FROM ART TO INTERDISCIPLINARY ENGINEERING SCIENCE — AND BACK

Daniel E. Rosner

I will start with the comment that my Intellectual Trajectory, like several that I have had the pleasure of hearing or reading, is quite far from a straight line. My plan is to describe how I made the transition from a graphic arts major at the High School of Music & Art in New York City to a Guggenheim jet propulsion fellow at Princeton University, and, ultimately, to emeritus professor of chemical engineering at Yale! That was a completely unforeseen, rather circuitous trajectory; and, along the way, you will see how I incorporated my graphic arts background into my professional activities in chemical engineering.

Childhood in New York City

Proceeding chronologically: I am a New Yorker, born October 30, 1933, in New York City. My parents were also born in New York City. Their parents came over from Eastern Europe (probably near the present Austria-Hungary border) in the 1880s. My father made a living during the Depression as a radio repairman. He was quite a handy fellow, giving me a lot of instruction about how to fix things and how to build things. Indeed, most of my earliest toys were his handiwork, and I am grateful that he spent so much time with me. My mother, who had a sweet disposition, made some extra income doing dress alterations in our street-level apartment. My sister, Inez, and I were raised in two (successive) one-bedroom apartments on the same street in the Bronx, one block south of 170th Street, two train stops north of the famous Yankee Stadium. Being born in 1933 might not seem like an opportune time! In fact, both the location and timing of my birth turned out well for a number of reasons. First of all, New York City was a very exciting place for my parents, as well as for me as a youngster. In fact,

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Daniel E. Rosner, Professor Emeritus of Chemical Engineering, joined Yale's SEAS faculty in 1969, after eleven years of USAF-OSR-oriented basic research, having completed his B.S. in mechanical engineering at CCNY and his Ph.D. in aeronautical engineering–chemical propulsion at Princeton University as a Guggenheim Fellow. The arrival of 2020 marked sixty-one years of his research/archival publications on transport processes in multiphase and/or reacting flows, with twelve papers produced since becoming emeritus in 2014. The cumulative citation count for his written output, including his ASEE/Wiley award-winning textbook-treatise (reprinted in 2000), now exceeds 5,000—with many coauthored with one of his twenty-three Ph.D. students or postdoctoral research associates. Since 2014 he has also completed approximately fifty watercolor and ink paintings, many depicting Yale's iconic buildings. His memberships include New Haven's Paint & Clay Club, Creative Arts Workshop, Hamden Art League, and Arts Council, and he frequently participates in their annual exhibitions.

I have many times thought that, had I been born in, say, Vienna or Berlin, I wouldn't have made it to age ten or thirteen because of unchecked Nazi anti-Semitic hysteria. As you will see, the timing was also perfect because I ultimately came "on stream" (as a fresh Ph.D.) when there were unique opportunities in the emerging engineering fields that fascinated me—tied to high-speed jet-propelled flight and rocketry. So, that's a fortuitous circumstance because none of us has any control over when and where he/she is born. I lucked out on both scores.

I should add that my parents were both fully assimilated and Americanized people, whose speech was free of any conspicuous accent. We were basically a lower-middle-class Jewish family, but not especially religious. I went to a public school, P.S. 64, just a short walk from our apartment in the Bronx. My major recollection of how I spent my time (apart from enjoying a variety of low-budget sports) was as the "artist-in-residence." Apparently, I was discovered to be a good draftsman/artist, so I spent much of my time in public school creating murals for various history-oriented classes. I should also mention that I had two significantly older siblings (from the previous marriage of my father—who became widowed when his first wife died giving birth to my half brother, George Rosner). The older of the two, Cecille Rosner, was a talented artist, and she married a rising-star sculptor by the name of Milton Hebald. He influenced my childhood quite a bit, providing me with periodic advice, occasional instruction, art supplies, and also an occasional book. I remember once he gave me a copy of *The Complete Woodcuts of Albrecht Dürer* to study and retain. I probably was only about twelve years old at the time. He also advised me about what would be a good choice of high school, and I think that's probably why I ultimately took and passed the onsite exams/auditions for the High School of Music & Art in upper Manhattan (HSM&A, at 135th Street and Convent Avenue).

Becoming a Serious Art Student

Some of you probably know of Laguardia High School, located on the perimeter of the Lincoln Center complex in Manhattan. The full title of that school is Fiorello H. Laguardia High School of Music & Art and Performing Arts, and, indeed, it was the result of merging two schools: the one I attended (i.e., Music & Art), which was more academic than the other, the High School of Performing Arts. So, on the advice of my brother-in-law, and based on the onsite exam and a credible portfolio I had developed over the years as a budding artist in both elementary school and middle school (Wade Junior High School), I entered HSM&A for a four-year period. It was a wonderful experience for me because HSM&A attracted many talented students from all parts of New York City, several of whom became lifelong friends. It had very high academic standards, and each one of us also had the opportunity to become more proficient in either music or art. This included all of the major musical instruments as well as all of the principal visual arts media. I happened to gravitate toward graphic arts (so-called printmaking) and also became art editor of the high school newspaper, *Overtone,* for

Fig. 1. HSM&A graduation photo, from January 1951 senior yearbook

which I created ca. 3x3-inch original linoleum cuts to illustrate feature articles. I also was elected co-art editor of our senior yearbook (which contained my official graduation photo, fig. 1), and I was ultimately awarded the Saint-Gaudens Medal for art upon graduating with the Phi Beta Kappa Alumni Award from HSM&A in January of 1951. It was a great experience for me to be immersed in such a student body in a very special public high school with a rigorous academic program. It is true that I didn't have some "technical" subjects (including calculus!) that students from, say, Bronx High School of Science or Brooklyn Tech might have elected, but I did have a memorable physics course. I made up for these gaps when I moved on to the college level.

College Education

What was behind my transition from HSM&A to a four-year college? Again, my brother-in-law (who ultimately taught sculpture at the Cooper Union in New York) thought it would be a good idea if I took the entrance exam for Cooper Union for access to its three-year Visual Arts program. I did so and passed that exam. For a while I was really intending to go to Cooper Union, but I ultimately chose to enter a four-year liberal arts college—Brooklyn College in New York—as an art major even though it was not close to where I lived. I reasoned that in addition to a very fine art program I would also have access to a full academic program, which would (and did!) broaden my future opportunities. When I entered Brooklyn College I still thought I would be an art major, perhaps ultimately becoming a book illustrator full-time. But that goal receded for a number of reasons. One was that, at the time I graduated from HSM&A in 1951, from my perspective the art world was going berserk! The kinds of art that I appreciated were the Renaissance painters and the post-impressionistic art of Cézanne, Van Gogh, Degas; and all of the graphic artists that I admired (e.g., Piranesi, Daumier,

Goya, Beckmann, Kollwitz, Kent, Steinberg) were, essentially, "realists." So when I saw what was passing for contemporary art in the 1950s, I decided that this direction was not likely to be my cup of tea! Put more bluntly: it was beginning to worry me that the scribbling and dripping paint that was attracting so much attention was not my idea of fine art. More fundamentally, being in a field in which the standards for what constitutes merit are so vague seemed too risky. But, perhaps more important, I found myself paying more attention to technological developments of the Second World War, especially progress in liquid-propellant rocketry and jet-engine-enabled high-speed flight: e.g., swept-wing (even supersonic) propeller-less aircraft. These developments were capturing my attention, and I soon concluded that this was more likely where my future lay—a choice my father was undoubtedly relieved to hear!

Because my academics were quite strong I had no real problem adapting to that change in direction. Fortunately, my physics teacher at Brooklyn College had learned of a recently established graduate program at Princeton University in the area of jet and rocket propulsion. Based on my performance in her class and my expressed interests, she presciently concluded that someday I might be interested in this particular program, a Guggenheim-enabled graduate/research program at "nearby" Princeton. I stashed that brochure away, and several years later I also concluded that it *would* be right for me. But, for the present, I first made the necessary transition to preengineering. So I never did take an art course at Brooklyn College, even though the celebrated Mark Rothko was on its art faculty. That is just as well, because I still do not appreciate what Rothko was doing then—or subsequently!

Completing My Transition from Art to Engineering

In 1953 I entered City College of New York (i.e., CCNY), which was considerably closer than Brooklyn College to where I lived in the Bronx, and actually physically adjacent to HSM&A! I attended CCNY for two years, completing its mechanical engineering program. City College did not have an aeronautical engineering program—that might have been a better match for me—but mechanical engineering was certainly close to many of my interests. It was a rather traditional program, so traditional that I remember actually cutting gear teeth in steel in the machine shop and testing the performance of reciprocating piston-driven steam engines in the laboratory. These were well maintained (and high-performance in their day), and we learned a lot by quantifying their thermodynamic performance. We also studied the design of axial-flow turbines and compressors, and some of this material was getting close to then current technologies. But even then I had the sense that I had to get much closer to fundamentals if I wanted to accomplish much in the way of chemical propulsion (including rocketry and air-breathing jet engines). I did actually publish a paper on rocketry (on the concept of escape velocity) while I was an undergraduate at City College—that article, which was based on my outside reading, included my accompanying scratchboard illustration of an ascending V-2 rocket, as well as the surface of the moon.

I completed this traditional mechanical engineering program at CCNY, graduating *summa cum laude* in June of 1955. By then I had successfully applied to that Guggenheim-funded graduate program in jet propulsion at what my parents considered to be "distant" Princeton University. I was awarded a coveted Guggenheim fellowship in jet propulsion, but I recall and must confess to then being somewhat embarrassed by the associated title: jet propulsion fellow!

Ph.D. Studies in Aeronautical Engineering at Princeton

A few words would be in order about the impressive aeronautical engineering faculty assembled at Princeton by 1955 to direct needed research to advance rocketry and air-breathing jet propulsion. My early dissertation adviser was Martin Summerfield, who was editor-in-chief of the *American Rocket Society Journal* for eleven years, and who became president of the American Rocket Society by the time I got my Ph.D. in 1961. He was a leader in this rapidly developing field, had been a cofounder of Aerojet Company during World War II, and also developed (at the Jet Propulsion Laboratory in California) small liquid-propellant rockets to assist the take-off of heavy aircraft. Also prominent was Luigi Crocco, who had been recruited from Italy shortly after WWII and was a leading researcher in high-speed gas dynamics. I should also mention the recently recruited Wallace Hayes, already a prominent theorist in the emerging field of hypersonic aerodynamics. In fact, required reading for his grad course was a recent book on supersonic wing theory coauthored by Abraham Robinson. I mention this here because not long after WWII Robinson reverted to his earlier love of pure mathematics and became a Yale professor of mathematics! Alas, I never did get to know him after my 1969 arrival at Yale, but, ironically, I did meet his widow, Renee, at New Haven's Creative Arts Workshop in a mid-1970s printmaking class.

Not surprisingly, early on I was introduced to several other people at Princeton who had a dramatic effect on my subsequent career. None was more significant than John Bennett Fenn, who about a decade later was to be recruited to Yale. Fenn was directing an Office of Naval Research grant-research program (ca. thirty contractors) dealing with jet propulsion from his office at Princeton's recently created Forrestal Research Center. I didn't realize it at the time, but he was a Yale Ph.D. in chemistry from 1940. I don't think he ever mentioned that to me because he had moved into the field of chemical propulsion only after the war. By the mid-1950s rocket propulsion, and all forms of air-breathing jet propulsion, were hot topics in the research community. While Fenn was not yet a Princeton faculty member when we met, he in effect became one of my dissertation advisers. In fact, he (along with two Princeton aeronautical engineering faculty member-advisers, Martin Summerfield and Seymour Bogdanoff) formed a small company, appropriately called AeroChem Research Labs, focused on contract research for the U.S. Air Force, Navy, and other agencies/corporations interested in these combustion-related fields. Shortly after I passed my general qualifying exam for the Princeton Ph.D. program, I became one of AeroChem's first employees in Princeton Junction, not far north of the Forrestal Research Center.

Fenn really became an important adviser on what kinds of research would not only be of widespread interest, but also would fit my background and abilities. He also was doing excellent research of his own, which dealt with forming and exploiting high-intensity molecular beams for studying gas-gas and gas-solid reaction rates. His research was attracting a lot of attention, and he began collaborating with several faculty members in chemical engineering at Princeton. One of them was Assistant Professor Michel Boudart. My (then future) colleague Gary Haller and I were both highly influenced by Boudart, a charismatic Belgian import whose field of research, surface catalysis, was coincident with Haller's. Ironically, this also included research coming rather close to my emerging interests, namely high-speed flight! How is this possible? Well, Boudart had one student experimentally studying how atomic oxygen and atomic nitrogen recombine on high-temperature solid surfaces. Why might this be of interest to aeronautical engineers? Well, if you move fast enough in our earth's atmosphere, perhaps 3 km/s or faster, you actually rip apart the molecules of N_2 and O_2 in air. Depending on whether/where those atomic species reassociate, a reentry vehicle can either survive or fail, based on the catalytic activity of its surfaces. That's the interdisciplinary aero-chem field I dove into for my own Ph.D. dissertation. Indeed, the first thing I did for our small company was work on an electrical discharge device that John Fenn had developed and patented for producing a high-speed gas stream containing atomic nitrogen—to be used for energy transfer testing in the laboratory.

While these were my early influences at Princeton, I did want to briefly come back to a few developments initiated while I was still an engineering undergrad. Based on my academic record at CCNY I had earned a General Electric scholarship, which allowed me to not only have summer jobs at the General Electric Co. (including in Lynn, Massachusetts, and Schenectady, New York) but also gave me access to some of their senior people who could provide valuable advice on my future trajectory. When I asked about whether graduate school would be right for me and what field would be appropriate, I got the following advice—that if I wanted to do research in areas that I defined, and that I thought were exciting, it would be best to go for the Ph.D. That explains why I elected the Ph.D. path at Princeton rather than immediately entering U.S. industry (e.g., a corporation with a well-developed in-house training program) with my CCNY B.S.-M.E. degree.

I should also mention that while I was a graduate student I met and fell in love with Susan Daniels, now Susan Rosner. It is amazing we did not actually meet at City College itself, although we noticed each other as undergrads. But I had the misimpression that Susan was somehow "attached" to a friend of mine, so I kept my distance. Ultimately, I found out that she asked my friend about the prospect of being introduced to me! So, while I was a graduate student we arranged to meet on several occasions (both in New York and Princeton). We soon fell deeply in love and married in 1958. That was an important year for me for other reasons as well. As mentioned above, I had recently passed my general exam and had become an employee/grad student at AeroChem, where I was able to devote myself full-time to theoretical and

experimental research studies, publishing several timely papers well before my 1961 dissertation, which was titled "Diffusion, Heat Exchange, and Surface Catalysis in Flow Systems." This environment enabled me to remain productive as a group leader in the eight years after my Ph.D., with two of my principal research themes being: (1) flow reactor studies of how atomic species (O,N,Cl, F,…) chemically attack (even "gasify") refractory solids, and (2) how physical transport (e.g., reactant diffusion in gases) limitations influence the rates of chemical reactions occurring at solid surfaces. The first of these areas (for the O(g)+N(g)/SiC(s) system) provided useful data for NASA's then embryonic Space Shuttle (hypersonic glide vehicle) Orbiter program—roughly a decade before these vehicles (with siliconized pyrolytic carbon leading edges and nose cap) were successfully launched and recovered by NASA. The second group of studies were largely extensions and applications of what fluid-dynamicists call boundary layer theory.

I should add that during the 1960s I published several timely papers in journals that don't exist anymore. To name four: *American Rocket Society Journal, Jet Propulsion, Journal of the Aeronautical Sciences,* and *Pyrodynamics.* The first three became parts of the American Institute of Aeronautics and Astronautics, so if you try to find these early papers, it's not that simple. This is not unusual if one works in fields that are evolving rapidly. But that's what made them interesting to me—we were breaking new ground! Ironically, some of the journals that I published in during the 1960s were actually edited by prominent Yale chemical engineering faculty members—of course I didn't appreciate this at the time. The *American Institute of Chemical Engineers Journal* and *Chemical Engineering Science* were edited by Harding Bliss and Barnett Dodge, respectively. Also, at that time I wasn't aware of what was developing at Yale Engineering and Applied Science in the emerging general areas of high-speed gas dynamics and aerothermochemistry. Because of these independent developments—undoubtedly encouraged by Peter Wegener (an import from Peenemünde via the Jet Propulsion Laboratory) and Boa-Teh Chu—John Fenn received an offer to come back to Yale as a professor of engineering and applied science, with the goal of revitalizing research in chemical engineering within the E&AS framework. He returned to Yale as a full professor in 1967.

Transition to Yale University

As soon as Fenn got settled here, he invited me to join the chemical engineering "group" within Yale E&AS. Remarkably, he was not educated as a chemical engineer, nor was I. Even Gary Haller, who had arrived at Yale slightly before Fenn, was not educated as a chemical engineer! By that undergraduate-credentials standard, the only bona fide chemical engineer in our group by ca. 1969 was Csaba Horváth, a Hungarian import who essentially invented liquid chromatography (LC) as a postdoc (with Professor Seymour Lipsky) at Yale School of Medicine and who was also recruited to chemical engineering by Fenn shortly after Fenn arrived. But, most important, we were

each involved in interesting research, and our timely research programs fit together rather nicely. Because we were working at the fairly fundamental level and publishing in both chemical engineering and physical chemistry journals, we also had little difficulty covering the course work required for an accredited undergraduate degree in chemical engineering. Horváth was breaking new ground with his HPLC analytical chemistry techniques, and Fenn kept advancing his molecular beam research. Indeed, he ultimately developed a way of taking the output of a liquid chromatograph into a mass spectrometer using an electrospray "interface" as a novel ion source. In the years immediately following (i.e., the 1990s) this development revolutionized the chemical analysis of biologically interesting macromolecules. As early as 1995 Gary Haller and I actually had the opportunity to nominate Fenn for the Nobel Prize in Chemistry—this was shortly after Fenn became emeritus and departed from New Haven to Richmond, Virginia. (He had already been obliged to retire from Yale in 1987 when he turned seventy.) By 2002 the tandem LC/ES/MS work he completed on either side of his seventieth birthday became so important that Fenn shared the 2002 Nobel Prize in Chemistry—perhaps the only example of an academic chemical engineer to be recognized in this way.

I should comment here that the Engineering and Applied Science structure that Haller, Fenn, Horvath, and I entered was fundamentally interdisciplinary. Yale had no chemical engineering department at the time and, from the point of view of interdisciplinary research, that was fine. However, from the perspective of undergraduate education, it was not optimal. Ultimately, to satisfy the accreditation organization governing chemical engineering, we did lobby for, and ultimately reform, a bona fide Department of Chemical Engineering at Yale. In any case, for the next twenty-five years or so we were remarkably successful: the timing was right, our research funding was healthy, our research productivity impressive.

Ultimately, I got involved in some administration—it's hard to avoid in a small department. I became chairman of the department in the mid-1980s (see fig. 2, which includes two of my woodcuts in the background) for three years—ironically briefly becoming John Fenn's "boss"!—and I accepted the chairmanship again in the mid-1990s for an additional three years. Mercifully, I avoided the interval when Fenn turned seventy and reapplied to Yale for an assistant professorship, claiming Lord Kelvin (in Scotland) as a precedent! I can't say I enjoyed my time as department chair. For example, despite my efforts, I did not succeed in attracting some stellar people I was eager to recruit as faculty members. But I did enjoy meeting many distinguished Yale chemical engineering alumni from the past, including those we invited to comprise an effective Advisory Committee group.

To reach out to our alumni, we also began issuing annual department newsletters/reports. Each of these provided graphic arts opportunities for me, with several displaying "abstract" versions of distillation columns (based on the tall woodcut prints in fig. 2).

Fig. 2. The author as chair of the Yale Chemical Engineering department, ca. 1984

From the vantage point of Yale (and Ivy League) history, it is also interesting to note that Fenn and I, were, in effect, the next generation of Princeton imports after Herb Scarf and Martin Shubik (Economics) and Joseph LaPalombara (Political Science).

Comments on Research

I will not say much about my own Yale research program. Perhaps a few brief examples will suffice. The areas I worked in continued to be largely motivated by fundamental issues encountered in ultra-high-speed flight, aircraft gas turbines, or rocketry. Two common denominators here were often: (1) combustion research—i.e., how gaseous, liquid, or solid energetic fuels burn, and (2) the behavior of suspensions of fine particulate matter—e.g., aerosol science and technology. An emerging technology that also attracted my attention was chemical vapor deposition (CVD), important to the rapidly developing solid-state electronics industry (i.e., a class of techniques for growing thin solid films using chemical reactions at solid surfaces). In the last three decades I became quite interested in the synthesis of valuable materials (pigments, photocatalysts, optical wave guides,…) using cost-effective combustion techniques. And, most recently, I even got involved with pharmaceutical processing (so-called powder micronization techniques) exploiting compressed (i.e., supercritical) CO2.

There was one prominent exception to these abovementioned studies, driven as they were by new technologies. I also got involved in the mid-1970s in a now famous

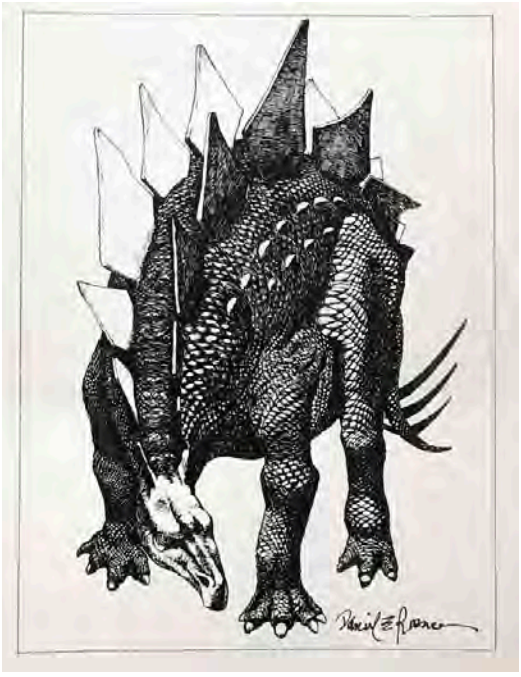

Fig. 3. Cover etching of *Stegosaurus,* 1976

Stegosaurus project dealing with dinosaur physiology! This was so out of the ordinary that I will say a few words about it here. It not only gave me the opportunity to work with a Yale paleontology Ph.D. student (who had become curious about the *function* of the plates of this dinosaur), but also had the effect of getting me involved in creating the cover design (a dramatic etching of *Stegosaurus* [see fig. 3]) for *Science* magazine that went along with our June 11, 1976, technical article. Ironically, this opportunity drew me back into the graphic arts! For the technical paper itself we used engineering methodology (including small wind-tunnel tests and "fin" heat transfer calculations) to convincingly prove that the plates appearing on the dinosaur *Stegosaurus* were efficiently deployed for heat dissipation, not mechanical defense! I am proud to say that this *Stegosaurus* etching is reproduced in the most widely used textbook-treatise in engineering heat transfer (authored by J. Lienhard IV and J. Lienhard V—a father-and-son team).

Most of these studies at Yale involved topics at the intersection of several traditional disciplines and enabled us to contribute to a variety of technologies. This itself provided useful stability because, like fashions in art, research fashions and needs also change: you can't depend on one technology remaining the center of attention for more than about five years. Another feature was the balance we struck between "inexpensive" experiment and theory. About half of my twenty-three Ph.D. students were involved with bench-scale experiments using novel chemical reactors or combustors that each had personally helped develop and assemble. That provided good training for them, and we avoided becoming "slaves" to any one large facility or expensive

piece of equipment. We also did a lot of relevant theory (sometimes called mathematical modeling), including the assistance of increasingly affordable digital computers. Many of our results, always cast in the most universal (general or "correlation") form possible, are now embedded within commercially available computer software for engineering design purposes, or explicitly cited in specialized engineering texts and handbooks.

Looking Back and Ahead

While I still think that whatever manuscript I am currently working on will be among my very best(!), it is satisfying to now look back at the body of research I have published (ca. 275 peer-reviewed papers and one book, *Transport Processes in Chemically Reacting Flow Systems* (Dover Publications, 2000), in collaboration with my doctoral students and postdoctoral collaborators over the past sixty years. In principle, almost all of this knowledge—in effect our written legacy—will be retrievable and useful to generations to come. But equally satisfying is contemplating our human legacy: in my case, the approximately fifty doctoral and postdoctoral individuals currently making their notable R&D contributions worldwide.

Since attaining emeritus status in 2014 (marking forty-five years on the Yale faculty), I am currently dividing my time among the following five classes of activities: (1) research, now fully theoretical-computational studies, often in collaboration with former students, as a term research professor (2017–20) and senior research scholar (2020–23); (2) service to the Yale Chemical Engineering department: e.g., managing our annual lecture series honoring the late Csaba Horváth; co-organizing a recent (June 10, 2017) centennial celebration honoring our '02 Nobelist, John B. Fenn; and rebuilding our Chemical Engineering Library in 319 Mason Lab; (3) watercolor painting (briefly discussed below) for local exhibitions and sale; (4) Koerner Center social and educational activities (which have been a delight!); and (5) the daunting task of downsizing, both at our home for some fifty years (in Woodbridge) and at Yale (Mason Lab).

My taking up watercolor painting was largely enabled by the time released from teaching. Watercolor is a medium that requires less mechanical equipment and (via inexpensive, high-quality color photocopying) facilitates increased productivity. Some of you may remember my Koerner Center exhibition in May of 2015. Entitled *One Engineer's "Trajectory" in the Visual Arts,* it assembled thirty-two of my pictures, both prints (etchings, a collograph, and several woodcuts) and watercolor paintings. While some went back to my HSM&A days, most were quite recent, commencing with my election of Yale's phased retirement program in 2011. Encouraged by a retired HSM&A classmate (Gerald Shertzer, who taught art at Andover, including a student named Jock Reynolds!, and, in his retirement, took up watercolor painting), I registered for a beginner's watercolor class at New Haven's Creative Arts Workshop. One of my first paintings was a "portrait" of Mason Lab (fig. 4), where I had worked for forty-five years,

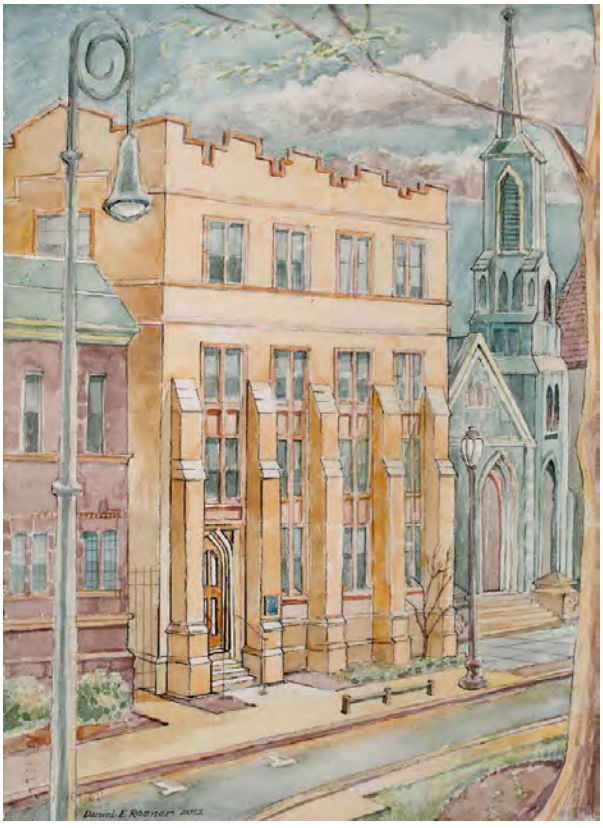

Fig. 4. Mason Laboratory (9 Hillhouse Avenue)

because I thought my former Ph.D. students and postdocs, now dispersed around the globe, might appreciate such a personalized memento. That picture was such a hit that I embarked on a series of paintings of iconic Yale buildings, now totaling about nineteen, with a recent one, Strathcona Hall via Grove Street looking west, completed in 2017; and Bass Tower, completed in 2018.[1] By now Susan would like me to "give it a rest" (i.e., turn to other subjects). However, Merwin's Art Shop (on Chapel Street) demonstrates that there is a steady market for inexpensive matted reproductions of these paintings among visiting parents and Yale alumni (fig. 5). I am also hopeful that organizations like the Yale Alumni Association, which expressed an interest in these images during my 2016 show at the New Haven Lawn Club, will ultimately use some of them in their future literature and correspondence.

Concluding Remarks

Looking back, I would say that I actually have few regrets! Fortunately, I was born at the right time, and in an exciting place—one that included, as launching platforms, such merit-based and tuition-free institutions as the High School of Music & Art and the City College of New York. I had loving parents, received rather sound advice, and actually made a succession of reasonable choices! I have also been blessed with good health, a devoted wife and companion, and our two very special children—Lisa and

Fig. 5. Rosner family gathering at Merwin's Art Shop

Stefan—now both college-educated engineers (without any coercion!). While my own trajectory (especially beyond my Princeton Ph.D. in aeronautical engineering) was in many respects unforeseen, Yale University and New Haven have provided a rich interdisciplinary environment for me during these past five decades. Our emeritus faculty club members are now another important part of our extended family—including our two teenage grandchildren, Zachary and Paloma (in Palo Alto, California)—so Susan and I have much to appreciate and look forward to.

In preparing these remarks I have described how I merged my graphic arts background with an academic/engineering research career. I hope some of this particular story will interest the reader and, perhaps, the reader's grandchildren!

NOTES

1 The Koerner Center now has fifteen of these paintings in its permanent collection.