplomas) resulted in my being very self-driven, and as a consequence of my often solitary rambles in the desert, I became more and more fascinated with the natural world. I collected insects, rocks, fossils and shells, and later became interested in astronomy and chemistry. These were subjects that my parents could not easily understand, and it helped separate me from a very troubled family (my father was later diagnosed as mostly manic phase bipolar and my mother suffered from severe depression, occasionally bordering on being suicidal). I especially liked the evidence-based nature of the natural sciences, which countered my father's delusional and manic thinking.

What finally tipped me over into being a biologist was reading Edwin Way Teale's *The Insect World of J. Henri Fabre*, an anthology that I almost literally devoured. I became especially interested in spiders, at least in part because I encountered other people who were involved with these fascinating creatures and probably also because of a personal identification with little-known and often solitary organisms.

By a happy series of accidents and the intervention of several very concerned people, I passed my GED exams, got a scholarship and entered a junior college that had just opened outside of Yuma (Arizona Western College). I then got a General Residency Scholarship to attend the University of Arizona in Tucson, where I finished my B.S. in zoology and then wrote my M.S. thesis on jumping spider behavior and morphology. My association with my major professor and the graduate students, as well as my ex-officio committee members Vince Roth and W. J. Gertsch (both arachnologists) increased my enthusiasm for spider research, and after I passed my finals, I was accepted at the University of Florida at Gainesville, where I got my Ph.D. under Jon

Reiskind. After many years of post doctoral and staff positions I have now become a faculty member in the Department of Entomology, Plant Pathology and Weed Science at New Mexico State University.
David B. Richman (1972)

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My spark took place in he 1930's when my older brother was given a Gilbert Chemistry Set and also a Porter Mineralogy Set (I also got my own mineralogy set). He was hooked and so was I; as a result of our early interest in science, we both became chemical engineers and spent our entire careers in science and engineering.
Charles B. Henderson (1952)
glencoe@edurostream.com

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When I was in third grade, I asked my teacher (an exceptional woman named Miss Garrard in Watts Street public school in Durham, North Carolina) for a recommendation of something to read. She gave me from the school library *Mr. Tomkins in Wonderland*, a wonderful story by George Gamow, a brilliant theoretical physicist.

The story, beautifully illustrated with drawings, is about a bored-to-tears bank clerk named Tomkins who decides to brighten his life by going to a lecture on relativity at Columbia University. At the lecture, he understands nothing and falls asleep. In his dream, the speed of light is something like 5 mph. Wonderful things happen in this relativistic world. When he wakes up, he is alone; everyone else has gone home. But the book has an appendix: the lectures through which he slept. I was overwhelmed by the mystery, the fun, the challenge of this little book, and wanted to be a physicist ever since.
Lewis M. Branscomb (1945)
Professor Emeritus, John F. Kennedy School of Government
Harvard University
lbranscomb@branscomb.org

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The first spark was a lab in embryology when we looked at slides of living chick embryos. The sight of a heart tube not yet folded into the body of the chick, which was pulsating, filled me with awe. That was an epiphany that was reinforced by two summers in the Research Training Programs at Jackson Memorial Laboratory in Bar Harbor, Maine. I went on to receive an M.A. in embryology with Jane Oppenheimer, and a Ph.D. in developmental genetics with Salome Waelsch. Development has never ceased to amaze me.
Anna Chao Pai (1959)

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My first science class in elementary school, with Miss DeCelle, provided my spark. She devoted one session to describing the exciting research that was going on in geology, in chemistry and other sciences, but then as she sat on her table facing the class with her ankles crossed she held up her right hand and spoke: "If all the energy could be utilized that is contained in a lump of coal that I could hold in the palm of my hand, it would drive an ocean liner across the Atlantic! Scientists are now studying and analyzing this." My eyes popped open and that became the

inspiration that led me to be a scientist and to do research or work on atomic energy. Eventually I studied at the University of Chicago and worked on the Manhattan Project plus the atomic bomb program.

Romuald Anthony (1951)
Santa Barbara, California

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At the age of ten, my family, father, mother, two sisters and baby brother lived in Borger, Texas, where my father was a watchmaker at the local jewelry store. In 1938 Borger was a small, dingy boom town surrounded by oil rigs and carbon black plants. Among the amenities were an excellent public library and two movie theaters. Relatives and parents at Christmas times gave me a series of Erector Sets, a microscope set and other educational toys, including a chemistry set containing materials that would be strictly prohibited today. An interest in guns focused my attention on the potassium nitrate and sulfur. Charcoal was not included but was easy to obtain. Success in making black powder came very slowly but surely. It is by no means as easy as it is represented, whereas satisfaction came quickly and easily with magic fire ink. A saturated solution of potassium nitrate is used as ink to write a message on paper. When a match is applied to the spot where the invisible writing reaches the edge of the paper, the message is revealed by a creeping progress of fire. At the beginning of World War II, I entered high school in Hutchinson, Kansas, to continue my chemical studies. I taught myself some elementary chemical thermodynamics and was thrilled to see that the heat of explosion of a chemical compound could be calculated from tabulated data. Throughout the war I invented explosive devices and explosives and propellants and sent my findings and recommendations to the Office of Naval Research and the War Department. Needless to say, it turned out that everything I discovered was already known including the use of shaped charge in rocket shells and propellants containing RDX, but I had a lot of friendly correspondence with government scientists who recommended helpful books like *The Chemistry of Powder and Explosives* by Tenney L. Davis. When the war ended, I continued to study chemistry at MIT with less emphasis on explosives. In the qualitative organic analysis course I found a large open box in the balance room and to my amazement it contained chemical samples prepared by Tenney L. Davis. From age 20 to 65 my work was not connected with explosives, but a Center for Explosive Technology Research was established at New Mexico Tech and I became reanimated. I studied the kinetics and mechanism of explosive decomposition at high temperature and pressure and was ultimately able to determine reaction products and rate constants for reactions lasting one microsecond at pressures near 100,000 atmospheres and temperatures from 1100-1300 K. Reaction mechanisms could then be assigned. Some explosive compounds were studied but most were ordinary organic compounds that had been thoroughly researched at lower temperatures and pressures. The entire field of organic reactions was covered until my happy professorial career ended in retirement.

Kay R. Brower (1951)
Professor of Chemistry Emeritus,
Socorro, New Mexico
kbrower@msn.com

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While studying to become a high school math teacher immediately upon my return from army service in WW II, I enrolled in a course in psychological measurement. This was a purely serendipitous course enrollment, with no particular purpose in mind. The professor happened to be extremely enthusiastic about his subject, and he opened a vocational possibility I had not

previously considered in applied mathematics. His enthusiasm was contagious, and he encouraged my further exposure to this field. I pursued it and, with his guidance, earned support for graduate study through the Ph.D. I made this field my life's work, with equal parts of teaching, research, service and consulting. I owe my initial interest and the support that supplemented my GI bill to the inspiration and encouragement of a college professor. He introduced me to a field I would not have considered on my own.

Leonard S. Feldt (1953)
Professor Emeritus, University of Iowa

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From my earliest remembrances, my father taught me how things worked and how to fix them. I understood house wiring by the time I started to school. I knew how to tear down and reassemble a bike almost as soon as I had one. While I didn't really know what an engineer did, I had decided to go to college and study engineering. When I got to college, I was exposed to all the other foundation core courses and some electives and ultimately decided to pursue chemistry, primarily because of the real interest my teachers had in the subject and because it WAS interesting. It was analytic and you could perform chemistry experiments and confirm that the rules worked. About this time I went back to my high school to visit some teachers, one of whom had been my basketball coach. As we talked he began to describe how physics, even more than chemistry, was the foundation of the universe. The next term I enrolled in the basic physics course, as required of chemistry majors. I was anticipating exciting revelations. What I discovered was a mild-mannered teacher, quiet and reserved, who had ultimately discovered physics while in the navy. He loved its beauty and its potential to let you understand how things would behave. Like the Greek scholars, he understood the intertwining of mathematics, philosophy and physics, and he helped me to see those connections. While chemistry led me to the physics class, once there, that was the no turning back point for me.

This description of a point of revelation doesn't fall into the category of early stimulus for which your inquiry was directed (primary/secondary education period) but I offer it as a reminder of the importance of the early teacher in any field. A basketball coach whose knowledge far exceeded basketball (he was a fine basketball teacher). A college physics professor who saw the world more broadly than his discipline. These provided the spark. I offer this response not only to recognize their importance to me and ultimately my adult life, but to make the point of the importance of the interest of the teacher in the subject and in the student. It is unlikely that a teacher will stimulate excitement in a subject unless he/she is excited by the subject and WANTS to impart that excitement to others. It is also necessary that the teacher have a solid in-depth understanding of the subject that goes well beyond the particular class they are teaching. In this regard I offer my experience in the high school physics class. Nothing that occurred in that class provided any stimulus toward physics. That experience was perhaps the worst of all my high school classes, whereas the English and mathematics classes were superb. In looking for the triggers that stimulated individuals to get turned on to science, don't forget that of equal importance is to identify those experiences that killed any hope of stimulating that spark. Most young people are easily excited by new things when they are presented by an interesting teacher whose interest in the topic is clearly visible. Some students will still elect to make less of an effort than they could and their progress will be correspondingly less. But some will be inspired! If however the teacher inspires none, then none will benefit from the experience. A teacher inadequately prepared in the subject will be inadequate to create the "spark" toward science. Those who do have the depth of understanding but show no excitement of their own will not create the "spark." As one examines the number of students who elect to pursue science in college and notes the diminishing fraction who make that choice, it could be that there are more

cases where the stimulus results in killing the spark rather than exciting it. Perhaps those of us who have enjoyed a life in science might also be queried on experiences in our early lives that turned off an early interest in say literature, sociology, mathematics, etc. Such results might provide complementary information to that achieved by this inquiry.
Raymond F. Askew (1959)

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Looking back, one remembers a number of sparklings. I will cite two. Sometimes adults said and did things that didn't make sense to me. In third grade after Sunday School one Sunday, I remembered our very nice (Congregational) minister talking about "Gd is Love" over and over, and then we all got up and sang the ferocious "Onward Christian Soldiers." I later asked my dear mother about it and she said, "It's not NICE for little girls to ask questions about religion!" But I couldn't stop asking questions about everything. I even tried prayer, asking, "Please, God, let me stop asking questions!" It never worked.

The second spark occurred the winter I was in the second grade. In our classroom, there was a large cocoon resting on the window sill. One spring day our beloved teacher (Miss Mueller) told us that we should all quietly get up from our desks, and move to the window to watch what was happening there. (There were only about 12-15 of us in the classroom..) It must have taken an hour or so, but finally, miraculously, a huge cecropia moth emerged from the cocoon! Miss Mueller opened the window and we watched, amazed, as the gorgeous creature flew away!
It was an emergence for ME as well!
Louise Russert-Kraemer (1969)
Professor Emeritus of Zoology
University of Arkansas, Fayetteville

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When I was about fourteen years old (~1946), a very good friend of mine, same age, and a very enthusiastic model airplane builder, said that after school he was going to the university library to check out a book on radio so he could get an amateur radio operators license, so he could build a radio controlled model. I was very into classical music at the time and said I would go with him and check out a biography of a classical composer. When we got to the University of New Mexico library, I could not find a biography that appealed to me, so I checked out a book on the fundamentals of radio by Marcus and Horton. It was perfect for my age and stage of development. I read it "under the covers for half the night" for days, and shortly got my amateur radio operators license. I had a great deal of fun with this, and after high school went to Cal Tech to major in electrical engineering. Freshman physics being a required course, I decided after the first year that I liked physics even more than radio, and besides, if I got a B.S. in physics, I could probably get an M.S. in electrical engineering. I stayed with physics, and after graduate school at Rice, spent my career at Oak Ridge National Laboratory. It is amazing what a random spark can do.
Philip D. Miller (1955)
PhilipM657@aol.com

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Five teachers and one uncle set me on a course toward three degrees in chemical engineering and a fine career. Two of the teachers were at a British boys' school in Santiago, Chile, where classes

were taught in Spanish, with a few hours each week in English so the Chilean students could learn that language. The others were at El Paso High School in El Paso, Texas.

In Chile, Sr. Santander introduced me to chemistry in such a vivid way that I set up my own small lab on a table in my bedroom at home. We had no lab at school but the chemistry classroom was fitted out with a lab bench at the front where Sr. Santander could demonstrate various experiments with the aid of one or two students. Even at twelve years of age I could go to a chemical supply house in downtown Santiago and buy my glassware and reagents, even strong acids, bases, various salts, sulfur, organic chemicals and mercury, among others (I used the mercury to extract a flake of gold from a sample packet of gold ore my father brought me from Bolivia). I had a great time at my lab table, though my friends thought I was nuts.

As a result, I arrived for my last year in high school in El Paso with a considerable knowledge of chemistry, but I took chemistry again, anyway, to learn the terminology in English. My teacher, there, Mrs. Oliver, was excellent, and she inspired me further to pursue chemistry as my career. I had no lab of my own there, but she offered us the chance to do special experiments after school, offers I gladly accepted.

In Chile, Sr. Yrarrázaval was my physics teacher and he introduced me to the austere beauty of classical physics, while in El Paso I had two excellent mathematics teachers: Miss Kelly for trigonometry and Mrs. Mather for solid geometry. These latter two teachers loved their subjects and knew how to impart that love to their students.

As the end of my senior year at El Paso High School approached, I knew I wanted a career involving chemistry. I also liked the idea of involving physics and mathematics. An uncle, recently graduated from the University of Texas in chemical engineering, told me that if I wanted to combine those three subjects and do work of immediate, practical value by applying them, I should study chemical engineering. His idea appealed to me, and so it was that I arrived, at age sixteen, for my freshman year at the Texas Agricultural and Mechanical College (TAMU, today) knowing exactly what course I wanted to pursue. I have never regretted taking those early cues to heart for a moment.

Paul F. Deisler, Jr. (1949)
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As a kid I grew up in the countryside. I killed birds, crabs, wild doves, tried to catch iguanas, etc and also suffered what was later known as a type of hay fever when under the branches of certain trees. I always tried to get answers to why some crabs were on land, yet had gills, while others were always under water; the relationship between wild doves and homing pigeons, etc. I eventually became a botanist, although my spirit was in zoology and I still work with plant-animal interactions, especially related to pollination in cycads.

Alberto Taylor (1960)
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For me it was a two-phase spark process. When I was about eight-years-old, my family and I stopped by Florida’s Homosassas Wildlife Park, on the way back from Disney World. I learned about the intelligent gentle giants that are manatees. In their "fishbowl" I ended up in a staring

contest with one of the juvenile manatees. To me, any one who has ever wondered about whether or not animals think or feel like we do should take a good look into the eyes of these amazing creatures. Learning more about their passive gentleness and their endangered status, I knew I wanted to learn more and figure out how to help. I went on to college to begin my studies as an environmental science major.

And then on to Phase Two... As an environmental science major I was offered the opportunity to study "abroad" at the Biosphere 2 in Arizona. Long story short, after a paperwork mix up and a series of miscommunications, I ended up in the "Universe Semester" part of the Biosphere 2 study program. I've always had a thing for the night sky, so I figured I'd just go with the flow and learn something new. What I didn't realize was that I was enrolling in a semester of Columbia University Junior/Senior level astrophysics classes. Um... I took physics and calculus in high school!? Talk about diving in head first, sink or swim, and any other metaphor that can be extracted from that. Needless to say, it was a group effort to teach me all the background information everyone else knew from their years of studying physics, astronomy and math! There was a moment when one of my classmates explained that I was confused about a particular concept because I was thinking in terms of Newtonian physics, and those laws don't work on an astronomical scale... wait... what?!?! Newtonian physics isn't all there is to it!?...???... Finding out that Newtonian physics doesn't work on very large, or very small scales blew me away. I wanted to learn more. What does work? Why do we still use Newtonian physics?? I had a lot of questions. And came to find out that we are still defining physics and the equations that really do govern the universe, and not just our human-sized approximation, are still unsure! And then add to that how much we know about the heavens, and how little information that actually is! I was hooked. I switched my major and changed schools to study astrophysics.

So now I've come to a combination of both in my life. I study astrophysics and I love it. And in my free time, I scuba dive and volunteer research effort for the environment, especially with the water related aspects. And somewhere in there I also do outreach for young women to encourage them to join the science community, because as much as I loved all the guys in my core research classes, it would have been nice to have had some more girls to bond with.
Michelle R. Darrah (2006)

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I always loved being outside and exploring nature. My parents took my brother and me on trips to the beach, hiking in the mountains, and each summer we vacationed at a lake. But what decided me for sure that I wanted to be an environmental scientist was during my third grade year, when the *Exxon Valdez* spilled millions of gallons of oil in Alaska's Prince William Sound. The photos of the birds and animals coated in oil, many of them dead, and the shoreline completely slicked with oil and unusable, convinced me that I wanted to do work that would help us understand and protect the environment. From that day forward, I planned to be an environmental scientist. I majored in environmental science at Oregon State University and then went on to get my Ph.D. in ecology at Duke University, graduating in May, 2008. In June, 2008, I moved to Maryland to start a post-doc at the Smithsonian Environmental Research Center. I am working with senior scientist Patrick Megonigal, examining estuarine wetland biogeochemistry, specifically the iron and carbon dynamics.
Ariana E. Sutton-Grier (2005)
ariana.sutton@duke.edu

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I know for me it was reading *The Dorling Kindersley Science Encyclopedia*. It was one of those big science books for kids, with lots of pictures and a page for each field or subject (e.g. one on plastic, one on stars, etc). As a kid, I used to stay up at night with my lights turned really low, so my parents wouldn't see, and reread it for hours each night. I think I practically had the whole thing memorized at some point.

I'm a physics graduate student at UC Berkeley, entering classes in fall 2008. I'm not sure what field I'm going to do my research in, but I'm interested in string and elementary particle theory (there were a couple of pages on that in the book too!).
Danny E. Mittelberger (2004)
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Mine is more or less an anti-spark story. I entered Emory University as a freshman planning on a medical career. My first term in school I discovered just how much I hated the smell of formaldehyde and was casting about for alternatives. Meanwhile, I had a 100 average in calculus so I switched—for a time—to math as a major. A later event triggered a change to physics as a primary major, a decision I've never regretted.
Robert A. (Bob) Harbort, Jr. (1979)
Professor, Computer Science, Southern Polytechnic State University
bharbort@earnshaw.us

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There were several people who played an important role in my life. The first who was the most important in my scientific career was botany professor Earl Hall at the University of North Carolina Women's College. He lived around the corner and he adopted me as a foster son. He did not have a son of his own, and because I was interested in the things he was interested in, he treated me as one. He did all he could to encourage my scientific interests. It was not important to me at the time, but he was a Christian. He went to church and so did I, but there were many people in my life who went to church, but by the standards I later learned they would not be considered so. Jesus said that people would know we are Christians by our love. Hall was a loving man. He loved me, his wife and his daughter. My home was not filled with love like his so I envied his daughter. He also was patient. I was constantly questioning him and he always patiently answered me.

He raised chickens and hatched his own eggs to do so. In those days it was okay to have chickens in town. One day I was over at his house and he was tending his incubator. It was in the garage. I was standing outside watching him when he turned and invited me inside. He took an egg out and showed me where the chicken was pecking his/her way out. He took some other eggs out and showed me their increased progress. Then finally he held one as the little biddy broke the shell open and stepped out into his hand. I was awed. I have always been awed by God's creation. That is the first time I remember experiencing that wonderfully pleasant emotion.

Hall also had a big garden. He germinated his own seeds and propagated a variety of shrubs in a rooting bed. He taught me how to do make cuttings and to place them in rooting soil, keeping them moist and undercover until they took root. He also taught me to layer branches of some shrubs so they would take root.

I guess I was a born tiller of the soil for even in my old age I am still doing the things that he taught me to do as a child. While I was still able to do so I would have a large garden. One year I

had over an acre of garden. We had vegetables running out of our ears that summer. We had so much corn that we were eating it for the next three years. When God sentenced man to get his sustenance out of the soil by the sweat of his brow, I did not know he would make it fun. Hall thought it was fun too.

One other thing he taught me was to enjoy nature. He loved to sit and observe wildlife. His patience was a real asset to him. He would sit in the woods and bird watch. He kept a feeder outside his kitchen window so he could watch them when he was in the house. He told me once of laying under a bush and watching a mother quail with her chicks search for food. He would watch squirrels and became proficient in calling them. They would come to his bird feeders, which was a nuisance, but he nevertheless did not run them off. I have had the same interest in wildlife that he had.

William P. Wilson (1959)
Professor Eeritus, Pychiatry, Duke University Medical Center
williamwilson@verizon.net

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My spark for becoming a botanist occurred early in life on the farm in my parents' woods. When I was about five-years-old, I searched through the melting snow for bloodroots and hepaticas, and was overwhelmed with the smell of fresh spring earth.

Beth A. Middleton (1992)
National Wetlands Research Center
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I suppose the original spark that turned my mind to science was my paternal grandfather who had an extraordinary ability to explain natural things clearly.

Werner G. Heim (1951)

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It was not a teacher or teachers who induced me to study science and engineering. The sparks came from father and godfather, who both graduated with Ph.D.s in June 1915; my father in chemistry and my godfather in chemical engineering. They and their parents (and perhaps some of my grandparents) were born in the U.S., my father on the East Coast and my godfather in the Mid West. They both had German ancestry. Also, when I was young I enjoyed working on my father's house, puttying and painting the windows, cutting the grass, trimming the hedge, and so on. My father and godfather both received an honorary D.Sc. later in life, as a tribute to their efforts and good deeds. They were both outgoing and very social, and were very active in their work life. They had a number of good qualities. I admired both greatly. I hope this synopsis gives an idea of the influences and ambiance in my young life that helped me decide what to major in.

Arthur L. Thomas (1954)
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When I was 16 years old, I was sort of flirting with the idea of becoming an engineer, possibly chemical (that is what happened eventually). But the spark came by having a big crush on my mathematics teacher in high school. In order to impress her, I studied mathematics as if there were no tomorrow. Well, it did work!

Thomas Z. (Tom) Fahidy (1965)

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My initiation to science was reading. I was an avid reader from first grade (1927). My cousins had *The Book of Knowledge*. This was a subscription series that appeared as a hard-cover set of volumes. The result was that each rubric was spread through all the volumes. I remember the articles on evolution, how the Cro Magnon lived in huts on stilts in the Swiss lakes, about dinosaurs and mastodons and Neanderthals. I read all the science books in the children's room at the New York Public Library main building on Fifth Avenue (along with mythology, my other love).

I had an older cousin who was going to study chemical engineering at Lehigh and he influenced me to enroll in (chemical) engineering when I entered CCNY. "We will go into business together." Unfortunately I had no head for memorizing all the tests to pass inorganic chemistry. When I entered electrical engineering all you need was R,L,C and mutual inductance. As for electronics there were only diodes, triodes and pentodes. For computers, finally, there was only 0 and 1. So I had to learn just a small number of basic concepts (not really joking).
Morton Nadler (1990)
Professor, electrical and computer engineering (ret.), Virginia Tech

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Dissection of a frog in high school.
Anon (1952), M.D.

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For me, it was a number of things (I had pretty good science teachers in grade school, my parents are both scientists, I read a lot), but I think the main thing that got me interested in science was being out in nature.

I grew up in a small town and the house my parents owned was right next door to a vacant lot. (I hasten to explain to city-dwellers that this was more like an abandoned pasture than a true city "vacant lot.") Pussy willow grew in the wetter area (and some years there were frogs), while various goldenrods and Queen-Anne's lace grew in the drier part. There were lots of birds and bugs and there were trees to climb. My parents weren't terribly worried about my safety (I think maybe some of today's parents worry too much, or else times are very different from the 1970s) so I was pretty free to roam as long as I came back home when my mother called me. She also didn't worry about it too much if I got muddy—I remember several times she hosed me off (clothes and all) in the backyard before having me come in the house, I was so muddy. I never got in trouble for it; I guess she felt that as long as I was happy and doing something the mud didn't matter.

Also, several falls when I was fairly young, my parents would take me and my (then-baby) brother on hikes in the Cuyahoga Valley National Recreation Area that was a few miles from our home. Hiking was a lot of fun and my parents would tell me about the different trees and rock formations and we'd sit quietly to try to watch birds.

So I spent a lot of my free time as a kid poking mud with sticks and trying to catch dragonflies and looking at the different kinds of wildflowers and wondering about them. My mother is a botanist and when I was a kid she taught me a number of the species that were common around

the area, and told me a little bit about the different types of plants. She also let my brother and me catch fireflies and grasshoppers and keep them in jars, and several summers we raised monarch butterflies from caterpillars and released them after they emerged.

Not surprisingly (I think) I wound up as a field ecologist; I think all those early days spent looking at plants and animals, and collecting stuff and learning to identify plants and bugs helped get me interested.

Erica A. Corbett (1993)
Associate professor, biological sciences, Southeastern Oklahoma State University

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My earliest yearnings for studying bacteria began read at the age of 14, when I read Paul De Kruif's *Microbe Hunters.* This book is an exaltation of the early pioneers of microbiology pretty much written for adolescents. Not only did I read the book, I re-read it and memorized parts of it. Each one of the people described seemed as fearless and as reckless as any great adventurer who faced insurmountable odds. I remember my mental anguish about the injustices committed to such noble figures as Spallanzani, Pasteur, Bruce and the rest. I became committed to go down the same path and brave the slings and arrows that undoubtedly would befall me as I was blazing the trail towards the cure of infectious diseases. Quite a few other microbiologists relate the same experience, about how this book influenced them in their career choice.

At the age of 16, I worked summers in a small pharmaceutical company in Quito, Ecuador. I first worked in the media kitchen where we had to make from scratch all the nutrients for bacteriological cultures (nowadays they are pre-packaged as dry ingredient—you add water, sterilize them and they are ready for use). A break from this routine came when a cow from the stable they maintained for various purposes had died. In the frugal ways of the day, nothing went to waste. I was given the heart and told to turn it into powder for the preparation of the reagent used in the classical Wassermann test for syphilis. Not a small matter, it turned out. First, I had to grind up the heart and dry it into highly pungent dark brown and hard shapeless lumps. Then, I was given a porcelain mortar and pestle to convert the stuff into a fine powder. Each little lump became a challenge as they had to be pounded, crushed, triturated and comminuted one by one. A fragment larger than a pinhead was unacceptable. I must have spent a whole week doing this, counting each hour and each minute.

Moselio (Elio) Schaechter (1951)
Distinguished professor, emeritus, Tufts University, Boston, Massachusetts
Adjunct professor, biology, San Diego State University
mschaech@sunstroke.sdsu.edu

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There were very early signs that I would someday be a Soap Box Derby Engineer. First, I showed a remarkable interest in soap boxes, and some time later I discovered the great benefits of wheels.

From his advertising dealings with Chevrolet, my dad was well aware of the All American Soap Box Derby. In 1936, he induced me to build a car and enter the Chicago Regional Derby. A boy had to design and build a race car according to prescribed rules and deliver it to a Chevrolet dealer who would transport it to the race hill in Lincoln Park, Chicago. It was probably the first real sign, maybe the cause, of the engineer I was to become, with a Ph.D. in mechanical engineering and a member of the National Academy of Engineers.

William G. (Bill) Agnew (1949)

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I had a lot of influence from my father (retired soldier and postman, who was also an amateur scientist) and other relatives (most of whom were farmers). But what really clinched the deal for me in becoming a scientist was a factor that you'll probably hear a lot from scientists in my generation: a magical TV show (at least by early 1980s standards) on public TV called *Cosmos*, hosted by Carl Sagan.

It came at the perfect time, right on the heels of *Star Wars* and *Star Trek*, and when the still-recent Moon landing was commemorated on every silver dollar. Virtually everybody I went to college with in my science classes cited *Cosmos* as an influence. It was an unforgettable TV show. Over the years my interest turned from the other planets that Sagan focused on to what makes Earth unique: the life that dominates and shapes every aspect of our planet. So I became a biologist. But Sagan's show also made me appreciate what science is, and how it works, and I owe a lot to that first exposure, which has been melded over the years by books I've read by scientists like **Stephen Jay Gould** (1966), **Lynn Margulis** (1963), **James E. Lovelock** (1959), Freeman Dyson, **E. O. Wilson** (1950), Jared Diamond and, of course, Carl Sagan.

James D. (Jim) Cheaney (1994)

Assistant professor of biology, Ellsworth College, Iowa Falls
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I was about seven years old. Window shopping with my mother in downtown Buenos Aires I saw a tiny microscope kit at an optician's shop and I was fascinated by it. I eventually got it, I believe, for my birthday. It was a 4-5" tall gadget (made in Japan, of course). It may have cost at the time less than $1.50.

I started looking at drops of oil in water. My grandfather, who was a window glass repairman, cut for me glass "slides" of rather thick glass that I often glued together to hold my preps. I soon graduated to catching flies and pulling a wing or a leg, sandwiching them in the makeshift slides and observing the magnified image with fascination. No animal care committee nearby, luckily!

However, the same shop was selling professionally made preps, either of vegetable or animal sources. I wanted some. My mother told me, "I'll only buy you one!" After looking for a long time at the list on the window I chose a cross cut of small intestine (I suppose it was rabbit). It may have cost less than a quarter, but every "peso" counted at home. Then I could see the foldings of the intestinal mucosa and the villi.

But the kicker is that maybe it was a predestination, because decades later I spent many years involved in intestinal absorption studies and its mechanisms.

And over 70 years later I still have that small intestine slide!
Raul A. Wapnir (1967)
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My chance encounter was with a physics teacher, John Bacon, who had just completed a M.S. in solid state physics at Penn State and was teaching at our newly opened Knoch High School in Saxonburg, Pennsylvania. He ran a science club after school, doing things like building tesla coils which really would strike a spark in you. We also learned how to make front-silvered mirrors by sputtering aluminum onto glass. I think my first experiments were on the effect of different color light on plant growth in a biology class.

Somehow he got in touch with Caroline Gibson at North Hills High, near Pittsburgh, Pennsylvania. As this was the post-Sputnik era, they were able to get National Science Foundation money to run a summer program. John R. Jablonski, a plant cell culture person from the University of Wisconsin, recently hired at the University of Pittsburgh, and a statistician there whose name I don't recall at the moment (Mr. Sunderman?) introduced us to science methods. We commuted the 30+ mile distance daily in an old station wagon, half a dozen of us. For part of the time over a one year period I stayed with my grandmother in the city. Another time I stayed with a family of another participant, Ed Jesteadt, who now is a researcher at Boys Town, Nebraska. I don't know what happened to other participants except that they went to college and probably medical or vet school.

For sure it was this science club that got me into the Westinghouse science talent search. That in turn helped me get into a good college where I majored in chemistry. The rest is résumé.
Lawrence C. (Larry) Davis (1985)
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In my case the spark was a combination of reading exciting science fiction stories—especially those of Isaac Asimov—and the influence of a high school chemistry teacher.
George D. Ryerson (1958)
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What was the spark as a child that led me to want to be a scientist? I really have great difficulty in answering the question since I cannot remember a time when I didn't want to be either a scientist or a physician. I was raised in a small town in New Jersey where very few of the citizens when to college. No one in my small town family had ever gone to college. In grammar school I seemed to have had two passions: science and talking. My report cards seem to congratulate me on scientific subjects and to reprimand me for talking too much in class.

Since I had been adopted I didn't learn until much later in my life—in my 60s—who my biological father had been. It seems that he was descended from Pilgrim ancestors who included William Bradford the first governor of Plymouth Colony. This has been subsequently confirmed by analysis of my Y chromosome. Many of my paternal ancestors were college trained and achieved significant success in both business and academia. This raises an interesting question as to the role of nurture vs. nature.

The dichotomy in my interests—science and people—has played out throughout my life. While in high school I enjoyed both science and playing a role in organizations such as president of the chemistry club. I received a state scholarship to Rutgers University where I enjoyed both the science courses—particularly organic chemistry—and playing a role in various organizations, which included being the first president of the State of New Jersey's student affiliate chapter of the American Chemical Society. Following my undergraduate training I was accepted in the organic chemistry doctoral program at Stanford University. I was elected to Sigma Xi in 1952. I was fortunate to receive my Ph.D. in organic chemistry (terpene chemistry) from Stanford in three years and decided to pursue my chemistry career in industry. After five years working as a research chemist in industry serendipity stepped in and I became an "economist"—the title for professional employees in the economics division at the Stanford Research Institute (now SRI International). In this capacity I performed marketing, planning and management studies for industry and government, eventually serving as the director of the Institute's long range planning service. After ten years this led me to management and marketing assignments in the engineering and construction industry. I took early retirements in 1991, after completing an assignment in Düsseldorf, Germany, trying to develop major projects in the former Soviet Union and Eastern Europe for an alliance between a major American and a large German engineering construction company.

For the next few years I was active as a consultant. In addition, I have become very active as a board member in the San Diego Museum of Man (museumofman.org). I am currently chairman of the board of trustees of the museum.
James C. Selover (1952)

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I do believe it was the hours I spent outside as a young boy lying in the backyard and staring up into the night sky, filled with stars. In small town Iowa, you could (and still can) see a lot more of the night sky than you could in a city, and I was awestruck not only with the immensity of this vision, but also with the thought that the light had taken so many years to reach my eyes. As a boy I originally wanted to become an astronomer. Mercury, Gemini and Apollo changed that dream to that of becoming an astronaut, which transformed into being a NASA scientist and then a physicist. Ultimately, of course, I became none of those things, but when I visit my family in Iowa, I always look up fondly into the night sky.
Kurt S. Godden (1994)
GM Technical Fellow

kurt.godden@gm.com

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In my case it was a high school math teacher. Miss Miller, who taught geometry, made the subject so interesting that I pursued my college degrees in mathematics, culminating in a Ph.D. in applied mathematics from the Illinois Institute of Technology. Looking back, I believe what interested me most was the rigor of thought and logic associated with mathematics. Those patterns of thought and analysis, refined through my college education, served me well in my career, both when using mathematics to support my colleagues in science and engineering, and in my many years in management. I owe Miss Miller many, many thanks for launching me on a wonderfully rewarding career.

Ronald J. (Ron) Detry (1966)
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With me, it was Sputnik. I was in 9th grade and planning to be a lawyer. The push was to be patriotic and get into science. As I needed to explore, I decided that basic science was my best bet. I chose to get a Ph.D. in physics and I rode the rollercoaster ever since 1957.

John G. Kepros (1965)
keproslpico@aol.com

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Early impetus: As a child I had two problems:

1. When I was about five, I was sent by my mother to my room without supper and was told my father would talk with me when he came home. My father later came to my room, sat me upon his knee and shaking his head, told me what a good little girl I was and yet what a terrible thing I had done that day. The terrible thing was that I had found a whole lot of fuzzy yellow caterpillars with shiny red heads in the garden and had brought them into the house and up to my room to watch them. I still remember them. They were so beautiful and so interesting! Yet I had really alarmed my parents. This turned into a series of such events, for which I was apologetic.

2. I couldn't stop asking questions! This habit seemed to be of even greater concern to my poor parents. As a child I'd say prayers, "Please, God, help me to stop asking questions!" It didn't do a bit of good. I couldn't stop.

L. Russert-Kraemer (1969)
Emerita professor of zoology, University of Arkansas

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The spark that made me a scientist came from Adolf Hitler. My teenage years were spent under his regime. In emulation of my father, I had planned to become a historian of ancient history. To be prepared, I assiduously studied in high-school (Gymnasium) my Latin and ancient Greek. Only when, in the spring of 1939, I started my first semester at Bonn University, did I suddenly realize how foolish it would be to enter a career that, as long as Hitler and his cohorts were in power, would make advances depend on whether I could re-interpret history in terms of "race" and "Arian" heroism.

Natural science was my second-greatest interest, and I became a geologist. My wife and I were glad to leave Germany at the earliest opportunity after World War II, and after some wanderings

we ended up in the U.S. There, for 36 years until retirement, I taught students the science I by then so loved. At the age of 88, I still, informally and not-for-credit, teach a specialized subject to a few graduate students.

Gerhard Oertel (1961)
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I knew I was going to be a biologist when I grew up when I was six years old. My father had gone off to fight in the Pacific during World War II (he came back in a coffin) and I was living with my mother and grandmother in the Blue Ridge Mountains of North Carolina. I had no human playmates, just my animal friends and the forest around me. I was already keeping snakes as pets and I wanted to learn everything I could about Nature and science in general. Somehow I had already learned to read well enough to read newspaper. I know this because I remember reading the account in the Hendersonville newspaper of my father's exploits in the Philippines for which he was awarded the Silver Star medal. I devoured everything I could get my hands on: *National Geographic* articles about nature, library books... whatever! By the time I was 11, I was reading college-level zoology textbooks: *Animals Without Backbones* by the University of Chicago's Ralph Buchsbaum (who years later, as the owner of Boxwood Press, published a treatise I wrote on polychaetous annelids) and *General Zoology* by UC Berkeley's Tracy I. Storer.

When I was 15, I went to work at the Scripps Institution of Oceanography while still in high school. I worked full-time during the summers and on the weekends and after school during the school year. I was also fully trained in SCUBA (I had begun spear fishing and diving for abalone when I was 11) and first went to sea on an oceanographic ship at age 15. There were a number of other seagoing trips as well week-long, land-based "temperature runs" down Baja California. I knew all of the great oceanographers of that time by their first names: Walter Munk, Norris Rakestraw, John Isaacs, Dennis Fox, Francis Shepard, Carl Hubbs, Francis Haxo, Roger Revelle, Connie Limbaugh, Ken Norris (both Connie and Ken became my close friends and mentors), and many, many others. They provided the best training I have ever had.

I took time out to live in Germany, Spain, Morocco and Mexico and to be a professional musician for a few years. There was also a tour in the Army during the Vietnam War. Then back to school to complete my education. I eventually worked with a master's degree in the systematics and ecology of polychaetous annelids at the California Academy of Sciences, and published a number of papers and an identification manual on the group (Boxwood Press).

I went back for my doctorate later in life, earning it in marine biology at age 42. I then completed a two-year postdoctoral fellowship in environmental toxicology and limnology at the University of Wisconsin-Madison. I taught at the University of Colorado in Denver for some years and was a consultant in benthic biology and animal venoms. I authored a four-volume series on the biomedical complications and toxicology of alcohol abuse (Charles C Thomas). I came to Atlanta, Georgia, as a senior medical writer for an internationally based med-ed agency, then worked as a scientific writer-editor at the Centers for Disease Control and Prevention. Now in semi-retirement, I work as a freelance science writer and editor. I am currently writing *The Complete Idiot's Guide to College-level Biology* under contract to Penguin-Alpha Books.

I spend a great deal of time in the field and go out nearly every day. I am a serious, life-long birder and general naturalist. I began life being born as a field naturalist (it's a disease you inherit in your genes, like being an artist or poet), became a research scientist and professor, and have now come full circle back to my roots again as a field naturalist where I have always been

happiest. But I never stopped being a naturalist, even when I was doing the "science" thing.
William H. Light (1980)

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I was quite sickly as a child after a difficult gestation period and labour for my mother. I had various severe allergies, including respiratory problems and whole body eczema.

Once I learned to read at about age four, new worlds opened up for me. Also, at about the same time, TV became available. The adventures of the last of the 19th century naturalists—Roy Chapman Andrews, Lowell Thomas and many others—let me experience a world indirectly that I did not have access too any other way.

Now many more than 60 years later I have worked as a field biologist and science educator and have developed internationally recognized programs in science outreach education.
Michael T. Caley
Associate Editor, *The Trumpeter: A Journal of Ecosophy*
shanshui@shaw.ca

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A Lionel train set. When I was about eight, my dad and my uncle stayed up all night on Christmas Eve and built a substantial Lionel train layout in the playroom. I began to be fascinated with the wiring and started to figure out how to expand it, improve it—and also make sparks.

From then on I was headed to electrical engineering and haven't stopped. I retired from the University of South Carolina in 1990, and now teach full-time at Rose-Hulman Institute of Technology—in electrical engineering, of course.

I teach mostly basic courses, trying to motivate budding electrical and computer engineers and hoping to convince civil and chemical and mechanical engineering students that electrical stuff is important to them, too.
William J. (Bill) Eccles (1963)
Professor electrical and computer engineering, Rose-Hulman Institute of Technology
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I had the very best teacher of my entire academic experience in high school. She was my science teacher and she totally inspired me to love science and to be a teacher. I admired her because she always took time to write copious notes on my papers. She did not just mark correct or incorrect answers, she taught me further through her written remarks. She also made class interesting by bringing in real examples to illustrate scientific concepts. She was always very professional but also very personal with each student. There was no question that she cared that each of us learned science and were able to apply concepts to our daily lives.

This teacher just passed away at 91, but I was able to tell her more than once what an impression she made on me and how my own success was due in part to her early example of how influential a high school teacher of science can be.
Peggy S. Meszaros (2007)

William E. Lavery professor of Human Development Director, Center for Information Technology Impacts on Children, Youth, and Families College of Liberal Arts and Human Sciences Department of Human Development, Virginia Polytechnic Institute

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It was on the Fourth of July, Independence Day, of 1932. My small hometown, a farming community, with fewer than 300 people, was celebrating the day with a parade and other celebration attractions for such a celebration. One item of the day was a barnstorming pilot and airplane that came up to our town to sell airplane flights. My brother and cousin and I went out to watch the flights and to see if anyone was willing to pay for them. We three were each less than nine years of age with me being the eldest of the three.

Then our uncle, visiting from his home in California, and a friend drove up in his Model A coupe, with rumble seat, and they went out to take a ride. Our eyes were bulging. That was our Uncle Chris! But, then he got out of the airplane and came over to the three of us to ask, "Would you boys like to take a ride?" It was a back-to-the-wall question, "What would Mom say?" But, we quickly resolved the problem and took the ride.

I was enthralled. I was so much taken by that ride that I squirmed all afternoon as to whether I should find dad to loan me a dollar to take that second ride. But it was in the depth of the depression and Iowa farming was suffering the full effects of the Great Depression. I didn't get that second ride.

But I was hooked on flying. From then on I wanted to qualify for enlisting in the Army Air Corps to learn to fly. I would have to get at least two years of college to qualify.

After high school graduation in 1941, I was to go to college. By that time the economy was such that college could be supported, for two years at least. I knew little or nothing about what curriculum I should take but I told the school, Iowa State College, that I wanted to qualify for entry into the Army Air Corps. So, my curriculum was settled. I was admitted to Engineering because Mechanical Engineering had a number of aeronautical courses that could be taken for the degree.

Then came World War II. After two years in the Navy I returned to Iowa State on the G.I. Bill to get a B.S. degree in aeronautical engineering in 1947. But in 1947 there were no jobs. Since I had very good grades in engineering mechanics I was admitted as a graduate student to study for a master's degree in engineering mechanics. I was also taken on as a full time instructor in the department of theoretical and applied mechanics. Four years later I was awarded the M.S. in T&AM and got a job with Goodyear Aircraft Corporation in Akron, Ohio, working with very early versions of technical computation, electronic analog computers, working on projects associated with early versions of guided missiles as well as airplanes. I did that for nine years.

I then returned to Iowa State, now University, as an assistant professor in aeronautical, later aerospace engineering, in 1960. I spent 33 years in the department teaching undergraduate courses in aerospace engineering. I was also able to afford flying lessons and became a private pilot in 1975, 43 years after taking that first airplane ride in 1932.

I retired from Iowa State in 1993, after teaching aerospace engineering for 33 years. I never did get the Ph.D. but I always considered that I did a good job in the undergraduate teaching function

that helped make the Iowa State degree in aerospace engineering to be one of the best in the country.

Paul J. Hermann (1963)
Associate professor emeritus, Iowa State University
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Some of my earliest memories are of going to the coast of California with my parents. My father used cut fish for bait. My brother and I got a lot of laughs by feeding it to the greedy little tidepool crabs. As I grew up, my fond mother got me a "shell kit" (mostly shells from anywhere but California) and a couple of simple seashore guides. I started a shell collection. In high school, I had a simple marine aquarium in which I kept track of the molting rates of a common shore crab. This won me an honorable mention in a science fair. The rest is history. I now am an authority on eastern Pacific decapod crustaceans, with an interest in behavior and adaptive coloration.

Mary K. Wicksten (1977)
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My “spark” came in three levels:

1. Interest in animals starting with pets, then collecting animals from about age 9 to 15—insects, snakes, mice to feed the snakes that developed into a colony sold to pet stores, and eventually squirrels, an opossum, raccoon, et al. And library books about animals.

2. Science fiction movies such as *Them* and *Forbidden Planet*, and science fiction books. (Starting about 5th grade.)

3. Finally, it turned from fun science into real science in high school with two superb teachers in zoology and chemistry, with both courses taught at college level with college texts. The biggest single spark was a day when our chemistry teacher brought in a guest college professor for a day of lectures on atomic and molecular structure with models of the atomic and molecular orbitals of electrons. From that day on I had to find out how we "know" that—eventually leading to a Ph.D. in theoretical chemistry from Johns Hopkins.

Edward W. Stuebing (1967)

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From my high school years on, my goal was to become a career military officer. This came from a family tradition of military service in Hungary and Australia, avid reading of history and my experiences as a hidden child during the Holocaust. When I was about to graduate, I wanted to get into West Point, but was too near-sighted to pass the physical. Instead, I enrolled in ROTC in Queens College of CUNY. In the middle of my sophomore year, bored with school and rationalizing that experience in the ranks would benefit my later career, I enlisted in the Army for three years. When I was discharged, I returned to Queens and the ROTC, eventually becoming the cadet commander of the unit.

I had to major in something, and one could not major in ROTC; I picked psychology as something that might be helpful in leading troops. As I started my final semester before

graduation and commissioning, I took a 1-semester course in experimental psychology, required of all psych majors who definitely did not want to go on to graduate school. The instructor, Dr. Alice Lasker, had an unusual way of teaching the course: instead of having us do a series of experiments out of a lab manual, she assigned chapters from an advanced text and had us generate our own experiments about questions that had not yet been answered by the existing research.

For the first time, I came upon the idea that I could do something that would actually advance human knowledge! I was "sparked." I took my commission in the Reserves (permitted because I had already completed my active duty obligation), wrote off frantically to graduate schools, and wound up at Princeton. In the ensuing 45 years (including seven since I've been officially retired), I've never regretted that change in plans: psychological research and all that goes with it—publishing, teaching, administration—have given me a fascinating life, doing not only laboratory experiments but field research in both polar regions, contact with astronauts and other very interesting people, and a small role in turning psychology away from its overwhelmingly pessimistic view of the aftermath of highly challenging experiences toward a better balance in appreciating human strengths, resilience and ability to achieve personal growth.

Peter Suedfeld (1962)
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The spark that led me to science occurred in high school. I had developed a tremendous interest in airplane design during World War II and in my senior year in high school, I began doing design drawings for new types of airplanes. This was because I was allowed to be in an aeronautics course as an elective. I actually designed some planes which were flying wings, something which was not yet available in 1946-1947.

This resulted in my choosing aeronautical engineering when I entered college. I applied and was admitted to the University of California at Berkeley, and because of all the returning veterans on there G.I. Bill, the college of engineering was overcrowded. I passed the entrance exams and was enrolled in mechanical engineering. After one semester in this program I became disenchanted with this as a career but did enjoy my chemistry course. So I transferred to chemical engineering, but this too quickly was not the answer I was looking for. So I transferred to chemistry, majored in organic chemistry, got a Ph.D. in medicinal/organic chemistry and after a year as a postdoctoral student at University of Michigan, I got a job at G.D. Searle in the chemical research group. I later worked for Cutter Laboratories, Bayer Corporation and Schering-Plough in regulatory affairs, and as head of quality control/quality assurance.

Max J. Kalm (1951)
mkalm2@juno.com

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No spark, due to some mentors. When I enlisted in the Army in 1945, I ended up in cryptography school at Scott Field, Illinois. Then I shipped to Japan in the Occupation Army Air Corps–they didn’t need cryptographers, but since I had had one year of college they put me in the medical corps at Itazuke Air Base, near Fukuoka, Kyushu.

There the docs were like the ones on *Mash*–hated the Army, etc., but they did two things for me–taught me to play bridge and convinced me to try for medical school when I returned to the U.S.

in 1947—which I did, graduating from Kansas Medical School in 1954. Along the way I met my wife in the laboratory of Wesley Hospital in Wichita. Life truly is a chain of chances! Being in the Army, like some other things, is a something I'm glad I did once!

Robert T. Manning (1969)
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For me, the spark was spread out over many years. It culminated when I was in the Air Force and got bored with my work. I was a "base veterinarian," assigned to monitor food safety and flight-line toxic hazards, and to manage the human hospital laboratory. To alleviate boredom, I started reading research journals in the hospital library. Because I had a veterinary medical education, which is of necessity very broad based, I discovered that I understood most of what I read, and the research I read about excited me.

William R. (Bill) Klemm (1963)
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I often think about the spark/whiz/bang/turn on that got me interested in science. There wasn't just one thing but a collection.

I was instilled with a wonder for nature by my parents and grandparents. I remember when I was very little being taken to pick up stones by my grandmother and marveling at their differences and beauty. Both of my parents were teachers, my mother never left kindergarten and my father was a math chairman in high school. My mom showed me the excitement of simple things. My dad was always reading, learning, doing math, and learning science. He showed me that it is fun.

My parents took me to places that had great science exhibits, museums and opportunities. I marveled at the diversity of nature, sea creatures, fossils, rocks and minerals; and the surprise and excitement of finding fossils in rocks from the Badlands or near Lake Champlain. Nature's ancient gift to me.

I have always been fortunate that I enjoy reading. As with many scientists, reading *Microbe Hunters* by Paul De Kruif, and other biographies enchanted me with the adventures and excitement behind scientific discovery. In 8th grade, Mr. Faust gave me college science texts and said read them for fun; and it was. Then other "upper level" books became part of my reading list and not to be feared.

I got to play with science at science camp and attended a National Science Foundation sponsored summer program in high school.

It wasn't until chemistry and Miss Scotto's class that I was reminded that enjoyment truly comes from mastering the material. Her teaching and subsequent lessons taught me that great personal rewards can be obtained from working hard and really learning a subject.

In summary, my sparks came from my parents, from role models and mentors, from great books, from experiences, and from positive reinforcement.

Now I am a professor of microbiology, immunology and biochemistry, a researcher, teacher, course director and co-author of a successful medical microbiology text and several review books. Who knew that picking up pebbles could lead to such a life in science?

Ken S. Rosenthal (1978)
Professor, microbiology, immunology and biochemistry, Northeastern Ohio Universities College of Medicine and Pharmacy
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I decided that I wanted to become a marine biologist during the summer of 1960, which I spent in Honolulu, Hawaii, snorkeling and exploring the reefs of Hanama Bay. My family and I had flown 11 hours in a DC6 prop plane to reach Hawaii from San Francisco, accompanying my father, a tax attorney for the Internal Revenue Service, who was on a two month assignment to the Honolulu IRS office. Unlike today, the reef in Hanama Bay was splendid with corals of all shapes and sizes and teemed with colorful fish and all imaginable marine organisms. I remember climbing down the precarious cliff face with islanders who worked in the IRS office to reach the Bay, and swimming out to reach the reef with a large inner-tube in the rough waters under clear blue skies. I had seen pictures of coral reefs in books, but nothing then or now compared with the experience of being in the water so close to so many extraordinary organisms and in such a beautiful environment. It would be seven more years until, as a college freshman, I would become a trained SCUBA diver (No. 101 at the University of California, Berkeley) and be able to explore and begin studying underwater habitats, but those reef dives in the pristine waters of Hawaii were the inspiration for all my subsequent studies.

Josephine Y. (Josie) Aller (1975)
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Research professor, School of Marine and Atmospheric Sciences, Stony Brook University

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I decided early in life to pursue an education in microbiology. This was triggered by reading *Microbe Hunters* by Paul De Kruif. This book made a great impression on me and lead to a more than 50-year career working as a clinical microbiologist and college professor.

Joel R. Cohen (1950)
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I can tell exactly when I decided that I wanted to be an engineer or scientist, working on rockets, in the hope that man would someday achieve space flight. It was while looking at a copy of the *Saturday Evening Post* which had the illustration for Robert Heinlein's *Green Hills of Earth*.

Robert O. (Bob) Woods (1965)
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I knew when I was 13 that I was going to be an engineer. Before that, at a boarding school, I was the Meccano (a British erector set) expert. Before that, aged about seven, I remember finding out how to make electric light circuits. Before that, my grandfather, who died when I was six, was showing me how to make things in wood. I've always been curious about how things work. Still am. I'll retire when the phone stops ringing.

Michael J. McCann (1966)
mjmccann@iee.org

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While in high school biology in the late 1950s I found a dead squirrel in my back yard. I brought it to my biology teacher who made a class lesson out of dissecting it. I was hooked on biology since then.

Edward I. Saiff (1968)
Professor of biology, Ramapo College of New Jersey

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I remember having a kid's chemistry set and a microscope. I also had a magnifying glass that I used to look at small stuff in detail and start fires in piles of dry leaves. Also, Carl Sagan's *Cosmos* series was inspirational. When I got to college I took a course called comparative psychology and I've been in the area of animal behavior and the biology of behavior ever since.

Darryl J. Mayeaux (2005)
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I cannot say exactly what first sparked my interest in science, because as far back as I can remember I have always been interested. I can, however, comment on the inspiration that allowed me to pursue a career in science research. I first would credit my high school biology teacher. I attended a small rural high school (the type not normally associated with stellar science education). Beginning in my sophomore advanced biology course I started having classes with Spencer Reames (Benjamin Logan, Logan County, Ohio). I had two more years of courses with Reames, giving me a total of four years of biology education in high school. Reames required his students to participate in science fairs, so I ended up doing a three-year project on a fluorescently pigmented bacterium. This experience completely solidified my interest in science research, because I had SO much fun doing it! I took my project to local, district and state science fairs in all three years and received a superior rating at each one. And I was not the atypical student. Our school won many state science awards. It wasn't the awards that kept me doing the work, however, it was the process and the excitement instilled by Reames. He continues to teach and again won a school award at the state science fair this last year. This research experience also introduced me to science libraries and other research resources at Ohio State (where we often went to investigate the literature) and at nearby institutes.

In addition to the excitement for research I learned in high school, I have been fortunate to have many excellent mentors throughout my career. I absolutely adore my Ph.D. advisor because he taught me so much about integrity in addition to being a great role model. He also really facilitated my independence as a scientist and continues to support me. As I have progressed I have learned to seek out other mentors and my training continues to this day. I hope that I am now instilling the excitement of science research in my own trainees. I have both graduate and undergraduates working in my lab, many of whom I hope will incorporate research into their career plans. My first Ph.D. student will graduate next week and I hope many more will follow her!

DiAnna L. Hynds (2004)
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I guess my trajectory towards a career in chemistry started when my parents gave me a chemistry set while I was in grade school. In those days, chemistry sets came with a bunch of little containers of chemicals, test tubes and beakers, an alcohol lamp and a book of experiments. You mixed various chemicals (maybe heated them) and observed color changes, precipitates, gas evolution and smells. I took chemistry in high school and continued to be intrigued with the manual arts of chemical experimentation. As the night follows the day, I majored in chemistry in college and went on to getting a Ph.D. in organic chemistry. Even before I got the chemistry set I performed my own scientific experiment when I filled a milk bottle with water, capped it firmly and put it on the back porch one winter's night. Voila! The next morning the bottle had turned into a bunch of shards and the water had turned to ice. Even though I did this experiment almost 70 years ago, I can still remember how the milk bottle looked.

Unfortunately because of the concern about the toxicity of the chemicals in chemistry sets and the dangers of fire and explosion, chemistry sets are no longer made.
Ronald S. (Ron) Ratney (1958)
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I was seated and ready for my first grade 9 class of the day (as it turned out, science) at Selkirk Collegiate Institute in Selkirk, Manitoba. SCI drew the majority of its students from the town, but also a fair number (like me) from the surrounding farm country.

Mr. Lavery, a relatively recent graduate (physics, I think) from the University of Manitoba, walked into the room and closed the door behind him with an uncharacteristic firmness. Oh, oh, I thought, he must be peeved, if not angry, at us for something or other. I tried to imagine what we had done that might have got him in this mood.

“Does anyone know what happened yesterday?” he asked. If he meant “in the world,” I wouldn’t have heard about it because my mornings were always rushed—I helped with farm chores first thing, cleaned up and gobbled down my breakfast, then walked a quarter mile to catch the yellow school bus at about 8:00 a.m.

He proceeded to tell us that yesterday (October 4, 1957) the first “man made” satellite, Sputnik 1, had been launched into orbit by the USSR. It took a few moments for us to grasp what he was talking about. What is a satellite? What is an orbit? Why doesn’t the satellite fall back to earth? What does a satellite look like, or do?

Lavery led us through the most fascinating classroom experience of my life. After explaining the fundamentals he went on to speculate how satellites might benefit human kind. I remember in particular his enthusiastic speculation that satellites might one day allow for practically instant communications across our vast country by telephone, radio and television.

My jaw was ajar with fascination and wonderment throughout the class. At the end of it I remember imagining, “How can I be part of this?” After high school, thinking satellites are probably designed by engineers, I went on to study mechanical engineering at the University of Manitoba. Upon graduation and with a lucrative “anywhere in Canada” scholarship in hand, I asked one of my professors which university would best allow me to study “space stuff”. The field was so new that no Canadian university offered a specialization in space engineering, but my professor advised that Carleton University in Ottawa offered one of the best programs in aeronautical engineering, and “aeronautics is in the right direction” to space!

The rest is history! After my graduate studies I began a wonderful career in the Canadian space program, working on many Canadian and joint international space projects until my retirement (sort of) in April 2004. Mr. Lavery, thank you so much for gifting me with that seminal branch point in my life!

Victor A. Wehrle (2004)
Past president, Sigma Xi (Ottawa Chapter)
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It was a devoted elementary school science teacher who was successful in educating several Nobel Prize winners. He devoted much time to extra-curricular activities such as a science club in which we competed in devising experiments and in spending time with us with delightful discussions on his sailboat. I also benefited from a supportive father who helped with such projects as constructing a "scanning disk" TV set around 1935, before commercial ones using CRT's were available. While he only had an elementary school education, he participated by painting it!

The mention of "blue sky" inspired a thought, since in my teaching days I tried to explain its origin to my students. I was gratified by having one of these become an astronaut who verified my explanation in her space ventures.

Richard S. (Dick) Stein (1944)
Emeritus Goessmann professor of chemistry, University of Massachusetts, Amherst
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The reasons that I became a physicist are rooted in my childhood. The original seed stemmed from a friendship with a boy named Jack Dempwolf, who lived on the next block during my teenage years. Jack was absorbed with wildlife, specifically reptiles and amphibians, and most importantly, butterflies and moths. My teenage mind became intrigued by these creatures that Jack loved and collected. I soon found myself equally involved in such biological projects. Before long my brother and I had a collection of snakes, turtles and frogs in an outdoor herbarium in our backyard. It was fun being an “expert” at handling creatures such as snakes that most other kids were afraid of.

But it was the butterflies that most excited my imagination. By 1946, Jack, my brother, and I were heavily involved in building a butterfly and moth collection. The collection we put together we eventually named the “Thayer-Dempwolf Collection.” That collection, which by 1949 numbered thousands of specimens, still exists today; it is maintained by Jack, who lives in the Cincinnati, Ohio, area and is still active an active lepidopterist. After Jack’s death, the entire collection (much added to by him over the years) is destined to become part of the *Lepidoptera* collection in the McGuire Center for Lepidoptera and Biodiversity at the University of Florida's Museum of Natural History, at Gainesville, Florida.

I continued collecting butterflies off and on over the years, dropping the pursuit in the early 1960s when the demands of job and young children made the avocation difficult. My wife, Retta, was an eager participant in the collection and study of *Lepidoptera* for as long as we both continued it. In 1957 we made the first East Slope capture of *Pieris beckerii*, until that time found only on the West Slope. This event was published by the *Lepidopterist* in an article written by Donald Eff, a well-respected Colorado lepidopterist and co-author of *Colorado Butterflies* (Denver: Denver

Museum of Natural History, 1957).

Meanwhile, in 1949, I entered Cornell University as a freshman, a school picked largely because of its reputation in biological fields of study. During the several years following, however, I became convinced that my expertise lay more in the fields of mathematics and physics than in biology. Upon my discharge from the U.S. Army in 1954, I enrolled at Newark College of Engineering. After completing one year of study there I transferred to the University of Colorado at Boulder (partly because they had a more liberal transfer credit policy than NCE), where I became a major in engineering physics. Cornell awarded me a B.S. in engineering physics in 1957.

The rest, as they say, is history. But were it not for that boyhood enthusiasm for biological studies, particularly in the pursuit of *Lepidoptera*, I might never have become any kind of scientist.
G. David Thayer (1959)

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There were several. My dad was a chemist and I was fascinated watching two clear solutions poured together and turning pink. I was fortunate in having two excellent general science courses in 8th and 9th grades. What really tipped the scales toward physics was the atomic bomb in the summer between 9th and 10th grades.
Charles W. Nestor, Jr. (1958)
CNestorjr@aol.com

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I was born in 1933, so World War II was very real and inspiring for me. My father made the D-day invasion of France.

Airplanes were the main interest of mine, flying and designing. I earned a B.S. in aeronautical engineering from the University of Texas in June 1955. Upon graduation I was commissioned as an ensign in the Navy. I had requested flight training and had completed all the pre-testing and evaluation for this assignment. So off I went to Pensacola, Florida, to start my flight training. At the time I didn't think jet powered aircraft were as safe as they should be, so I requested dive bomber training in the Skyraider, a single seat, propeller-driven aircraft.

Unfortunately, I was assigned to an Airborne Early Warning squadron flying the Skyraider that was equipped with airborne radar (APS20). I was very disappointed, but I performed to the best of my ability. After my first cruise I wanted to change squadrons, but found out that the commanding officer was giving anyone who left the squadron before completing two deployments were assigned an unsatisfactory fitness report. However, one could apply to attend the Naval Postgraduate School (NPS), in Monterey, California. I applied, listing every possible major that I would possible enjoy. Obviously aeronautical engineering was my first choice.

One of my choices was meteorology since it is closely associated with flying. Unfortunately, I did not know the Navy was short of meteorologists, and everyone who requested this major and was otherwise qualified was selected for this major. So I was selected to study meteorology at the NPS. The top two students earning a masters in meteorology were nominated for and accepted membership in Sigma Xi. This how I became a member of Sigma Xi.

Most students upon graduation were returned to their prior type of service. Thus, I was expecting to be sent to a squadron to fly before being sent to serve as a meteorologist. However, they were short of meteorologists, so I was sent to serve at the Fleet Weather Central/Joint Typhoon Warning Center (FWC/JTWC) on Guam. JTWC had meteorologists from both the Air Force and the Navy. After serving as a section leader (forecast duty officer) in FWC for about six months, I was sent to study an advance meteorology course at the University of Hawaii. Most of the attendees of this class were military meteorologists serving in the Pacific.

Shortly after returning to FWC/JTWC, I requested to be transferred to the JTWC side to forecast typhoons. My request was granted and I served as a typhoon forecaster for the 1962 season. Yes, I was there when Typhoon Karen went right over Guam. Karen's track was as we had forecast.

After this season I was returned to the FWC side as a forecast duty officer and departed Guam in August for Fleet Weather Center Suitland (Maryland). It was during this period that I knew I could not really return to flying - I had missed too much time away from operational flying. So I requested a change in designator from aviator to meteorologist, which was accepted.

I was selected by the commanding officer of the Naval Weather Service (who had been my commanding officer on Guam) to serve in Project FAMOS (Fleet Applications of Meteorological Observations Satellites). I became the acting officer-in-charge of this project. Our mission was to determine which information from meteorological satellites could be used operationally in the Navy, and produce reports how this was to be accomplished at our Fleet Weather centrals. The billet structure was such that a meteorologist with the rank of commander was to be the officer-in-charge. I was only a lieutenant at the time, thus I was the acting officer-in-charge until Commander Arnold reported aboard. I worked closely with the National Weather Service and NASA meteorologists.

Upon completion of three years service in Project FAMOS, I was selected to attend the University of Stockholm, in Sweden, to earn a doctor's degree in meteorology. Upon successful completion of this assignment I was ordered to be an assistant professor of meteorology at the Naval Postgraduate School in Monterey, California. My next assignment was as department head of the computer systems department of Fleet Numerical Weather Central (FNWC) in Monterey, California. After the completion of this assignment I was ordered to be the executive officer (XO) of the Naval Environmental Prediction Research Facility (NEPRF) in Monterey. When our director of research resigned, I was appointed as acting director of research, in addition to my XO duties. After we hire a new director of research, I am appointed by the commanding officer to be the project manager of the satellite-data-processing-system software development office (SSDO). Again this is cutting edge research and development.

I retired from the navy the end of July 1977.

On the first of August 1977, I opened an office in Monterey as the program manager of the Space Applications Division of Systems and Applied Sciences Corporation (SASC) for the West coast.

During June of 1989, I transitioned to being a software support/research specialist through contracts administered by the Government Services Agency (GSA) while working on site at Fleet Numerical Meteorology and Oceanography Center (FNMOC) —the new name for FNWC. I performed these duties until the end of September 1997.

This is probably more than you wanted to know, but I wanted to get across that there was no easy straight line to the research and development I performed over the years.

Harry D. Hamilton (1961)
harryhamilton1@comcast.net

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There are two sparks that I can remember from back when I was in elementary school. I grew up in a small, rural town and was an avid reader. Once I became a competent reader, I quickly read through our local library's children's books. The librarian wouldn't let me read young adult books and steered me to the nonfiction science books. I read them steadily and became very interested in science.

During this same time period, I discovered my uncle's college chemistry textbook in our attic and read it cover to cover. I was so fascinated I decided to become some type of scientist.

I now have a Ph.D. in chemical engineering and material science. My research has been in modeling and simulation, both the development of methodology and applications in various fields. I am presently a professor of computer and information sciences at Brooklyn College, CUNY.

Paula A. Whitlock (1974)
whitlock@its.brooklyn.cuny.edu

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It all began at the age of eight because a small bird landed on the railing of our summer cottage porch, 40 inches from my face, for perhaps 1½ seconds. I thereafter wanted to know everything I could about birds and the natural environment that supports them and us.

As a World War II veteran, I attended Brown University, graduating in 1949 with a major in botany and a minor in geology. I have also had a long career in the Audubon movement, in Rhode Island (1950-58) and the national office in New York City (1958-77).

Roland C. Clement (1948)
Rcc112212@aol.com

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When I was very young—11 years-old—and living in the far north of Ontario, Canada, on a radar station my father worked at, rock and roll was just starting. It was 1955 and I was, of course, interested in listening to it. My father only liked listening to classical music and pretty heavy stuff like Wagner! I could listen to the radio after he went to bed but only on the lowest level of volume.

For my birthday in September, 1956, I got a crystal radio, which I built and tried out. It worked, but not that well, so I asked my dad how to make it better. He said you need a better antenna. After doing some research I searched near the radar site for something to use. I found an old transformer with miles of fine wire on it and was able to make a very long antenna (100m). I strung it out the back of our house in the trees.

Boy, now I could hear stations like WKBW Buffalo, I think it was, and some from New York—1000 km away! I was in heaven. After that there was no doubt I would be an engineer.

Captn. Barry P. Brown (1982)
Manager, Surveillance & Reconnaissance Resource Centre, Command and Control Systems, NATO C3 Agency

Barry.Brown@nc3a.nato.int

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I have been reading science fiction since early in high school. (I have amassed a collection of over 3,000 books and am still buying more. I need a home for them.) At any rate, that sparked my interest, along with the fact that my father had a chemical engineering degree from MIT (1931). He was a textile chemist. I began studying chemical engineering at MIT in 1956, but soon decided I was more interested in food than textiles. At that time MIT had a department of food technology so I minored with them. (The department gradually phased out and disappeared several years later.) I then went to the University of Massachusetts, Amherst to get my M.S. degree in food technology. In 1961, I was married and my wife was pregnant with our first child, so I figured that it was time to get a job.

I worked for various food companies for several years before coming to the U.S. Army, Natick Labs, to work on the food irradiation program. After about 10 years in that area the Army decided to stop their program, and I then became a textile engineer for about another 10 years (under the theory that "chemical engineers can do anything.") I finally finished my working career in 1999, back in the food program studying novel ways of preserving food for the Army.

I might mention that I have had multiple sclerosis (MS) for 42 years now. I vowed early on that it would never let it be a handicap. It has not stopped me from doing anything. I used to commute to work by bicycle, a 19-mile round trip.

Joseph S. (Joe) Cohen (1977)
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The spark for me was having my interest in the natural world stimulated and cultivated by a teacher in high school that made the extra effort to get us outside to view nature and learn about its workings. He was an outstanding mentor, has followed my professional career with pride and is still a very good friend.

Roger D. Applegate (2007)
Small game coordinator, Tennessee Wildlife Resources Agency
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My spark was probably when, as a teen, I volunteered with a dance troupe to visit nursing homes and provide vaudeville/ 'old soft shoe'/ tap types of mini-shows to the residents. The stimulation / jogging of memories brought on by these shows (music, dancing, colors, sound) always transformed the sedate wheelchair occupying group into a toe tapping, hand clapping and head bobbing audience. This transformation and the time spent with these older people after our mini-shows were what convinced me I wanted to study aging.

I am now a life span developmental research psychologist who studies sensory and cognitive aging relative to health management capacity, including health literacy and medication adherence.

Katharina V. Echt (1997)
Research scientist, Atlanta VA Rehabilitation R&D Center assistant; professor, Emory University School of Medicine, Geriatrics and Gerontology
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For me, the spark came when I was seven years old. Staying at my grandmother's for part of the summer, she had in her bookcase, to entertain me and my many cousins, a series of rather thick Walt Disney's books (I don't recall the collection's name), one of which was about science and technology. The first chapter in this book, some 100 pages long, was about the quest for control of the atom and detailed the efforts of the many scientists over the centuries to understand our Universe, from the Greeks to modern times.

I was literally enthralled by all this and decided that this is what I wanted to do. I never really deviated from that path since then, and the only major decision left was to choose between photonics and fusion plasma physics (I settled on the latter in my late teens).
Xavier P. Bonnin (1997)
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My original spark was the *Book of Knowledge* in my great aunt's house, which I started reading when I was in the second grade. I began telling people that I wanted to be a bacteriologist. I didn't become a bacteriologist, though. Instead, the high school chemistry course that I took steered me into chemistry. I went on to obtain a Ph.D. in chemistry.

Just after it was awarded, I went to visit my old chemistry teacher and told him about it (this was in 1954). His reply, "What are you going to do with it? Work in a perfume factory?" Ouch! But by that time I had a very supportive even though non-scientist husband plus one of my eventual three children, and I wasn't deterred. I had a moderately successful career as an industrial researcher and then community college professor and I enjoyed every minute of it. I've been retired for ten years now, but I still keep up with *Chemical and Engineering News*, *Science* magazine and *American Scientist.*
Patricia H. (Pat) Moyer (1949)
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I was surrounded by science as a child, without any awareness of how my childhood was different from other possible childhoods. My parents were scientists, my friends' parents were scientists, virtually all the adults I knew were scientists or married to scientists. In the 1960s in Livermore, California near Lawrence Livermore National Laboratory, this was not so unusual. We were a tiny community and we were definitely not mainstream.

As Sigma Xi members all know, the scientist mentality embraces far more than one's profession—it pervades every aspect of one's life. I recall hiking in the Sierras one summer with a group of kids and our parents when we stopped to examine a sunflower growing by the side of the trail. This provoked a lively discussion of the Fibonacci Series as it related to the spirals of seeds in the heart of the flower. We kids didn't know much about the Fibonacci Series but we absorbed the magic of the concept along with the magic of the sunshine and alpine air. My father could name birds at a glance while driving, and would often pull off the side of a country road to regard a green heron or get an update on his favorite nest of burrowing owls. He could also tell you where to find garnets and how granite was formed. My mother could identify most of the wildflowers in California. She could also tell you exactly why bleach got your clothes whiter or why frying turned your hamburger meat brown and crispy. This all seemed normal to me. We

carried field glasses everywhere we went and I thought all families did.

Years later at university I was to discover how unusual and special the scientist perspective truly is. In my junior year, my house mates and I hosted a dinner party for my parents and siblings at our run-down little rental house in Santa Cruz. We had furnished the table with our best plates and silverware from the local thrift shop. The dinner was a great success, due to the advanced social skills of my non-scientist housemates, and also no doubt to my parents' amazing tolerance for novice cooking. As we were washing dishes afterward, my younger brother held up a dark blue glass serving plate and asked my mother, "Why is this plate blue?" She replied thoughtfully, "Well, it probably has cobalt added to the glass for coloration." One of my housemates gave me a shocked look. "If anyone had asked my mother that question," he said, "She would have said that it was blue to go with the dining room set." From then on, I have celebrated the scientist view of life. Yes, we are lucky!
Virginia Wilkinson (1979)
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I don't remember a particular spark. However, I do recall at the age of ten a visit to the 1939 Worlds Fair in New York, where everything I saw further solidified my interest in chemistry. My science teachers in junior high school and high school further strengthened that, as did a birthday gift of a chemistry set during my junior high school days. My mother didn't even complain, very much, when I accidentally took the paint off of the kitchen table.
Morris Tanenbaum (1950)

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I was adrift in high school, bored by English, history and other foolishness, given the lack of imagination of my teachers. But the courses in math and chemistry were terrific and challenging. To avoid studying what they called 'history' and 'literature,' I often returned to the set of 20+ volumes of the *Book of Knowledge*, which someone had given me at the age of 13. (The year was 1936). I used to pile them up beside my bed and read them late into the night.

It is important to remember that, concerning scientific discovery, the 1930s did not capture the excitement of the late 18th and the 19th century, when each scientific discovery became the most exciting event of the year, where people like Ben Franklin attracted mobs of thousands of people anxious to hear of his discoveries. Of course, there was Einstein and relativity, to be sure, but few people understood it, nor could they grasp its significance, compared to the invention of such things as the sewing machine, the telephone and the concept of electricity. By the 1930s, intellectual life centered around the automobile, the radio and the refrigerator. These things were understandable, useful and one could own them, repair them and talk about them.

As a young teen-ager in that period, I suppose what truly turned me on was a pulp magazine called *Doc Savage*. Born with superior intellectual and physical traits, his parents deepened his education in science, technology, medicine, etc., and he became a fighter against crime and injustice, a 007-type with a never-ending bag of gadgetry used to protect people under attack and to eventually capture the varmints and put them away. Of course, Tom Swift was another folk-hero of mine. He was little more than a teen-ager himself, but he had already invented video telephones and other kinds of exciting things which were useful in his adventures.

Today, barrier-breaking discoveries come along at an incredibly fast clip. They are well publicized by an increasingly competent set of science writers (and Hollywood producers), and

our schools are gradually acquiring faculty with the capacity to understand modern science and to create an exciting environment in their classrooms, at least for kids of above-average intelligence.
Paul J. Hoffman (1952)

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What got me started into science/technology/engineering was a teacher—actually three teachers; Mrs. Bryant (fourth grade), Mrs. Shaw (fifth grade) and Mrs. Bachman (sixth grade). I was in a 3rd/4th grade split classroom and Mrs. Bryant had me help the 3rd graders with their math assignments. Both Mrs. Shaw and Mrs. Bachman gave me free reign to oversee the science corner of the classroom because of my ability and interest in science. Having Sputnik launched during my sixth grade year help cement in my mind that I wanted to pursue science or engineering. I really had no guidance through high school—I just kept taking science and math classes. It wasn't until I enrolled in college that I finally decided to go into engineering, since it seemed to offer a greater potential for doing something for the world; it was the idealistic 60s after all.
Richard L. (Dick) Zollars (1974)
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My first encouragement toward becoming a scientist came from Eldon Kienholz, poultry science professor at Colorado State University. He assisted me with an undergraduate research project while getting a second B.S. (my first B.S. in microbiology was not helping me become employed, and was not quite what I thought it would be when I signed on). With his assistance and encouragement my little research project became a paper presented at the annual poultry science meeting. It was reported as an abstract: *Harwood, E. D., W. R. Renegar, and E. W. Kienholz. 1976. The effect of carbohydrate source upon folacin requirement of the chick. J. Poult. Sci. 55:2043. (Abstr.)*

Eventually this work became part of the information that led to changes in the National Research Council's publication *Nutritional Requirements for Poultry*. I had contributed to altering the recommendation for folacin in chicks from zero to eight weeks of age. I remember feeling proud and thrilled when Kienholz told me this. It was awesome to think I had done something that meaningful. He then suggested I apply for an M.S., which I did, obtaining my diploma in 1979. In the late 1980s I worked for a company that was adding software to the product line I managed. I had taken Fortran to assist with my thesis data analysis, but was quite naïve about computer programming. I made a lot of mistakes and eventually these errors cost the company a good deal of money. I was sure that computerizing the dairy industry would eventually be a big thing, so I asked the president of the company, Paul Thompson, if I could go to school and learn more. I applied to the UW-Madison for a Ph.D. in dairy science and was accepted, graduating in 1990.

My favorite publication is *American Scientist* because it continues to remind me of the scientific method, support my curiosity and make me proud to be a member of a select group who take great care in learning, communicating and concluding. I especially like Henry Petroski's articles where the case is made: without failure, little would be known—and there is always some important context (politics, funding, unknowns, etc.) to consider.

I never became a professor in the academic sense. I feel that I am accurate in calling myself a scientist because I use what I learned of the scientific method, statistical analysis and how to think about problems nearly every day. Most recently I invented and tested a method to grow

plants in cloth leading to a patent application and a potential business. Throughout the intense learning curve (I began with no formal education in plant science), to the comparison of growing methods, to the library research to find citations justifying a new approach to light spectral provision to plants, I used every speck of experience and learning that a scientist would.

I think that any student, who shows curiosity, should be shown an applied path to explore the methods of science. They may not become a scientist at a university or a company, but they will always be a scientist making contributions to knowledge and assist others with their life long learning.

Edward D. (Ed) Harwood (1990)
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If my tale is typical, the triggering events are random and reinforcement provided by adults is essential.

I was about 11 when I was given a used bicycle. I learned to ride and found that the brakes were not what I felt they should be. So I located a pair of pliers and removed the back wheel, taking the New Departure apart. A collection of parts spilled out on the driveway. I had to collect and save all the parts, and figure out how to reassemble and make it work. This took time and thought, but I did succeed and gained confidence that I could and enjoyed figuring out such problems.

A few years later the one radio our family had promoted the thought that leaves were being burned early that year. With my older brother we diagnosed the source as a burning-out transformer. A family friend helped with a soldering iron and the location to buy a replacement. We figured it out, since the alternative was no radio. Later in high school I took a class in building a radio. While others were more skilled with tools, I found that I was the only one in the class that understood why things worked. So I enrolled in the physics class, taught by a nonphysicist, who promptly put me in my place for reporting solutions to problems he had labeled as beyond us.

So when I became a college freshman I enrolled in chemistry, where for a semester we did interesting physical chemistry laboratory. The second semester entailed memorizing the formulae of various compounds, so when I asked the professor when would we be doing more like we'd been doing in the first semester and his reply was, "Oh, that's physics," I knew where I was headed. Despite being warned that I would starve to death with no job, I wound up with a Ph.D. in physics, as did my three other brothers who followed their own routes.

Elmer Eisner (1959)

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I turned to science while attending a small high school in central California, where my mother taught biology, chemistry and physics. What appealed to me most was the factual basis of science, what one might call the "truth" it offers, as opposed to mere human opinions (theories expressed without back-up evidence, and the constant appeal to authority-figures), which seemed to be so common in classical high school humanities courses. I really enjoyed the challenge of committing to memory the "facts" in the science courses I was taking, assuming (naively) that these would not be subject to future change and that they weren't just "hypotheses." I suppose there is a philosophical term– "positivism" perhaps–for this expectation that knowledge derived from scientific methods is innately superior to subjective intuition, or (worse) to theories tainted

by misunderstandings, outright ignorance, prejudice, religious dogma, xenophobia and a laundry list of other human faults.

With further scientific training and life experiences, through college and a teaching/research career, I've reached a certain sophistication about humankind's effort, over time, to understand the truth about our origins, our basic nature and the totality of our environment. The best insight I got, early on, was that scientific knowledge is itself ever advancing, changing and improving, and that what we used to think was true often turns out to have been only a theory or hypothesis, which is now proven incorrect or incomplete. I learned that this is the reason we do research, primarily to bring about change, not just to add more and more data to existing theories. I also learned that although many people accept the findings of science in these terms, the vast majority of citizens believe that "there is something more to life" than science provides. This basically is the pull of human imagination, which in effect is how our brains work to give meaning (of some kind) to our ongoing sensory experiences. Since we have the most complex and powerful brains currently existing on earth, the ability of our human imaginations to invent “reasons” or “causes” for every perception is unmatched. We may be content, for example, to accept all the laws of physics involved in airplane flight when we entrust our lives to a commercial airlines. But if we see glowing balls of light in the sky, we readily believe that they must be flying saucers manned by exotic creatures from another solar system (not simple electric discharges). Supernatural explanations are particularly attractive, because they entirely avoid scientific testing and can be expanded to cover whatever phenomena one wishes to include.

Examples of human beliefs unsupported by known scientific facts are practically endless, given the billions of existing human brains at work inventing them to satisfy this innate need. I wish now that I had had this natural human trait more on my mind, during my teaching years, as something to consciously bring forward when discussing with my students the benefits of the scientific approach to knowledge.

So the question of “what was your spark?” takes me back to my early intellectual contacts with science; and in retrospect I still think that I made the right choice of a career in science, to satisfy my own intellectual needs and predispositions. It only means that I am better positioned now to understand and value the humanities as worthy disciplines for intellectual exercise in an academic context.

Kenton L. Chambers (1952)
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For me, it was discovering science fiction and the writers like Asimov, Clark, Bradley, Bradbury, Anderson, Heinlein and Zelazny, to name a few. Many of these writers knew their science as well as how to write. I came from a farm-ranch family that lived far from town; there were few books in my home (certainly no more than five). Mom would go to town about once every two weeks; while she shopped she dropped me at the town library and it was only a small library. There was one, stand-alone book case with science fiction books. I could check-out three for two weeks—so three books at a time I worked my way through most of what they had. When I finally decided to go to college, the reading I had done (and was still doing) was what saved my butt.

Wallace D. Kleck (1960)
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I had more than one "spark," as others realized I was interested in science before I did. I enjoyed the content of my high school biology and chemistry courses, and appreciated the efforts of my chemistry teacher to teach us the metric system and how to do simple chemical calculations. I kept insisting that I was going to college to major in history and minor in modern languages, however. When I told my favorite high school history teacher that I wanted to major in history, she said that she felt I belonged in the sciences.

Upon arriving in college, I still wanted to major in history, but took chemistry as science requirement. I found that I really preferred chemistry to history, and my chemistry professor for the second semester of general chemistry was the "wow" factor in persuading me to change from the "comfort" of history to the challenges of chemistry. Not only was he one of the best lecturers I have listened to, he proved most helpful when I approached him about changing majors.

Our son Mike had a similar experience when he started college as a physics major. The teacher for his first mathematics course was so impressive that Mike started thinking that he could teach also. He graduated college with a double major in mathematics and physics and a minor in education. He is now teaching algebra, geometry and physical science in a high school in Illinois.
Carolyn P. Mayers (1965)
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The spark that motivated me initially was struck when I was eight years old and I received a Chemkraft chemistry set for Christmas. I shortly became a budding "alchemist" and began reading everything chemistry-related that I could get my hands on. My teachers included some real "jewels", particularly Mr. and Mrs. Brezhenski, my 7th grade science and mathematics teachers. All my teachers tried to make sure what I was reading was all written at a below-quantum-mechanics and pre-calculus level; but my readings were extensive and I learned a great deal of "descriptive chemistry" that most college chemistry programs never have time to teach.

At age nine, I won a local science fair competition and was invited to show my science fair project live on the local television station; but by then I was already a highly motivated, somewhat experienced and somewhat widely read chemist. During the summers of my 17th and 18th years I worked as a lab technician in the R&D department of a nearby Olin Mathieson paper mill. By the time I reached Rice University I had over nine years experience as a "boy chemist" and had conducted semi-independent polymer chemistry research in collaboration with the only chemistry professor at a small state college near my high school. All of these early influences were important and very much appreciated.

I did better in college physics than in college chemistry, mostly because physics was more mathematical (mathematics I do very well in) and less qualitative. So I could have made a career in physics or mathematics; but with that original spark at age eight, I also had learned that chemistry was much more than physics or mathematics: chemistry is fun!

I went on later as a national merit scholar to earn a bachelor's degree cum laude in chemistry from Rice University and a Ph.D. from the University of California, Berkeley, but the original spark was that Chemkraft chemistry set.
Robert L. (Bob) Horton (1972)
Senior research advisor, Completions Technology

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As a farm-reared youth, active in FFA in high school and son of a school teacher, I was interested in agriculture and education. In my sophomore year at Texas A&M I got a part-time job in the laboratory of Dr. George Kunze, a soil mineralogist, and worked in his lab until graduation. After two years in the Army, I became a graduate assistant in his laboratory. He was my principal inspiration to become a researcher, and my parents were my inspiration for getting an education beyond high school. They were also probably the main reason that I was more strongly attracted to teaching and advising students than to doing research; and I received more career recognition for the former as compared to the latter.

Murray H. Milford (1959)
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I went to a poor (though huge) inner city high school—but one that made a huge effort to get everyone to succeed in life, and that meant special college-prep courses for the top performers. My biology class did not have labs—no money. I skipped physics (a mistake) but took, and loved, chemistry. My chemistry teacher took me aside near the end of my senior year and said he knew I didn't plan to go into science, but if I would promise to consider it he would nominate me for the Bausch and Lomb science medal because he thought I had a "good mind for science" (there were at least two boys in the class who were much more deserving so I felt I really had to honor his request to consider science). Also a guidance counselor (we had four for a school of about 3000 students) went out of his way (I was not assigned to him) to encourage me not to limit my options in college—I could become whatever I wanted to become.

As a college freshman I took biology because I couldn't imagine what one did in bio lab! My life changed forever the first time I dissected a rat! How could so much specialization of structure and function come from one fertilized cell! I got hooked on questions of intercellular communications—how do cells know who they are, what they are to become, what their neighbors are doing, and how is it all organized into one functional animal?

It was too early in 1962 to effectively study development but neuroscience was just starting to discover neurotransmitters beyond acetylcholine, norepinephrine, substance P and serotonin. The rest is history - I became a Ph.D. neuroscientist working in drug discovery at two major pharmaceutical companies and then followed the biotechnology boom into recombinant protein characterization. I later moved to Sigma-Aldrich where I organize their products into product lines that are marketable to medical and life science researchers - neurosciences, cell signaling and, most recently, the bioactive nutrient explorer and the stem cell initiative are the ones I've developed or had a major input into.

While I mainly do literature "research" now, it's been rewarding to be part of that explosion of knowledge in life sciences in the past 45 years! Watson and Crick elucidated the structure of DNA just a decade before I started college and look where we are now!

Libby M. Yunger (1973)
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I raised rabbits when I was about 11 years old and sold them, dressed, to several customers in the small western Idaho town nearby, so I needed to reproduce those rabbits for a continuing supply. I started with a gray Chinchilla doe and a brown Belgian buck. This produced several color patterns, but when I mated the black female offspring to a New Zealand white buck, the variety of color patterns was astonishing. An older cousin (by two years and therefore much wiser) told me

I could predict the color patterns I would get from certain matings. I was dubious, but he told me about Mendel, who had found this out. I was then hooked on genetics, and I didn't even know the word yet. The following fall I approached my teachers with questions about how I could learn more and they were unable to help me.

I learned all I could the following year from Fruitland High School's unabridged *Webster's Dictionary* and encyclopedia, but I was hungering for more knowledge about this field until I enrolled in my first genetics class in college. I couldn't afford to buy the textbook, in the thirties, but I read the library copy from cover to cover in the first few weeks. I happily tutored several of my classmates that semester, and I found the subject matter exciting as no other subject that I had ever taken. I never tutored classmates in any other course. So I signed up for the advanced genetics course the next semester, and my infatuation with the subject continued.

After working for a year and a half in a hardware and lumber store and a grocery store to get enough money to start college, I never dreamed that I could actually spend my life doing something that was fun—and get paid for it. I so revered "scientists" as a student that it was several years after I finished my Ph.D. before I could refer to myself as a scientist. Growing up on a farm I never imagined that I could be a college or university professor as a career. It was a delightful one. My parents, although highly intelligent, had not gone beyond the eighth grade from financial necessity, but had regarded education highly and encouraged their children to continue without demanding it.

You asked about "stimulus," and it wasn't teachers and it wasn't a book I read, it was the hands-on experience of breeding and raising rabbits, observing the results and the fortuitous comments of the cousin.

Franklin E. Eldridge (1941)
Professor emeritus, animal science, University of Nebraska

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My first cousin, who I admired very much, was a mechanical engineer and a graduate of Carnegie Tech. He was 28 years older than me. I decided at a very early age that I wanted to emulate his professional career. I came close. I graduated from MIT as a physicist.

After graduation, I decided that I was happier solving short term problems than in performing long term research. Most of my career was spent in radar systems engineering analysis and radar component design.

Arnold G. Kramer (1952)
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From as early as I can remember I wanted to be an astronomer. Then on a trip from Cleveland to the south, I pestered my parents to stop at every cave in Kentucky and Tennessee. I was enamored of early cave exploration and retyped by hand an article called *Cave of the Eyeless Fish*. With my first chemistry set, I discovered how solutions could magically change color and I decided to be a chemist. My hero was Michael Faraday because he made alkali metals by electrolysis of molten salts. I built a laboratory in the basement and distressed my parents with explosions in the back yard. When the first atom bomb went off, I decided to be a nuclear physicist, but in the end I did graduate work in chemical physics at Harvard and taught physical and environmental chemistry for the next 30 years. I'm now retired but still fascinated by the pictures from the satellites and the Hubble telescope.

James N. (Jim) Butler (1955)
Emeritus professor, applied chemistry, School of Engineering and Applied Sciences, Harvard University
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I was born in Germany. At about 14 years of age I read something about three phase machinery. I asked my teacher about this and he loaned me a book on the subject. I perused this with great care, but probably didn't understand it too well. Soon later I received bound volumes of an engineering journal from a family friend and read lots of articles about power stations and their construction and initial tests, all from the years before World War I. I read those with great interest. In 1938, my family emigrated to the U.S. and I worked on the family farm. In high school I did drawings of a three cylinder steam engine just for the fun of it. After a year of working in a farm implement store, I finally had enough money to enter the University of Illinois. When I was asked to name a major, all I could think of was mechanical engineering. Later that first semester (1941) a room mate who was registered in engineering physics made me realize that that was what I wanted to do. I graduated in 1947, after military service, and found that I was better qualified to do electronics, at ITT, than electrical engineers. Later I got into infrared sensors via designing circuits to test lead sulfide detectors. Much later, I worked at The Aerospace Corporation in infrared detection of ballistic missiles.
Paul W. Shadle (1947)

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I attribute my interest in science and engineering from two primary factors: 1) growing up on a self-sufficient farm and; 2) family encouragement.

The farm I grew up on was 40 miles to the nearest mechanic/craftsman or parts supply. Consequently, my dad had to keep everything running and therefore had most of the tools to work on anything mechanical and most electrical. He had the skills to use those tools and he taught me those skills from the earliest days. My having easy access to those tools and the problems they addressed gave me ample opportunity to experiment and learn on my own as well. This environment, problems and tools associated with wonderful devices, was key to nurturing my interest in how things work.

The second factor was family encouragement. One of my aunts was a physicist at Sandia National Labs in Albuquerque from about 1949 to 1978. She was always encouraging my technical interests and was a great source of real information about the field in general. In addition, my parents were continually encouraging my interests in science and engineering. They made sure I had the usual erector set, microscope set and chemistry set to occupy me growing up. They also encouraged me to excel in school, particularly in math and science.

With this environment, I never doubted from the time I was in early grade school that I would go into some field of science and engineering. It became for me merely a matter of deciding which field to choose.
James P. (Jim) Shipley, Jr. (1972)
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Career choices start fairly early in one's life, and may undergo a number of changes, even in mid-career. In my own case, I had thought of a career in science since elementary school. Unlike many of my chemist colleagues, I was not inspired to go into a career in chemistry by my high school chemistry teacher. Instead, my plans became more definite when my 9th grade Civics class was assigned to research a career we'd like to pursue and make a brief presentation on it. I was faced with a tough choice: chemistry or geology, my two primary potential career loves. Even though I had a basement laboratory, I decided that it would be easier to be a professional chemist and an amateur geologist (i.e., continue being a rockhound) rather than the opposite. The one nagging doubt was that I predicted it would be more likely that a geologist would go to the moon than it would be for a chemist (aviation and rocketry were also my avid interests).

Sputnik was launched at the beginning of my senior year but I persevered in my decision to pursue an education in chemistry. I was assisted in a choice of specialty within chemistry by my classes and professors as well as by my mentor—and employer—as a college junior and senior, doing graduate level organic synthesis. After my Ph.D., working on a number of organic synthesis projects, I continued in that vein in industry. All of my previous mentors—undergraduate, summer lab job, graduate—were very information conscious. I loved lab work, but I loved information research almost as much. So when it came time to shift gears, I jumped at the chance to do chemical information research and I've been doing it ever since.

Robert E. (Bob) Buntrock (1965)
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I was born in 1935, in Germany, and my father was a career officer in the German Army. Soon our lives turned into the World War II dilemma in our home at Koenigsberg, East Prussia, now Kaliningrad, Russia. We became refugees in 1944, ending up near Dresden, Saxony at the end of the War. School was intermittent during those days, as survival became the first priority. My public school teacher recommended me to the now communist high school administration, for admission. There was a three step educational level of education in Germany: public school until age 14; middle school until age 16; and high school until age 19, with eligibility to enter university.

Due to my family background, I was denied entry into high school, so I continued at a slower learning pace in public school. Two years later, we managed to escape to West Germany, and I was admitted to high school there. I lost a year due to my "holes" in math, science and English. In 1951 we immigrated to Chile to join relatives and I attended a German high school in Santiago. All classes, except German, were in Spanish. We immigrants were given 18 months to pass a comprehensive exam of all subjects taught until then in high school. I failed all classes, except the science subjects—math, physics and chemistry—mostly due to my inability to speak and write Spanish well enough to pass the junior grade in high school.

A second chance to make up for the deficiencies up to the junior year was given, if I passed the five courses needed to qualify to continue school, after the summer vacations. I passed all courses, after intensive tutoring by a teacher, and only lost one year.

My main interest in high school was in chemistry, sparked by a good teacher.

When I graduated two years later, an opportunity presented itself to go to Ontario, Canada, to work on a farm and then enter the Ontario Agricultural College, part of the University of Toronto then, and now the University of Guelph. After I graduated one of my professors encouraged me to

take a masters in agronomy and then to go on to Oregon State University for my Ph.D., with a specialization in crop physiology.

All my professional life has been sparked by the question, why does a plant do what it does? Biochemistry, botany and plant physiology were the subjects of most interest, which helped me during my 35 years in the agricultural products industry, finally as a director of R&D with BASF Agricultural Products, retiring in 1998.
Anon (1964)

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I hated math and science while I was growing up, and wanted nothing at all to do with it. I loved language and wanted to be a linguist. Since my father wouldn't pay for me to go to university if I was going to study language (he quite intelligently thought it was a waste of time and money to get a degree in linguistics, since there were few job opportunities), I enlisted in the Army. The Army sent me through 1½ years of the Defense Language Institute studying Russian. That allowed me to get enough credits that I could apply for an in-service ROTC scholarship. So I did, and won the scholarship. ROTC allowed me to finish my first degree, a Bachelor of Arts in Slavic Languages & Literature.

Then the Army, in its great wisdom, sent me to become a signal officer! I didn't have a clue as to what a volt, amp or electromagnetic field was. Never-the-less, I spent the next four years in West Germany working with West Point engineers, and generally being clueless about the then-advanced communications technology I was working with.

But I could see that technology created a ***far*** better set of opportunities than knowledge of language did! So, at age 26, when I got out of the service, I started all over again, at high school trig, and worked my way up to get a degree in electrical engineering. I fell in love with math along the way. Now I have a Ph.D. in systems engineering.

When I was going through engineering training, I'd take six months off at a time to work out at sea as a Russian translator. It was a nice break from engineering training to go out and drink all the time (with the Russians, drinking was part of the job). I also met my husband when I was working as a radio operator at the South Pole Station in Antarctica. I always say I had to go to the ends of the earth to meet that man.

My most recent book: *Evil Genes: Why Rome Fell, Hitler Rose, Enron Failed, and My Sister Stole My Mother's Boyfriend*, (which Harvard's Steven Pinker called "fascinating"), is testament to the creativity that can result from mixing the apples and oranges that are science and humanities.

I wouldn't have done it any other way. I love having a background that allows me to see both the science and the humanities side of life.
Barbara A. Oakley (2008)
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Being a scientist for me was almost inevitable. Science caught my interest as soon as I could read. We were taken to our school library in 1st grade and encouraged to start checking out books. I was reading Dr. Seuss along with Roy A Gallant's beautifully illustrated books *Exploring the Planets* and *Exploring the Universe*. I was given a collection of science books for kids; *All about*

rocks, A*ll about the sea*, *All about inventions*, *All about the mind*. I read them all. When I was in 2nd grade, I told a girl that the world would end someday when our sun burned out and became a red giant and engulfed the earth (Roy Gallant's book). My friend misheard me. "The world will end Sunday?" I already had enough scientific authority behind me that she was willing to consider it.

So I knew from that age that I would be a scientist, though not in what field.

In health class in 5th grade, our teacher polled us on what we wanted to be when we grew up. A very literate friend of mine took an early turn to answer. "I'd like to be an astrophysicist". That gave me about 10 kids to think. When it got to me, I said I wanted to be an astrophysicist too. It seemed to fit my interest, and was a great word. After that, it only was a matter of taking physics and majoring in physics, being distracted for 15 years by the existential pleasures of engineering in Silicon Valley, and now, at 50, I'm a physics professor. Most of my colleagues are in fact astrophysicists, so I know what it is now. I actually do atmospheric physics by way of solid state physics.

My early inclinations could have been derailed if I had not had a really great physics and calculus teacher in high school, but I was fortunate. Really, you got to "hook 'em young!"
Richard G. Sonnenfeld (1981)
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On April 25, 2008, I was asked to spend some time with a first grade class at a charter school. It was a rainy day. The task was to discuss what first grade was like to me. That began in 1919 in a small town in North Dakota. I had mentioned to the teacher that I was an engineer interested in water problems. The class talked about such things as worms on the sidewalks, where the water went and playing in mud. Then the teacher asked whether anything I had done in first grade influenced my life work! I told about how playing in mud in the alley probably had done just that. Wagon wheels were just the right width and sunk to the right depth to make beautiful canals. I manipulated these to guide the water; I built dams and reservoirs; and I sailed bits of wood through these channels. A few years later, 4th or 5th grade, I lay on my back on the dry prairie and watched the clouds sail by overhead. Clearly, we needed my canals which might get water from the Missouri River, which I thought was a reasonable distance to the southwest, and then the prairie would be watered and ships would come to our town. (I didn't mention that after Oahe Dam had been built backing up the river into North Dakota, the State's congressional members tried to get the Corps of Engineers to build just such a canal—they didn't have enough claim to "pork", though.)

I still go to my office at the St. Anthony Falls Laboratory on Wednesdays, participate in seminars, but do no original work. I was an almost daily tennis player until I slipped while fording the creek behind my condo four years ago, injuring my back and tearing an Achilles tendon.
Edward Silberman (1957)
Professor emeritus, University of Minnesota

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I had no intentions of being a scientist when I enrolled at Dickinson College, in Carlisle, Pennsylvania; I was going to study Russian and be secretary of state one day. I enrolled in a geology class only to fill a distribution requirement, and one sunny afternoon I found myself at

the top of North Mountain looking out at the Great Valley and I thought, all the Russian majors are inside conjugating verbs—I'd better switch to geology! Dickinson has an amazing department, with lots of field trips and wonderful professors, who encouraged me to go on to graduate school. I finished with a geology major and Russian minor, and have never regretted it for a minute. Looking back, though, lots of my childhood was spent at a local nature center, walking through woods and fields with my mom, and attending summer camp there canoeing, identifying trees and slopping through swamps, so maybe my mom and those naturalists and counselors were as important to my geology career as my professors. Maybe I was bound to be a geologist all along, and just didn't realize it until college!

Susan Herrgesell Zimmerman (2003)
Postdoctoral researcher, Center for Accelerator Mass Spectrometry
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My generation was significantly influenced by the Sputnik launches by the then Soviet Union in the late 50s and early 60s. I, like many, assumed that I would follow a path of science or engineering, but it was not until I took chemistry in high school that I decided on pursuing it as a career. I had a chemistry teacher who made the subject and the classes so interesting that I thought it would be a good area to study. Then my older brother sat me down and told me that I needed to find out more about working in the field of chemistry through things such as trade journals and corporate issues and opportunities. I finished university as a chemistry major but was unsure about what to do next. My professors pushed graduate school and that was where I ended up. I was blessed to have a terrific advisor and after a post doc ended up in a position for 35 years before retiring in 2004.

Paul D. Fleischauer (1968)
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The spark? A considerable curiosity about many things has been with me as long as I can remember. My father's nickname for me was "the great experimenter." I had a strong interest in machinery, especially cars, trucks, tractors, orchard sprayers and dusters, earth moving equipment, airplanes, trains and ships. I learned to drive at age ten. My father was both an engineer and an orchardist and during my childhood we lived in a small, rural town in Massachusetts, in Mexico and, for a short time, in the Washington, D.C. area during the early part of World War II, where he worked for a time with the War Production Board. I watched the Pentagon being built, spent a lot of time at the Smithsonian and during part of the summer worked as migrant farm worker in rural Virginia.

In the bad old days one could buy chemistry sets that had "dangerous chemicals" in them, so it was great fun to concoct explosives, stink bombs and what have you. The Fourth of July afforded many opportunities for my brother and me to experiment with cannons that would fire crab apples, and catapults that would propel big firecrackers with the fuses lit up into the air and so on.

My last two years of high school were spent in the small town of my birth and there was a total of 65 students in the four year school. My chemistry teacher was a home economics teacher and she didn't let us go into the lab the whole year. We learned the names of some elements. My physics teacher was a different home economics teacher and I got to do one experiment, in the cafeteria. I measured the heat capacity of a rock. At our classes' 50th high school reunion, the salutatorian and I talked about the most important class we took in high school and she and I agreed that it

was typing. The valedictorian wasn't there so we didn't know what she thought. The salutatorian majored in biology in college and when she went to the principal of the high school, where her five kids would all eventually attend, to complain about the quality of the biology being taught, he invited her to teach biology, so she did.

So what was the spark? Parents who read to us and didn't set the limits too close. Living on a farm that was partly forest, with plenty of room to roam and observe. A father who came home from work with an unabridged Webster's dictionary under his arm and announced, "This is a dictionary. Use it." A teacher of the 3rd and 4th grade of an international school in a Mexican mining town who observed that I rushed through the assignment she gave the 3rd graders so I could sit near the 4th graders' side of the room and pick up long division on the sly (or so I thought). When I returned the next fall for fourth grade, she told me, "Go to the fifth grade!" A sixth grade teacher back in Massachusetts, who opened up the world to us by way of geography and drilled us mercilessly on vocabulary and spelling.

I feel sorry for kids today who live in cities and suburbs, over protected and scheduled by anxious parents. It must be very stultifying.

David W. Emerson (1956)
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My very earliest memories, memories that preceded my fourth birthday, are often about observing. I have read that according to development psychologists claims of memory before the age of six or so are not valid, that such "memories" are merely part of family lore. But my memories are such that no one else would have been privy to them - they were in my head and my head alone. One memory has to do with my fascination with little red thrips that fell out of a weeping willow tree in a park where my mother took me when I was a toddler. I would crawl in the grass and look intently on those fascinating little creatures. Another memory has to do with my discovery that when I pressed my nose on the window pane I could create a fog with my breath on which I could draw pictures. This was when I was about three years old.

Memories such as these make me think that scientific curiosity was part of my nature from infancy. Later in life, when I was in high school, I spent many hours in the tall grass of an open space close to my home collecting insects—butterflies, beetles, etc.—which I tried to categorize as to genus and species. I mounted some of my most treasured specimens. And I loved books like *Rats, Lice and History* and *Microbe Hunters*, and biographies of the great and famous, such as Marie Curie and Louis Pasteur.

At my high school in San Francisco, there were a number of after school clubs led by our teachers, including chemistry, astronomy, German, Italian and Spanish. Students were free to join clubs that met their interests for fun and for intellectual enrichment. Among those that I joined was the biology club. One afternoon a woman scientist, a bacteriologist, came to our meeting and told us about her work. I was entranced, enchanted. There was a world of opportunity waiting for me. I had long realized that I wanted somehow to make science my life work, and now I knew that my dream could come true. In those days, before World War II, no one suggested to me that being a woman would be a deterrent in pursuing a career in science. In fact, I was encouraged by my teachers and by the principal of my high school, himself a naturalist. And I persevered,

studied biochemistry bacteriology and chemistry and grew up to become a professor at my alma matter, the University of California at Berkeley.

Angela C. Little (1963)
Professor emerita, University of California, Berkeley
aclittle@uclink.berkeley.edu

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It seems like I always had an interest in science, but a significant factor was my 5th grade teacher, Mrs. Nell Jacobs, whose classroom was filled with all kinds of interesting "stuff"–rocks, hornet's nest, plants, posters, aquariums and insect cocoons. Her science classes were interesting and supported by this "stuff". I also had a great science and math teacher in high school, Mrs. Mary Jarrell, whose enthusiasm and knowledge for her subject kept me interested. I am SURE that a teacher showing an interest in science and communicating it to children at an early age can have a major impact.

Linda S. Wilson (1991)
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Because my mother had a degree in chemistry (though she didn't make a living from it) I always assumed I would like science. My first introduction was about as bad as it could get: my 9th grade general science course was taught by one of the boys' coaches, who knew zip about science and whose forte was prowling the hallways with a big paddle. He would assign a chapter for us to study in the book and then do his crossword puzzles for the remainder of the class. He gave quizzes with questions like, "What would Archimedes do if he were immersed in mercury?" Smart answers drew an F. Another example—he passed out textbooks, then insisted that they have book covers (remember those?) by the next day or we would fail. So, a test question: What is the color of your textbook? Right! When my and another mother spoke to the principal about our dismal class, principal told coach (everyone was afraid of him, after all, including principal) whereupon dear coach punished the entire class and told them whose fault it was. I was 13.

Surprisingly, I wasn't poisoned, though I can't imagine why. Credit the power of science. Or simple get-evens. And my wonderful mother who insisted that science was magical. All was amended in tenth grade biology. My teacher, Robert DeWitt Ivey, was absolutely the best teacher ever. For starters, he was 6'7" and VERY good looking. Better yet, he grew up in the Florida Everglades and all his lectures were peppered with wonderful personal stories that brought to life everything we studied, down to the tiniest organism. He was a formidable artist (he learned by hanging over the shoulder of the man who did the drawings in the *Peterson Field Guide to Mammals of North America*.) He drew elaborate ecosystems on the board in multi-color. We were taught how to take proper notes and did little with the textbook. Creating my biology notebook really set me up for college. Though Ivey never completed his doctorate at Florida (one of those fallings-out that happen) he was engaged in real research (small mammal and fish population studies) that he was publishing in journals, and many of us helped with the field work. Because neither he, the school, nor our parents had any money, all our traps and materials were home made. We scrounged sheet metal in the form of gallon cans from trash bins, bent it with a brake built in the school shop, wound our own springs. We learned—really learned—ecology (though it didn't go by a name in the 1950s) and the interconnectedness of ecosystems, learned to see so many dimensions—the tracks of a field mouse crossing the trail, the birds in the trees, which plants grew where, etc.

I would have been very happy to pursue biology, except for two filmstrips that Ivey showed us: *Our Mr. Sun* and *The Strange Case of the Cosmic Rays*, both created by Bell Labs. I was smitten. I now have a doctorate in physics. The high school physics teacher was again a real dud, but I was beyond discouraging and had been taught by Ivey how to learn on my own.

So beyond just teaching me some great biology, DeWitt Ivey taught me to see, how to take notes, how to create the tools I need from whatever materials I have at hand. Most importantly, he taught me how to think and to learn, to teach myself whatever it is I want to know. I think it all starts with the stories, giving context to the material, a reason for spending one's mental energy on it.

Jacqueline H. (Jackie) Ericksen (1967)
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My parents gave me Gilbert chemistry sets every Christmas when I was young. My brother was an engineer. In junior high there was a career day asking, what do you want to be? A chemical engineer was my answer and here I am, a Ph.D. Chem.E. Not so much a spark as an environment.

Thomas R. (Tom) Carter (1968)
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I was an only child to "older" parents (father 38, mother 36) in 1934, near the end of the depression and the beginning of World War II. I was a poor student in school as there was so much else out there rather than learning proper spelling or what odd things happen when 14 meets 3 in a multiplication. As a solitary soul (except for one great and good friend I remain in close contact with after all these years) I poked through the library reading what looked interesting. Geology books with nice pictures were great for a seven-year-old. The moment of discovery was realizing that my grandfather’s farm sat atop a Devonian formation complete with a reef of crynoids and trilobites. A revelation at eight of book and practice. Then came H. A. Rey's astronomy book, with the stars picked out in stick figures. The light filled skies of Louisville were a help as they limited the number of stars to be seen. There was lots of time spent with Rey’s book, a planisphere and the garden at night when I should have been studying math.

I bought a three inch objective lens of three foot focal length from a pulp magazine (Army surplus) in 1947. My father looked at my drawings and with a section of drain pipe, some strap iron, ash poles, carriage and stove bolts made an altazimuth telescope. I put the objective lens into some cardboard tube and made a simple eyepiece from stuff thrown into the kit and toilet paper rolls. We looked at the rings of Saturn and the moons of Jupiter that evening. This was only a little less habit forming than chocolate, whiskey and cigarettes!

My good friend, Lucien Beckner, curator of the Louisville Free Public Library Museum helped me focus on the composition of things; the chemistry of nature. I learned blow pipe mineral analysis from him and spent the next summer testing every rock I could find.

Then came Science Fiction!!! That was the real narcotic. I wanted to go to those strange places, some of which I had seen through my telescope (your first view of M31 will leave you never the same).

I started university at 16 on a Ford Foundation Scholarship. Mother saw the announcement in the papers that the first round of tests were closed but the second was being given. I passed the

second round (always good at tests, even poorly prepared) and just got in. Good bye senior year of high school. I looked about 12 on the campus and felt about ten. We did a round of science departments listening to people discuss their fields. Chemistry was it!

I got my B.S. in 1955 at the University of Louisville at 19. My astronomy interests were sustained by Prof. Walter L. Moor (who despaired of teaching me calculus). He also taught me how to run a lathe and take notes, and gave me the use of the Miller telescope at University of Louisville. I started a Ph.D. program in analytical chemistry with Prof. John P. Phillips. I had a bit of a burn out in 1957, and left with an M.S. and a VERY long thesis, to teach chemistry for a year at the University of Georgia. Prof. Scott (head of chemistry) was the soul of understanding and patience for this Yankee child (22) instructor. Prof. Whitehead (analytical chair) was a continued support.

I applied to MIT before my year teaching at Georgia was up, and was accepted for reasons best known to Prof. David Hume of the analytical chemistry department there. MIT was roughly the center of the universe. I dove into geology, astronomy and chemistry and found knowledge exploding; the Mid Atlantic ridge and plate tectonics had just been discovered, quasi stellar objects decorated the sky and the chromatographys and mass and magnetic resonance spectrometers were being born. I took up with Prof. Lockhart Burgess Rogers (Buck Rogers back to scifi!) with a project I had worked on for three years, differential thermal analysis of organic materials. He had been looking for someone interested in the same for five years. It worked. I got my Ph.D. in 1961, and have never looked back.

I have supported my science with publications and investigations and my science has supported me. QED. I have given it my youngest son, Geoffrey Alden Barrall, Ph.D. Berkeley, P.Chem.
Edward M. Barrall II (1955)
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"Spark" is an interesting choice of words! For me, it was a class project to build a quasi-working model of a volcano. Just the eruptive phase, naturally. I'm sure you are smiling, already, knowing where this story is headed. Well, my best friend and I put our second-grade heads together and identified a little mixture that included vinegar and baking soda to provide a foamy eruption. After moderate success in the classroom we relocated to her basement. We spent the next few afternoons with the ping-pong table turned upside down, providing the base for our growing paper maché volcano model. We then upgraded the additive components, poured them down the throat of the volcano and lit the concoction. Between the wood of the table, the paper of the volcano wall and the solution, let's just say that matches were not in our future for a long time to come.
Alison T. Stenger (2003)
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I grew up in Tucson, Arizona on a 22-acre piece of property, nearly all of which was natural desert. One of my favorite activities was to pick up pieces of milky white quartz, which were common in this area. Soon I was picking up pretty rocks of all colors, and by fourth grade in elementary school, I was interested in learning names of rocks and minerals.

The place where I lived also allowed me to observe geologic processes (though I didn't know the word "geology" at the time). After a rain, I remember walking over our flooded lower land,

feeling the slick clay between my toes. I also discovered wet sand at depth in a desert wash, even though the surface had dried. An elementary science text had a full-page picture of the globe to begin its chapter on "The Earth." That picture seemed almost magical to me.

When I was 11, my mother said, "You're so interested in rocks. Why don't you think about becoming a geologist?" The more I read about geology, the more interested I became. By the time I was in junior high school, I had decided to study geology. I never changed my mind. I was lucky enough to land a job at the U.S. Geological Survey after I finished school.
Gretchen Luepke Bynum (1978)
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There were several sparks. First, I remember quite vividly when I was 10-12 years old taking the subway from the Bronx, New York by myself to spend each Saturday morning at the New York Museum of Natural History, which by the way I still enjoy. I was enchanted by the exhibits of the whales and dinosaurs, animals that still bemuse me. No thought then of being a scientist, although the Buck Rogers comic strips stirred my imagination and I did want to zoom around the universe.

Secondly, I really was stimulated by my high school biology teacher, Dr. Paul Brandwein (Forest Hills High School), and without really thinking too far ahead decided to major in biology as an undergraduate. I enjoyed the courses in that subject as well as chemistry, but graduated from college not really knowing what to do with my life. This was the time of the Korean War and the government made up my mind for me, classifying me 1A in the draft. This induced me to go to the Navy's Officers Candidate School in Newport, Rhode Island, since I really had an aversion to being in the Army in the mud of Korea. Shortly after receiving my commission as an ensign, I was married to the woman I had known since I was 16, assigned to an aircraft carrier in the pacific for almost three years, had our first son, and was reassigned to teach naval science at the New York Maritime Academy in New York City. I found that job quite pedestrian, so decided to go to New York University (NYU) night school to complete an M.S. degree, having amassed about a years worth of credits towards that degree several years previously. This was NYU uptown and a campus long gone.

My first course was cell biology, taught by a young assistant professor my age (25), Paul R. Gross. It was as if a light was turned on, but it was I who was turned on by Paul who suggested that I do a research project with him for the M.S. degree. I quickly accepted, working nights and weekends, and Paul taught me the joys of science as well as how to plot kinetic data. That was the third spark! Our work was published in the *Annals* of the New York Academy of Sciences. I was hooked by the work, the field of study and by Paul, who sat majestically behind his desk smoking his pipe, teaching and doing research, and they paid him for that. Paul later became an internationally recognized developmental biologist and president of the Woods Hole Biological Laboratory.

That was the major spark, perhaps the volcanic eruption that made up my mind to go to graduate school for my doctorate at Cornell. I have never regretted this decision, serving two great universities over more than 50 years, Northwestern and the University of North Carolina at Chapel Hill. In my opinion there can be no finer life than influencing the minds of young adults and contributing to the planet's body of knowledge which continues to grow. Two of my three children are academicians, perhaps because they grew up seeing their dad so involved in his work, but always knowing that his family came first. I still can't believe that those universities paid me for having the greatest life I could ever imagine.

At 79 years of age I continue to do research but do miss the interactions with undergraduate and graduate students. I guess that all good things must end at some point, although at present I am still so very excited about the strides being made in the life sciences and the great work conducted by my former graduate students and postdoctoral fellows.

Lawrence I. Gilbert (1956)
William Rand Kenan, Jr. professor emeritus, biology, University of North Carolina at Chapel Hill
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I remember very well what made me want to be a scientist. When I was about 12, I read *Microbe Hunters* by Paul De Kruif. I was so inspired that I decided then to be a scientist of some kind, although it took me a while to decide what kind of scientist. I've occasionally read biographies of scientists who mentioned that book as inspiring them. I should have kept track of their names. I haven't looked at the book in many years, and don't know whether it would seem as inspiring to children and teenagers today.

Juliet P. Shaffer (1953)
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I had a great biology teacher in high school. He never emphasized memorization of facts. He wanted us to know the basics, but most of the time we spent trying to think. Early on it was drawing, such as cross sections of a fish when you are given a longitudinal view. We did a lot of lab experiments explaining how things worked and what and how we were able to measure. I thought that science would bring me to understand the basics.

Anna M. Senczuk (2002),
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The failure of religious teachings to hold up as an explanation for the world necessitated finding an alternative world view.

Manfred Luttinger (1984)
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I was always in to reading. I read every single book on astronomy in Virginia's Reston Regional Library when I was growing up, but I think the book that fascinated me the most was the book, *Joe Kaufman's Big Book About the Human Body*. It was a huge purple book, with descriptions of organ systems, etc., and it just enthralled me: Why does the body work the way it does? How do the organs work? Are livers really purple? I thought they were because that's how it was colored in the book (I think); in fact, until I saw a real one in medical school, I knew no better. It opened up an avenue of inquiry for me, leading me to more and more readings about the body, and has led to a career in medicine (pediatrics, specifically). Also, the idea of wondering *why* things are the way they are has led to a career in research, which will combine with my medical work to form some sort of academic pediatric career path in a few years, after residency. I was always that kid who asked "why?", but I actually followed it up by looking it up. And that's where these books came into play.

Animesh (Aashoo) Tandon (2003)
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I always hear stories of how scientists got their first interest through some romantic route. My interest grew out of "sparks." At the age of 12, a friend and I became fascinated by fireworks and started to experiment with various pyrotechnics we could launch atop model rockets that we would build from hobby store Estes Rocket kits. After some success with that we found a local plastics molding company was disposing of some rigid thickwall tubing in 8 ft lengths. Using CO2 cartridges, we made a gas-pressure launcher that could send a payload up about 150 feet. We also found we could make "grenades" from perchlorate and fine metal powder, launch them to land 100 feet away, blasting a crater. My friend went on to play high school and college football and became an insurance agent. I was intrigued by the chemistry of explosives, took high school chemistry, got a B.S. in chemistry at the University of Illinois, and a Ph.D. in organic chemistry at Oregon.

James E. (Jim) Nottke (1986)
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Born in 1939, I emerged from the unconsciousness of infancy in 1943. It was a world so different from today's, that it might have been on another planet. The only way I know that it was not is from going back to Philadelphia and seeing that some of the landmarks still endure.

It was an asphalt jungle, to be sure, but somehow civilized and orderly, unlike many urban areas these days. I enjoyed walking through Black Oak Park, one square block in the neighborhood that was trees and paths rather than pavement and rectangular buildings. When I eventually encountered the untamed wilderness to be found in nearby suburban areas, it was a delightful experience.

So it was that I started a lifelong avocation of observing things. In school I didn't so much learn by listening to the teachers as from observing them. They had quite a challenge, since some of the kids were quick learners and others were not. Worse still, some of their students were attentive and well behaved and others were not. Sometimes school became interesting.

Obviously, I was one of the quicker learners, or I would not have had the luxury of observing. So I stumbled through the ELHI system with good grades and few, if any, disciplinary incidents. A lot of my education, especially in the sciences, came from my own reading and experimenting. I indulged in a number of hobbies that were technical in nature, including stamp and coin collecting, boy chemist, transit and railroad enthusiast and photography.

During my high school years I decided that transit engineering would be a stimulating career and also my ticket out of the working class. My concept was what is now called "light rail." I began to plan to go to a local engineering school and started saving my pennies to pay for it. Then fate intervened in a bizarre fashion. At my high school was a guidance counselor whose special interest was recruiting boys for Wesleyan University, a liberal arts college in Middletown, Connecticut.

So off I went to Middletown with a generous scholarship and plans to participate in a 3-2 plan that granted two degrees, one in liberal arts and the second in engineering. It took me a few weeks to catch up with the preppies and the guys from the Bronx High School of Science, but after that I

was holding my own academically. But I was bored and a non-participant in the fraternity oriented social life and not enamored of the dingy Middletown environment. Perhaps unwisely, I dropped out of the 3-2 plan and decided to go for one degree in four years. And that I achieved, with a Phi Beta Kappa key and a Sigma Xi associate membership, no less. But I was glad that was over.

My research career began mostly by accident, as I eventually took a job as a mathematician at the Army Map Service. My assignment was to move an obsolete artificial satellite orbit program from an obsolete computer (Univac I) to a modern one (Honeywell H800). Eventually I did that and went on to try to replace it with a numerical integration program. I had to learn something about celestial mechanics, computer programming and numerical analysis, but it was a lot more fun than academics. Several short courses were quite helpful.

Later I moved to the Coast and Geodetic Survey, where I worked on various problems in satellite and physical geodesy. I began publishing and eventually placed an article in *American Scientist*.

Eventually I left the civil service and have been doing work in forecasting and dynamic systems modeling. Meanwhile, the light rail revival began in 1975 and has proceeded, though not without setbacks. My career plan has been extremely successfully, even though I never participated in it myself.

F. Foster Morrison (1961)
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I was always interested in things technical (chemistry sets, erector sets, building our own “cars”). However, my first real spark came from the Indian Guides, a father and son organization later affiliated with the YMCA. Each year our tribe took on study of some subject, and one year it was radio. That hooked me! I built amplifiers and then went on to get an amateur license in 1938. If my mother had known how dangerous that homebrew equipment in the kitchen pantry was, it might have ended there! I still have a license 70 years later.

A second spark came from my brother, who studied mechanical engineering at Washington University (St. Louis) and was working for GE while I was in high school. (Incidentally, until his death last year we were the only brother pair members of the National Academy of Engineering (NAE).)

The third spark came when I graduated from high school in 1940. I had a job scheduled at a bank in St. Louis, but while we were on stage for commencement I received a telegram from RCA. I was a winner of the RCA opportunity scholarship! This involved 11 of us going to RCA plants in New Jersey and New York, writing up daily reports graded by the people we had visited and getting a scholarship. Their selection was good—at least four of the 11 later became members of the NAE. With that, I attended Washington University, getting a B.S.E.E .in 1943, under the wartime accelerated program.

I then spent a year at RCA and two years in the Navy as a radar and communication officer, returning to graduate school at Cornell, where I eventually got a Ph.D. in radio wave propagation. After that I worked four years for Sandia Corporation in radar, until the University of New Mexico gambled on this youngster and made me chair of the electrical engineering department. After hiring 15 faculty members I got tired of “baby sitting” them and moved to the University of

Kansas as a distinguished professor. Although I retired from Kansas in 1994, I continued research projects until 2004, and now go in one day a week to help with other people's projects. In my days at Kansas, I started the remote sensing lab and was involved with every radar in space—except altimeters—until the late 1990s.

I've had a very satisfying career, and wouldn't regret a day of it.
Richard K. (Dick) Moore (1943)
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My 8th grade science teacher was an outstanding teacher who made his lectures and lab demonstrations relevant to situations and events I could relate to, such as weather, light, color, sound, heat, cold, pressure, vacuum, friction and surface tension.

Edward Gipstein (1961)
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My spark was an article in *Time* magazine—based on a quick Google search I think the article was published in the February 13, 1950 issue. I was 11 years old at the time. The cover photo was a picture of the first H-Bomb explosion. It was not the "fury" of the H-Bomb that caught my eye—it was, rather, the assertion that harnessing the power of hydrogen fusion would provide the world with limitless power "forever".

I asked my dad what one would have to do to participate in that marvelous quest. His answer was simple and straightforward; "You get a Ph.D. in nuclear physics," he said.

I was able to follow through up to the Ph.D. in physics, although the demands of the time led me, following a brief and formative but ultimately unsatisfying sojourn in nuclear device testing, to specialize in electronics, which my classmates prior to that time would find quite astonishing.

In the end, I was able to contribute to that quest only peripherally, by participating in the semiconductor and computer technology infrastructure. That quest remains at most a dream today—it seems that economical fusion power has been 30 years away for the past half-century and more.
Burnell G. (Burnie) West (1960)
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Shortly before Pearl Harbor I became interested in U.S. military aircraft because of the war in Europe and decided that I wanted to become an aeronautical engineer. That was my goal until I studied chemistry in my senior year of high school. Two months of classes with an extraordinary teacher convinced me that chemical engineering was the field for me, and I have never turned back.
Robert S. Miller (1954)
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The “spark” for me was a Gilbert chemistry set, which I requested and got at age six. I began to experiment with chemistry in our kitchen and became entranced with the science, deciding then that I wanted to be a chemist. I began to read and collect “chemicals” and equipment wherever I could. My decision to be a chemist never wavered throughout my education. I wonder now whether a child would ever have access to this freedom to experiment with our current penchant to be so hypercautious. Even our careless use of benzene solvents in the college chemistry lab is now proscribed. And what student today would know of chromic acid cleaning solution that was the mainstay of the analytical lab? But today's chemist has access to truly marvelous instruments to advance the science.

J. Kenneth (Ken) Poggenburg (1961)
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Model making and mathematics propelled me into engineering. I cannot remember a day when I was not curious about how things worked. As I made model boats, model airplanes and model forts of the wild, wild West, I would wonder how they worked. By 10 years old, I was the wizard of the single-edged razor blade in crafting balsa wood into all kinds of creations. If a request for a project was announced by my school teacher, watch out because I would be charging to the front of the line.

I also remember being intrigued by mathematics. I remember being curious as to why math work the way it does. Later in high school I focused on how to derive identities and operations and made a game out of predicting what the math teacher’s next step would be in his explanations. One of my high school math teachers steered me to a National Science Foundation (NSF) summer institute at the University of Chicago after my junior year in 1960. The fantastic experience of being immersed with a 100 others in nothing but mathematics for several weeks cemented my path in science. The entire thrust spawned by Sputnik was perfectly suited to me. I benefited greatly from that federal push as it impacted science and engineering funding.

In sixth grade I made a model of our house where the roof came off to show the floor plan. The second story lifted off to show the first floor layout. A home developer happened to see my model and hired me to build models of each house he was building in his development. He used them in his showroom to allow potential buyers to see all houses at one time. It ended up starting a business I continued through high school. I probably built nearly a 100 model homes, including one for a TV commercial. How cool is this—I got paid for what I loved doing—building models!

When I was recruited by Michigan State University into a special mathematics program, I quickly discovered that the world of theoretical mathematics did not include my love of building things. I switched to electrical engineering and subsequently in graduate school to computer science where I could use all the deep mathematics but still build products. Ever since completing one of the first few Ph.D.s in computer science in 1970, I have been in product design, development and architecture in the telecommunications industry. It has been a spectacular career full of contributions, purpose, and meaning. It even has included a formalized process for helping people “invent their own careers.”

Charles R. (Rick) Baugh (1969)
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I decided to study chemistry when I was about six or seven years old. My dad took me to his lab at the Indonesian agricultural research station in Bogor, Java (then Dutch East Indies, now

Indonesia), and showed me two clear liquids. He mixed them together and the mixture turned blue. Such magic I could not resist. My mind was made up from that point on.

Interesting also is how my dad learned chemistry. While studying electrical engineering in Holland, on his mother's urging he read chemistry texts in his free time and returned to Indonesia and the sugar industry as a chemist. His work in agricultural research came later.

Mathias van Thiel (1955)
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I'm a psychologist, but until senior year of college I was going to become a lawyer. I had long been interested in nature—for a time as a teen I seriously contemplated becoming an ornithologist—but that faded until I began to take courses in psychology and anthropology in college. I loved the elegance of empirical investigation. During my junior year, the instructor of my social psychology course, Henry Riecken, assigned a term paper that had to include an empirical investigation. I hypothesized that attraction between roommates would be proportional to the extent to which they differed in their personality trait of dominance. I came up with a significant correlation of about .70 in the predicted direction, which was very gratifying and was like hooking a fish. I began to rethink my career plans. Then the teaching assistant in the course, Renato Tagiuri, encouraged me to apply for a summer undergraduate fellowship from the Social Science Research Council to carry out a larger-scale follow-up project. That one worked as well. I loved the research process that whole summer, and the hook was thoroughly set. I abandoned law and applied to graduate school.

Eric Klinger (1958)
Professor Emeritus of Psychology
University of Minnesota, Morris
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As kid, I was always fascinated by taking things apart. I would beg one of my parents for anything old—clocks, mixers, whatever. It was always certain that it would never be put back together again, but I didn't care. I just wanted to see inside to know what made the thing tick. Eventually, that curiosity grew toward much larger things, like earthmoving equipment, cranes, engines—all the big stuff.

As I went from high school into college, I had decided that I wanted to be a mechanical engineer, especially since I really liked mechanical drawing and shop class in high school. Then, I got into physics in college and my direction changed dramatically. Upon entering the textbook section on fluid mechanics, I saw a photograph of flow visualization around an airfoil section, and it blew me away! I knew I had to know more about flow. I never really considered what air flow "looked" like, since I couldn't see it. I entered the aerospace engineering program and never looked back.

I have never regretted my decision, and my curiosity continues to drive me to this day!

I've been blessed to have a wonderful career and to be mentored by wonderful people—both, in the aerospace industry, and now, at the NASA Langley Research Center, the birthplace of the country's aeronautical research program.

Dan H. Neuhart (1976)
Flow Physics and Control Branch, NASA Langley Research Center

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I'm now 87 years old and have been a Sigma Xi member for 62 years. When I was 12, I became a Boy Scout, interested in hiking in forests. I took a required course called "Occupations" in junior high school and wrote a report on my chosen occupation, forestry. I had talent in the sciences as well as the humanities, along with a love of the out-of-doors. To attain my goal of becoming a member of the forestry profession, I had to complete a college curriculum in forestry. I lived in Oklahoma, which had no forestry school. The nearest was at Iowa State—too expensive to attend. Instead, I majored in botany and minored in chemistry and math locally at the University of Tulsa, earning a B.S. in 1941. My grade-point average was 3.94 out of 4.0. I received a scholarship to study for the master's in forestry at Yale, where I was initiated into Sigma Xi in 1948. In 1949 I earned a Ph.D. at Yale. I have had a long career in teaching and research in forestry.

Paul Y. Burns (1948)
Professor emeritus, renewable natural resources, Louisiana State University, Baton Rouge
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Trolley cars—I grew up across the street from a car barn where hundreds of the large beasts were stored at night. In a dense city without access to an automobile, they represented both the escape route to the larger world and a source of fascination to a child. How could a small wire like that move such a large heavy object? There were also actual sparks coming from the trolley wheels and wires adding to the mystery. My early fascination with electricity eventually led to radios, electrical engineering and finally a career in physics. I've since wondered if I had grown up in a rural environment, would I have gone into the biological sciences instead.

William R. Owens (1966)
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In 1959, as a high school senior, I was interested in the sciences and was planning on becoming a chemist. I had a particular interest in organic chemistry what with the then developing field of plastics. But it turned out that my chemistry teacher, George Mullfinger, was also a ham radio operator and an accomplished member of the Syracuse Symphony, playing viola. Mullfinger was interested in starting a student ham club at the school which he would sponsor so he let the members of his classes know about the opportunity.

I had not been interested in electronics even though my father had been an aviation electronics technician in the Navy during World War II, and had been trying to stimulate my interest in the topic. But I joined with for of my friends and Mullfinger helped us study for our ham licenses. All of us passed our novice tests (which Mullfinger administered) and we got a ham station up and running in a corner of the chemistry lab to use after school.

Well, the ham bug bit me and my dad helped me set up a station at home—I then advanced in my license grade. By the time it was necessary to apply for college I had decided that electrical engineering was the career I wanted to pursue.

It turns out I got my bachelors (1964), masters (1965) and Ph.D. (1973), all in electrical engineering, from Rensselaer Polytechnic Institute.

And what about today? When I went off to college and left my personal ham radio equipment behind, my dad got inspired and he got his ham license! Over the years he has made many friends on the airwaves and he is still going strong at age 89! I still keep my ham license active and am involved with community emergency communications groups. I worked for over 34 years with the electromagnetic systems laboratories in Sunnyvale, California, on advanced communications concepts. Earlier this year I joined Boeing Satellite Systems in El Segundo, California as a systems engineer.

So my 'spark' turned out to be a healthy electrical 'spark'!

As a side note, Mr. Mullfinger's proficiency in classical music never stimulated me to have more than a passing interest in the accordion or the Hawaiian steel guitar as a youth!

Richard K. (Skip) Stevens (1965)
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The spark that started me thinking about becoming a scientist was my 7th-grade science teacher, Mr. Waite. Actually, I should refer to him as Dr. Waite, for he was a Ph.D. who was unable to find a job in collegiate academia, industry or government in 1966. He took a job at DeLaura Junior High in Satellite Beach, Florida, teaching general science. He was also my homeroom teacher, which made him the first teacher I encountered on the first morning of my first day in junior high school. He introduced me to both the Linnaean system of taxonomy and the periodic table of the elements, giving me a sense of organization and structure to the biological and chemical worlds.

Waite presented the world in a rational, organized manner that I must have been craving because I found myself fascinated every morning to learn about the animal and plant kingdoms, phyla, classes, orders, genera and species; sedimentary, metamorphic and igneous rocks; and the properties of the 103 (at the time) elements. I guess it seemed to me that he had all the answers. He taught junior high science only that one year, moving on to a job in academia. I came out of his class thinking that I would pursue a career in chemistry. This was a watershed moment for me, because prior to taking that science course I had no serious aspirations for any career. My focus changed in high school when I took a course in marine science. I was again lucky to get an influential teacher who normally would not be teaching in secondary education, this time a marine ecologist, Mr. Sansom.

Eventually I got my bachelor's degree in biology and a master's in zoology. My master's work was on detrital food chain dynamics in the marine environment, which lead me to a career in biological oceanography at a U.S. Navy research laboratory. I went back to school (switching fields again) to get my doctorate in marine geology and geophysics.

Thank you, Dr. Waite, for striking that spark in me and making me look at the world in an altogether different, life-altering way.

Kevin B. Briggs (1986)
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Mine was my father, who received his Ph.D. in botany at the University of Chicago in 1941, I believe.
Charles F. Quibell (1969)
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The spark for me was the *Mr Wizard* television show I watched as a kid in New York City. I decided at the age of seven that I wanted to be a scientist. I achieved my goal and am now some 50 plus years into a highly productive career as a research physicist. I have contributed to several scientific disciplines including atomic and molecular physics, biophysics, material science, atmospheric physics and space-based passive optical/infrared remote sensing. I have always said that “physics has been good to me,” in that it allowed me to pursue problems of interest and to conduct research experiments all over the globe.
Anthony J. Ratkowski (1985), Ph.D.
US Air Force Research Laboratory
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I was very lucky in have a very hands-on father who was an electrician but also tinkered in our basement workshop. I remember that we had three work areas: the "electronics" bench, the "woodshop" bench and the "model railroad table" in our home in Southern Connecticut. My first "technical" memory is of building a crystal radio when I was about eight-years-old and hearing the BBC from London as the first station. I was hooked into electronics. Both my dad and mom encouraged me to build stuff from scratch—we didn't have the money to buy things that were already built. Luckily, with the wood shop there, I got pretty good at fabricating both electronics and the cases they went into.

Reading all of the Tom Swift books probably had a large influence. Receiving my ham radio license when I was 15 helped too, in 1962. This led to three degrees in electrical engineering from MIT and, starting in 1969, a long career at Hewlett-Packard first developing medical equipment, and then a career shift in 1993 into corporate education. I still consult part-time for Avago Technologies as an education consultant while enjoying semi-retirement. (Avago is a spin-out of Agilent Technologies, which was a spin-out from HP.)
Lawrence W. (Larry) Banks (1967)
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Everyone in my family, from my grandparents to my parents to my brother and I, always enjoyed learning new things and figuring out how stuff works—so that set the stage for me. The defining moment when I figured out that I wanted to be a scientist came just in the nick of time in my senior year of high school, when I was applying to colleges and needed to decide what my major would be. I was working in the guidance office and one of my jobs was to shelve new material that came in.

That week we happened to get in an encyclopedia of careers which included pictures and photos. The thing was a monster, about five volumes or so, and I had to clear an entire shelf just to fit it. As I was putting up one of the middle volumes I flipped through it and checked out a few careers.

Then I came across a photo of a tobacco plant glowing in the dark and I thought, "This is what I need to get into!"

It turns out the plant was infected with a tobacco mosaic virus containing firefly luciferase. The entry was for genetic engineering, but as I read the description I realized that I didn't want to be the person who designed the tools, I'd rather be the person who used the tools.

Fortunately, each entry had a section of related careers. This one said "See also: Biochemistry," so I pulled that volume off the shelf and checked out biochemistry careers. And that is what I've been doing ever since—using biochemistry and molecular biology to study human diseases and susceptibility on a genetic level.

Brooke L. Heidenfelder (2004)
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I have always had a scientific curiosity. In elementary school I recall someone bringing a microscope to class. As we were trying to decide what to look at, another class mate suggested that blood might be interesting. I was the only one willing to be pricked, so we put a drop or two from one of my fingers on a slide and watched it dry out and change over a few days. There was a small black blob that seemed to move across the sample, devouring it and leading to the hypothesis that I carried some kind of strange parasite that was “eating my blood.” In first grade, I would make “dinosaur tracks” across the playground and I still clearly remember a field trip to look at a geologic feature in southern California and another to observe changing leaf color as it became autumn. Most of the books I checked out from our school library dealt with dinosaurs, and I started a small rock collection at some point. I often found myself daydreaming about sitting in a cabin in a forested area surrounded by a globe and other scientific equipment; however, not knowing what scientists actually did, the illusion usually ended with being rescued from a forest fire.

My parents were also quite supportive and subscribed to *National Geographic* for me, where I became fascinated with articles on birds. Additionally, my mother worked for North American Rockwell (now Rockwell International) as an accountant. Rockwell was heavily involved in building rockets, and I was introduced to the space program and would wake up early and stay in front of the TV for hours watching the Mercury, Gemini and then Apollo launches and splash downs. The first Moon landing is still a vivid and exciting memory and I continue to look forward to shuttle launches and landings.

The real spur to become a scientist, however, came from the Boy Scout program. I loved hiking and camping and all the nature-related merit badges. While a Cub Scout we took a trip to California’s Salton Sea where I climbed steep slopes from one flat terrace to another and found that each was covered with sea shells, even though we were far above the ocean. This was fascinating to me. I decided that I wanted to do something where I could be outdoors. By the time I began college I had narrowed the choices to geology, archaeology, forestry and baseball coaching. Upon completing most of my GE requirements at Brigham Young University, I decided to visit a professor from each subject. My first stop was the geology department where Dr. Morris Peterson did such a good selling job that I never made it to any of the other departments but immediately went down the hall to the geology office and started the paper work to declare my major. I have never looked back and can now not imagine doing anything else.

William W. (Bill) Little (2004)
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My “spark” was the Buster Crab *Flash Gordon* serials with spectacular special effects and equally spectacular music (Les Preludes no less!). How could those escape anyone’s attention? Then came the TV Tom Corbett and the *Space Patrol* shows along with the Tom Swift and Rick Brant series of children’s books. I would buy one and read it non-stop. Soon I found myself reading Willey Lay’s series on space travel, and so on.

I was not alone. My best friend was equally enthralled with these early science fiction shows. Where I had my Erector set, he had a Gilbert chemistry and microscope set. We became amateur rocketeers—before Sputnik. We started out using Jetex engines and index cards for rocket bodies. I still remember the day when I broke the design problem into two categories—power source and guidance. Than along came Sputnik and Explorer. Soon we had a rotating nose cone “for stabilization.” Later on I added another category into the design problem—sturdy structure—a lesson learned through direct experience. My Ph.D. is in psychology, my boyhood friend—now a TV personality—has his Ph.D. in literature.

It seems that children’s toys of the fifties were designed as aids to expand the imagination and creativity of the child. Children’s toys of today seem to be designed more along the lines of a follow the dots approach. Lego is an excellent example. If you are not familiar with the modern Lego construction system, you are really missing something. Modern Lego has its own programmable computers, servo motors, pneumatics (!) and a large number of sensors (light, sound, temperature, orientation! and so on). The modern Lego system can be used as a fast prototyping system. Unfortunately, they are marketed in kits that are narrowly oriented towards building one or two different kinds of things. So if a child gets a bulldozer kit, they get only the parts necessary to build the bulldozer. So they build the bulldozer, directly from detailed instructions.

I discovered the modern Lego system last year. I never bothered to build one of their kits. However, as a child of the fifties, I saw several interesting possibilities. So off to eBay where you can purchase Lego parts a la carte. I am currently building an optical bread-board with the intention of building a Michelson interferometer with unmodified Lego at a fraction of the cost of using an off-the-shelf optical bread board setup (doesn’t everyone want to build their own interferometer?). The next project is to build an unmodified Lego apparatus to measure the speed of light. After that I want to see if I can build a rocket guidance system because after all these years, I am still trying to solve that guidance problem I identified in my childhood.

Robert J. (Bob) Lunn (1986)
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There was never a spark. I got to college after dropping out of the mountains into a simmering piedmont and discovering dorm life in 1960. I tried a bunch of stuff—English, Spanish, archaeology, geology, flunking out twice, working for a finance company and a city directory. None of them worked. I wanted to go home, so I got married. Those two things really had nothing to do with each other, but I did them anyway. The getting married part was pretty straight forward, hearts, bells and for-ever-afters, etc. Then there was the part about what to do with the rest of my life. Some of us just have to get things backwards for a while to make anything work.

The part about going home came back to haunt me right after deciding that going back to college might be the thing to do, really. What was home? I had grown up, so far, roaming woods, digging or picking plant parts for spare pocket money and going fishing for a high school diploma. The loving family thing never did much for me so I took a general botany course in summer school in 1966. BALOOIE! Where had meristems, Darwinian evolution, Neurospora and these things called plant species been all my short life? Suddenly, to get a college degree, biological sciences became the coarse load of least resistance. The success was heady. That first A was shaped like a rocket for me. Cryptogamic botany took me into areas I had only smelled and walked through unknowingly. It was fascinating and gave me something to lever my flagging GPA of combined academic failures.

Most of the rest was provisional graduate school, based on the good graces of a semi-willing committee. The concentration of botany courses favored me, my marriage and my future. I walk, now, through the woods and have knowledge of all I touch, or at least have come to know where to get that information.

David M. DuMond (1970)
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My experience is that the critical factor is internal—my state of mind, even as a pre-teen. The seed must fall on fertile ground.

By the age of 12 or 13, I had taken apart every appliance in the house to study the mechanisms. It helped that I managed to put them together again in working order, and my parents were tolerant. One day, the principal of my junior high school came into my 8th grade class and asked if anyone wanted to try out for Brooklyn Tech High School. I'd never heard of that school but that day I was bored as usual and it occurred to me that it might be a way out of dull classes, so I raised my hand. I got in and for the first time I loved going to school even though I had to work harder at it. At Brooklyn Tech I found that molecules are even more interesting than mechanics, so I took every chemistry course I could. Before long I had a basement chemistry lab at home, which I could keep well stocked because the lab supply house near NYU, Eimer and Amand, would sell me a few test tubes and beakers, small quantities of reagents and other essentials. I graduated from Brooklyn Tech in 1943, a few months before my 18th birthday, and wartime conditions enabled me to get a job as a chemistry lab technician. I loved it.

I don't know when I began to think of myself as a scientist. I had no role model and only hazy ideas about what a scientist does. But I was heading in that direction, without a plan. External influences helped but none of them was decisive. What really mattered was my intense curiosity about how things work. Was my experience common?

Two years ago, my grandson's 7th grade science teacher heard that I would soon visit Los Angeles. She knew a little about me as a scientist because my grandson interviewed me for a report a year earlier. She asked if I would talk to the students in her class. I thought for some time about what I might say that would interest the students. I recalled that it was in about the 7th grade that I began the process that made me a scientist. Perhaps I could talk about that and connect with students in the same state of mind.

Much has been written about the characteristics of scientists; Google will help the reader to find the literature. Often, scientists are said to have characteristics, including intelligence, persistence,

logical thinking and communication skills that apply to most professions. But one characteristic of scientists sticks out: an intense curiosity about how things work. In recent months, I've asked many scientists about what brought them to science. All but one mentioned his intense curiosity. It does seem to be a common thread.

The talk to my grandson's class went well. My topic was meant especially for a few, but it didn't bore the rest. They asked many good questions and the teacher remarked that her husband, a scientist, also had an intense early interest in how things work. And I reached at least one student in particular; my grandson decided a few months later that he wants to be a scientist, to my surprise.

Marvin Margoshes (1952)
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