About the Authors

Lisa E. Friedersdorf A piece of advice I often give my students is to build a strong foundation so they can take advantage of opportunities as they arise, and I have been fortunate to be able to do so myself. I never could have foreseen the professional path I've taken nor charted a course to the position I now hold.

I graduated summa cum laude with a bachelor's degree in mechanical engineering from the University of Central Florida. While there, I had the opportunity to conduct independent materials science research, an experience which was pivotal to everything that followed. Not only did I learn laboratory skills, but I also assisted with the finances and writing reports and proposals. The research group of graduate and undergraduate students was dynamic and collaborative. Some of my favorite memories are the all-nighters making posters in the days leading up to major conferences. My research focused on electrochemistry, to study the environmental degradation of high-temperature superconductors and stress corrosion cracking of stainless steel alloys. For graduate school, I wanted to study surface oxidation with scanning probe techniques, tools that were just becoming commercially available. I wrote a proposal to NSF on this topic and was awarded a 3-year graduate fellowship. I joined a group at the Johns Hopkins University to pursue a PhD in materials science and engineering. That fall, I married a doctoral student also in materials science. The delivery of the scanning probe system was delayed so I worked on a side project to fabricate and characterize photoluminescent porous silicon which became the topic of my master's thesis. As I was finishing the required coursework and ramping up my doctoral research, several unexpected events took place. I had a difficult pregnancy that required months of bed rest, my advisor left the university, and my husband took a job on the other side of the country at the US Bureau of Mines in Albany, Oregon. I knew I wanted to teach at the university level which required a PhD, so after relocating with a newborn, I worked to find a way to finish my degree. Having completed my coursework, the first few months were focused on studying for the graduate board exam which gave me time to look for the resources to do my research. The Bureau of Mines let me use a small concrete building where I could control vibration, Hopkins let me borrow the scanning probe system, Linfield College gave me access to equipment in the physics department to make samples, and I used the library at Oregon State University. The lessons learned in building partnerships were perhaps even more valuable than the advancements I made in understanding of the initial stages of copper oxidation using scanning tunneling and atomic force microscopy. Meanwhile, congressional initiatives called for the elimination of the Bureau of Mines, so my husband accepted a position at Bethlehem Steel's Homer Research Labs in Pennsylvania. Since this was before the widespread use of email, my advisor and I spent hours on the phone reviewing drafts of my dissertation sent by FedEx. I remember clearly pulling the final page of my dissertation off the printer, dropping keys on my supervisor's desk, pulling the gate shut, and jumping in the car on our son's second birthday for the trip back East.

Once settled in Bethlehem, I took a part-time research position in the Materials Research Center at Lehigh University working on functionally graded thermal barrier coatings for turbine blades until I had my second son. Although mostly at home for the next year, I worked with Lehigh faculty to write proposals and papers, and then I got a call from the center director. He offered me an industrial liaison position with the promise of flexible hours; it was the perfect fit. I found I was well suited to promoting and managing the complex interactions between academia and industry. Over the next 5 years, I grew the program, worked closely with Ben Franklin to support entrepreneurs and local start-ups, and established a multimillion dollar public–private partnership in microelectronic packaging. I also built my own research group, funded by the Office of Naval Research, and taught corrosion and electrochemistry classes for the materials science department. The steel industry, however, was not doing well and we decided to do a nationwide job search shortly before Bethlehem Steel declared bankruptcy.

Finding positions for two professionals is always a challenge, but especially so when you have the same technical specialty. I was offered two faculty positions and my husband had offers from a small company and a research institute. Although I loved teaching and research, at that time I decided that a tenure-track faculty position would not allow me the flexibility I still wanted with my small children, which was certainly a deviation from my original professional plan. We moved to Charlottesville, Virginia, where my husband joined a small company. For the first year, I continued to work for Lehigh managing the public–private partnership and helping to revise the university's intellectual property policy. I became actively engaged in the tech community and began consulting for the Virginia Center for Innovative Technology as my responsibilities at Lehigh wound down. I also took a position teaching physics and advanced placement chemistry at a local private high school. My role at CIT grew and I was promoted to director of the Virginia Nanotechnology Initiative where I led an alliance of academic institutions, industry, and government laboratories. I worked closely with the legislative and executive branches of the state government and the Virginia congressional delegation. I compiled an inventory of nanotechnology assets; facilitated research and commercialization collaboration; prepared and presented reports, strategic plans, competitive analyses, and investment proposals; reviewed legislation; provided technical support and briefings; and conducted outreach to build community. During this time, I was also building connections to the Office of the Vice President for Research at the University of Virginia and they created a new part-time research program manager position. In this role, I was responsible for building cross-school teams and leading proposal development for large programs. I also supported statewide efforts including the Virginia Research and Technology Advisory Commission (VRTAC) and served on Joint Commission on Technology and Science (JCOTS) citizen advisory committees. Although I was juggling family and several part-time jobs, I had the flexibility to work around the clock. As funding for the VNI was declining, I moved into a full-time position at UVA with an equal split between the program management role and as managing director of the Institute for Nanoscale and Quantum Scientific and Technological Advanced Research (nanoSTAR). At nanoSTAR, I oversaw institute operations including research program development, budget management, marketing, communications, and outreach. I established and administered funding programs for faculty seed projects, undergraduate summer research, and graduate student travel. I also designed and established an industry collaborative research program and facilitated the formation of a multimillion dollar public–private partnership in nanoelectronics. My passion for mentoring students continued and I taught materials science and corrosion classes, advised numerous senior projects, served on graduate committees, and was the advisor to Tau Beta Pi and the Nano and Emerging Technologies (NExT) club.

Shown an advertisement clipped from “The Hill” for a policy analyst, I reached out to colleagues at the National Nanotechnology Coordination Office (NNCO) to learn more. With one son in college and the other finishing up high school, I became a consultant at the NNCO while maintaining a visiting position in materials science at UVA. My primary responsibility was to support the Nanotechnology Signature Initiatives and after a couple of years I was asked to join the leadership as deputy director. I returned to UVA as a principal scientist and under the intergovernmental personnel act (IPA) joined the National Science Technology Council of the White House Office of Science and Technology Policy, and was later promoted to Director. In this role, I now lead the office that provides technical and administrative support for the National Nanotechnology Initiative and coordinates collaboration among the 20 federal agencies that invest approximately $1.5 billion annually in nanotechnology research and development. I also serve as the spokesperson for the NNI nationally and internationally. In addition to facilitating interagency coordination, I have strengthened communication with the research community through collaboration with technical societies, associations, and major conferences; initiated and expanded mechanisms for public outreach and STEM education including podcasts, contests, videos, animations, and student and teacher networks; and expanded the use of communities of interest including the US-EU communities of research.

My technical knowledge is of course an asset that enables me to advance major R&D initiatives, but my experience communicating across sectors and building collaborations has been equally important throughout my career. And it’s a lot of fun.

LeighAnn S. Larkin Retrospectively, my path into science was predictable. I was a curious child, and in school I had always loved my math and science courses. However, it was not until my senior of high school that I made the conscious decision to begin my journey to becoming a scientist. At 17 years old, with the encouragement of my high school physics teacher, I participated in a research opportunity during which I was able to conduct my own research. I immersed myself in the sciences and solidified my goal to eventually become a scientist. I started my journey majoring in physics at a small liberal arts school in NY state, The College at Brockport. In my senior year of college, I took my first quantum mechanics course. The strange and complex laws governing the world of the very small intrigued me more than any topic I had previously studied. I was fascinated by how these quantum mechanical properties influenced the macro-world we live in. I observed as modern technologies were utilizing nanoscale phenomena to greatly improve our quality of life. I decided I wanted to pursue a PhD where I could study fundamental principles to improve our world's nanotechnology. Upon graduation, I immediately joined the Nanoscale Heat Transfer laboratory under the advisement of Dr. Pamela Norris at the University of Virginia. I began studying how to best optimize heat transport for a range of applications, such as thermoelectric, magnetic storage, and microelectronic devices. I am currently in the process of finishing my PhD in Engineering Physics and finishing a dissertation aimed at advancing our current understanding of thermal transport across metal/semiconductor interfaces. As I progress in my career, I hope to continue conducting research on the transport properties of materials and how these properties can be tailored to improve the technology ubiquitous in our everyday lives.

As a first-generation college student, I believe that without the encouragement and support of my mentors and peers, my journey may have evolved very differently. I have channeled these beliefs into a commitment to mentoring the next generation of scientists and improving the climate of the sciences within the academy. I joined UVA's NSF-sponsored Institutional Transformation ADVANCE program as a research assistant. The ADVANCE program is focused on methods to increase representation of women in the academy in the sciences. The UVA program, referred to as UVA Charge, has a special emphasis on Voices and Visibility, increasing the visibility and sense of belonging of STEM women at UVA. My research has been focused on collecting ethnographic data from UVA's staff and faculty on the diversity climate at UVA and how they have been influenced by institutional change programs and policies. In addition to following my own career path, I believe that it is equally important to create an environment that enables our next generation of scientists to be able to pursue their own passions and craft their own journey.

Saniya LeBlanc My engineering career path has been a windy road with detours down avenues in education and service. For most of that path, my identity has been one defined by exception. The first exception was my decision to be a mechanical engineer. Unlike most people, I chose my discipline when I was a young child, and I never changed my mind (or regretted the decision). My upbringing was a fortunate exception. From a family full of female STEM professionals, I never realized that my career choice might be atypical, my proficiency in math might defy a societal norm, or my gender might distinguish me. I passed most of my undergraduate career in happy oblivion, learning independently with my nose in a book, reveling in the beauty that is engineering, vaguely aware that about 80% of my peers were male and only one of my engineering classes was taught by a woman (a fact which held true for the duration of all four of my engineering degrees).

Some very determined professors nudged me towards graduate school and graduate fellowships, so, with a B.S. in mechanical engineering (and a minor in French) from the Georgia Institute of Technology, I went to the University of Cambridge as a Churchill Scholar to earn a research-based master's degree in engineering. I had deferred admission to Stanford University, and I was supposed to head to sunny Palo Alto to pursue a PhD after finishing my degree at Cambridge. My path seemed clear, but my heart was going in another direction. I felt a calling to serve society in a meaningful way, and it was not clear how graduate school fulfilled that calling. Maybe it was the many hours in a cleanroom bunny suit trying to fabricate my device to no avail, but research was not fulfilling my passion for engineering.

Skimming a bookshelf in a college bar (the college bars have libraries at Cambridge), I picked up *Savage Inequalities: Children in America's Schools* by Jonathan Kozol, and, for the first time, I stared my privilege in the face. The systemic inequity in our education system appalled me. I was humbled … and impassioned to become an educator. I passed up Stanford's graduate fellowship, deferred the National Science Foundation Graduate Research Fellowship, and joined Teach For America to teach math and physics in an urban high school—to the dismay of family, friends, and mentors who were concerned it was a career mistake.

Teaching in a diverse, high-needs community fundamentally altered my understanding of society. With graduate classes in education, professional development, and many, many hours of exhausting practice, I started to learn how to be a teacher. More importantly, I started to understand how policy, paradigms, culture, and social injustice form a tangled web in which so many people get caught. I was no longer able to wrap myself in a cocoon of science and engineering, and my career path as an educator, engineer, or something else entirely was unclear. Although I was deeply fulfilled by my role as a teacher, I missed engineering. I longed for that hard engineering that makes you feel exhausted but energized when you finally conquer a technical challenge. I even missed the clean room (sort of). Maybe those mentors were right, and I should be an engineering professor—an engineer and an educator.

After a 3-year detour, I finally made it to Stanford University where I felt very much like an exception. I had never heard of Stanford before an undergraduate professor told me to apply there, so maybe it is no surprise I was out of place. Perhaps out of a sense of survival, I focused on what I knew best—learning. I relished the cornucopia of engineering topics—nanomaterials, energy systems, thermal transport, and microsystems—until I found the theme which united it all: energy. It links the nanoscale to the macroscale and provides invaluable services to society. The materials, manufacturing techniques, devices, and even economics of energy systems fascinate me. I also used the time at Stanford to learn about engineering education, especially the education research which drives better teaching and learning.

After obtaining my PhD, my passion for energy technologies led me to join Alphabet Energy, an energy technology startup company, as a research scientist. I created research, development, and manufacturing characterization solutions for thermoelectric technologies and evaluated the potential of new power generation materials. It was an outstanding industry experience, but the educator in me missed working with students.

In 2014, I joined the Department of Mechanical and Aerospace Engineering at the George Washington University. With a grant from the National Science Foundation, I created an undergraduate Nanotechnology Fellows Program which allowed me to combine my research and education expertise to influence future generations of scientists and engineers. The experience prompted the discussion presented in this chapter. My research is also an enjoyable exception since it spans many disciplines: thermal sciences, materials science, mechanical engineering, engineering economics, and engineering education to name a few. I have the privilege of conducting exciting, interdisciplinary research in advanced materials and manufacturing techniques for energy systems. I hope to push the boundaries of how we think about the link between materials, manufacturing, and systems for energy technologies.

As I continue on my path, I hope to use my experience as the exception to serve others and offer a perspective that deepens discussions between scientists, engineers, and educators. Many people do not have the luxury of learning independently, immune to societal pressures, identities, and stereotypes. They are not handed the privilege of unabated educational opportunity with the chance to pursue a career about which they are passionate. I aim to recruit and guide future engineers through the perilous journey of finding their own exceptional paths.

Karin L. Lee My interest in pursuing biomedical research started at a young age. As long as I can remember, I was interested in science; biology and chemistry were my favorite classes throughout grade school. Toward the end of high school I decided that I wanted to pursue a career in biomedical research after attending an engineering summer camp and participating in a summer internship in a biomedical engineering lab. I found the field appealing because the research done was directly able to impact human health. However, as an undergraduate, I learned that the field of biomedical engineering was broader than I had imagined and encompassed a range of research interests, everything from prosthetics and implants to tissue engineering and nanoparticles. Luckily, I had the opportunity to work in multiple labs that had different research interests and found that I was most interested in using biomaterials for biomedical applications.

My specific interest in nanotechnology grew out of this interest in biomaterials. I was first introduced to nanotechnology as an undergraduate, and as I considered graduate schools, I aimed to find a lab that worked with nanoparticles. I ultimately joined Dr. Nicole Steinmetz's lab, where we focused on using plant viruses as nanoparticles. I was fascinated by this work because the concept of using natural carriers to better human health was unique and innovative. My thesis work focused on the development of potato virus X (PVX), a flexible, elongated plant virus, for use as a cancer therapy. My early projects with PVX utilized it as a traditional nanoparticle for drug delivery, while my later projects investigated its use for immunotherapy. I received my PhD from Case Western Reserve University in 2016 and soon after started my postdoctoral research.

I am now a postdoctoral research fellow at the National Cancer Institute within the National Institutes of Health. I am working on the development of cancer vaccines, to be used in combination with other immunotherapies, and have had the opportunity to learn many new techniques. I am lucky to have been able to take my interests in nanotechnology and biomedical engineering and apply the skills I learned toward preclinical research in new in vivo models, which will be used to guide clinical trials. As I move forward in my career, my hope is that the work I've done and continue to do will contribute to improving clinical options for cancer patients.

Celia Merzbacher I have always been intrigued by understanding the fundamental physics and chemistry of materials. My doctoral research was in geochemistry, investigating the arrangement of atoms in silicate melts, aka magmas. By the time I graduated, my interest had shifted. I was attracted to work at government laboratories, where I engaged in basic research on man-made materials to address real-world problems.

I began my career as a postdoctoral fellow at Lawrence Livermore National Laboratory and then took a position as a researcher at the US Naval Research Laboratory (NRL) in Washington D.C. My research focused on developing and characterizing novel materials using various spectroscopic and microscopy techniques. I performed early research on high-temperature superconductors to better understand the structure of oxygen vacancies, which correlate with the temperature at which superconductivity is observed. However, most of the materials that I investigated were amorphous. I had the opportunity at NRL to work on materials for IR-transmitting optical fibers, space-based optics, thermoelectric devices, nonreflective coatings, and IR decoys. Working on materials that could make a difference—for the Navy and for society—was very rewarding.

In 2003–2008, due in part to my expertise in nanoscience, I was asked to serve at the Office of Science and Technology Policy (OSTP) in the White House where I oversaw the expanding activities under the National Nanotechnology Initiative (NNI). I co-chaired the interagency Nanoscale Science, Engineering and Technology (NSET) subcommittee and worked closely with the National Nanotechnology Coordination Office. Nanotechnology was a research priority while I was at OSTP and the multiagency investment grew to nearly $1.5 billion. Important steps taken in the years following the enactment of the Twenty-First Century Nanotechnology Research and Development Act in 2003 included development of the first NNI strategic plan to guide the program, establishment of an interagency Nanoscale Environment and Health Implications (NEHI) working group to identify and mitigate risks of the emerging materials and products, launching of nanotechnology standards activities, and broad engagement with industry and other stakeholders. I coordinated reviews by the President's Council of Advisors on Science and Technology (PCAST) published in 2005 and 2008. The framework established for the NNI has continued to support the program as it evolves and matures and has been adapted to the National Quantum Initiative launched in 2018.

Following my tenure at OSTP, in 2008 I became the Vice President for Innovative Partnerships at the Semiconductor Research Corporation (SRC). SRC is a consortium of the semiconductor industry that invests in basic, precompetitive research at universities to address the long-term needs of member companies, often in partnership with federal agencies. Today's microelectronics depend on nanostructured materials, making the semiconductor industry, in a sense, the largest nanotechnology-based industry. At SRC I worked with member companies to identify and develop areas of research that would enable the industry to continue to create new nanotechnologies and co-authored in 2016 a vision and research guide for "rebooting the IT revolution."

In 2019 I joined the Quantum Economic Development Consortium (QED-C), an industry consortium that was established by the National Quantum Initiative Act signed in 2018. QED-C is supported by the National Institute of Standards and Technology (NIST) with the goal of growing a robust US quantum industry. Quantum technologies are enabled in many ways by advances in nanotechnology and offer myriad applications in sensing, communications, and computing. The consortium, working in partnership with government, aims to ensure that the United States remains a leader in this critical and economically important area of technology.

My work in nanotechnology also led to opportunities to serve as advisor to various efforts and organizations. I was on the committee that performed the National Academies triennial review of the NNI in 2013 and I chaired the committee that performed the review in 2016. I have helped to review and advise nanotechnology programs and projects funded by the National Science Foundation (NSF) and the Department of Energy (DOE). I am on the advisory board of the SouthEast Nanotechnology Infrastructure Corridor (SENIC) co-led by the Joint School for Nanoscience and Nanoengineering and Georgia Institute of Technology. In addition, since 2009 I have served on—and chaired since 2012—the advisory board of the Penn State Nanotechnology Applications and Career Knowledge (NACK) center. Funded by NSF, the center has focused on educating students in 2-year programs, e.g., at community colleges. An important contribution of the NACK center has been the development of ASTM guidelines for 2-year curricula to ensure that students graduating from such programs are equipped with fundamental nanotechnology knowledge and skills to meet industry needs. It has been an honor to be part of the advancement of nanotechnology through my roles as advisor and reviewer.

My career in nanotechnology has spanned basic scientific research, policymaking at the White House level, and establishing and guiding innovative R&D and workforce development programs. I am passionate about crossing boundaries among disciplines, research institutions, sectors, government agencies, and even nations. Nanotechnology both benefits from and is a vehicle for the creation of such diverse connections. I hope to continue to break down silos and remove friction in the nanotechnology research and education systems, so that society can realize the benefits of our ability to control matter at the scale of atoms and molecules.

Heena K. Mutha In high school, at the Illinois Mathematics and Science Academy (IMSA), I was taught how to learn through scientific inquiry: pose questions, conduct experiments, and analyze results. I enjoyed research and loved testing hypotheses, and I wanted to use science to solve global challenges. I decided to pursue an undergraduate degree at Franklin W. Olin College of Engineering, where the design process is used to develop targeted, context-based solutions. At Olin as a mechanical engineering major, I was able to work on a variety of projects at the macro- and microscales: building an automated microscope platform for microfluidics research, designing a liquid crystal display by actuating crystals under an electric field, building a hovercraft with a lawnmower engine, and more. I was especially interested in thermodynamics and mass transport as it could be used for developing renewable energy technologies. While at Olin I interned at the National Renewable Energy Laboratory in Boulder, CO, under the DOE undergraduate research opportunity to do dynamic wind turbine modeling for extending lifetimes of turbines. These undergraduate projects and research experiences framed my desire to pursue a graduate degree in mechanical engineering.

In parallel, I also had spent both high school and college developing and running engineering outreach programs for K-12 students. This allowed me the opportunity to spend a year in India, studying the scalability of science informal education programs. While in India I observed that potable water was a scarce resource in some rural and urban communities, whether it was only provided by the municipal for a few hours a day, or transported by tanks and collected by people standing in line with empty pots to fill. There is a large gap worldwide for delivering potable water, where engineering solutions will be key to solving this challenge. I decided to use my dissertation research as an opportunity to focus on low-energy water desalination solutions.

At the Massachusetts Institute of Technology I conducted graduate research in water desalination using nanomaterials. High surface area, nanostructured electrode design, and device integration are key to scalable capacitive deionization systems. Nanoscale engineering and surface chemistry can alter desalination performance (throughput, water quality, lifetime) at the device scale. My work at MIT has given me the tools to continue to use nanoengineering to build solutions in water, renewable energy, and beyond. At present, I am a senior member of the technical staff at the Charles Stark Draper Laboratory in Cambridge, MA. My research includes next-generation electrochemical energy storage, biosensors, microfluidic platforms for high-throughput immunotherapy, and nanowire manufacturing. I hope to use my background in mechanical engineering and nanotechnology to continue to innovate solutions for water, energy, and biotechnology. In addition, I hope to continue to mentor and share that passion with young women and students to pursue a career in engineering.

Pamela M. Norris I was in fourth grade in Portsmouth, VA, when my class visited a lab sponsored by NASA meant to introduce kids to the field of engineering. At the conclusion of the exhibit, there was a "computer" that asked the question what two topics lead to a career in engineering. I guessed my two favorite topics, math and science, and was rewarded a little patch that said "engineering." I went home and told my mom "I want to be an engineer when I grow up." As a single mom and in a family where no one had attended college, she had no idea what an engineer was, but she instilled in me the confidence that I could be whatever I wanted. The best gift she could have given. I decided then I wanted to major in engineering with the ultimate goal of becoming a math and science teacher, probably in high school.

I stayed home and attended Old Dominion University for my undergraduate degree in mechanical engineering, as it was the only affordable option available to me. Last year, only 13.5% of degrees in mechanical engineering nationwide were awarded to women. I'll never forget the first day of my thermodynamics class. As I sat eager and bright-eyed on the front row next to my friend, Diana, the instructor looked out and said: "Ugh, girls are not supposed to be engineers." I'm pretty sure his words did not have the effect he intended. For I am certain he could not have said anything that would have motivated me more. At the end of the semester, there were two As assigned, to the only two females in the class, and the instructor would later write me one of my strongest letters of recommendation for graduate school. This is a powerful example of how people's words can affect us—but the effect is really a choice we make in how we interpret and process the words.

Contrast this to my fluids teacher. He made the mistake of writing, "Seems you are not doing quite as well in this class as everyone thought you would." His words also did not have the effect he intended. I was infuriated that others were discussing their expectations of me—in this case, their expectations that I would be one of the best students in the class. I responded by receiving one of the few Bs I got as an undergraduate. I really resented others expressing preconceived notions of my abilities—I didn't want to be prejudged, good or bad.

Nearing the end of my bachelor's degree, I was prepared to start looking for high school teaching positions when the department chair, Dr. Bob Ash, approached me to encourage me to consider graduate school. That thought really was outside of my comfort zone, and I don't think I ever would have gone to graduate school without his encouragement. So, I applied to MS programs (figuring with a MS, I could potentially teach courses at a community college). I applied to MIT, my dream school, and Georgia Tech, my backup. Dr. Bill Wepfer, the graduate director and my ultimate advisor, called me multiple times to convince me that Georgia Tech was the best choice for me. It was Dr. Wepfer who convinced me I was capable of a PhD. (This is when my career goals changed again, and I decided that a faculty position at a teaching college would be my goal.)

The PhD program had its own share of bumps along the way. My research was in the rather traditional and extremely male-dominated field of heat transfer in diesel engine cylinder heads. Perhaps the most significant bump along the way, however, was the PhD qualifying exam. The first try I aced thermodynamics but failed fluids and heat transfer. Then the second time I aced heat transfer but failed fluids. (Remember, I chose to get a B in fluids at ODU.) I was supposed to be released from the program, but Dr. Wepfer went to bat for me and I was allowed a third attempt. In the 6 months of prep I took five fluids classes, and yes, aced fluids the third time around. Those 6 months were definitely an emotional low for me, but it made me really examine what I wanted—YES, I wanted a PhD and to teach at the college level. And this story of failure has served me quite well as an advisor and mentor when students need to hear of experiences overcoming adversity and of failures.

As the end of my PhD approached, I began interviewing for faculty positions at mostly teaching colleges. I had several offers immediately, but from places that did not really excite me. Then I had the good fortune of meeting the then chancellor of Berkeley, Dr. Chang-Lin Tien—the father of the field of microscale heat transfer. He was giving a distinguished lecture on the topic of "excellence through diversity." He truly believed that only with a diverse team can you have creative solutions to engineering problems and that better solutions really result from a diverse set of people talking about the issues and working collaboratively.

At a reception following his talk I told him I was about to graduate as only the third woman ever to get her PhD in mechanical engineering at Georgia Tech and he said, "Oh, you should come do a post-doc with me." So after a few weeks I called to tell him I'd like to accept his offer and his response was, "Oh, I'm sorry, I don't really have a position, but good luck." While deflated, I thought more about it and I called him back and said, "I really want to come do a post-doc with you. Perhaps I could teach a class, or maybe find my own funding. I just want to work with you. I'll work for free." He was left speechless. He called back 2 days later and said he'd found a position for me. Definitely the best career move of my life because he was an amazing mentor. He approached each mentoring situation differently—recognizing that mentoring is not a one-size-fits-all activity.

I also totally switched my field of research while at Berkeley, from heat transfer in diesel engines to the much more exciting, cutting-edge field of microscale (or nanoscale) heat transfer. This bold move required a huge dose of self-confidence! Importantly this new field was very supportive and nurturing. Nearly all the faculty within the field at that time traced their foundation to Tien (most still do) and he had taught them a culture that was very supportive. In this community mentoring is expected and valued.

When I left Berkeley I ultimately chose UVA over a few other offers. I have been fortunate enough to have been given many unique opportunities along the way. The then provost Gene Block sponsored my attendance at a month-long intensive residential program for Women in University Administration in 2007—a clear signal of the University's commitment to my development. I was, however, quite aware that I was often the only female in the room, and I've often found myself in the position of having to be the spokesperson or the watch guard for "all women" in similar minority populations. Wishing to enhance the environment for other women in STEM, I began applying for an NSF Institutional Transformation grant in 2005, and on our third attempt we were finally awarded a $3.2 M ADVANCE IT grant in 2012. I'm extremely proud of the work we are just now finishing up with this award.

When I completed a Mission Writing workshop a few years ago, I converged to "My mission is to help others, be they my kids, students, faculty, or co-workers, to succeed beyond their wildest dreams." It is this mission which motivates. As I have accepted additional administrative responsibilities, first as Associate Dean of Research and Graduate Studies in 2011, then as Executive Associate Dean for Research in 2015, and as Executive Dean in 2018, it is because the ability to potentially impact a larger sphere of people excites me.

Christie M. Sayes People often ask me how and why I became a scientist. My path is not traditional, but it was clear to me; I lived by "seize the opportunity when it presents itself." I attended Louisiana State University in Baton Rouge, Louisiana, in my college years. While those years were certainly transformational in character, it was the next 4 years that shaped my future and placed me on the path where I am today. I attended Rice University in Houston, Texas, during my graduate school years. As a trainee in the chemistry department, I was challenged in physical chemistry (e.g., quantum mechanics, thermodynamics, wavefunctions, and heat transfer). But I enjoyed in the adversity; after all, nothing worth doing is easy. Not only could I learn the subject matter, but I could also communicate it (as a teaching assistant) and practice it (as a research assistant). I learned that being a trainee meant more than being a consumer of information; I also had the responsibility to produce new knowledge for the scientific community. I learned quickly that criticism was part of the job and accolades are few and far between. In my experience, both (critique and praise) have the potential to thrust you into the next realm of scientific curiosity—which corresponds directly with professional success.

I am now a practicing research scientist in the fields of chemistry and environmental health. Currently, I hold the position of Associate Professor of Environmental Science and Toxicology at Baylor University in Waco, Texas.

The 2018 Sayes Research Group in the Department of Environmental Science at Baylor University: Students studied issues related to nanotoxicology, nanomedicine, and particle chemistry. Top row (left to right): Gaby Cruz, Thelma Ameh, Henry Lujan, Daniel Kang, and London Steele. Bottom row (right to left): Sahar Pradhan, Desirae Carrasco, Christie Sayes, and Marina George

My subject matter expertise includes advanced materials, human exposure and health effect exposure, and risk science. My activities include working with partners, collaborators, and clients in designing and directing studies and training and advising facility staff. I possess a working knowledge of laboratory science and US regulatory climates. Routine activities include data collection, analyses, and interpretation as well as result documentation and reporting. Data is always related back to the published literature. Lastly, I function as point of contact for study control. Formerly, I served as a director of the environmental health program at RTI International and an Assistant Professor of Toxicology at Texas A&M University.

The 2010 Sayes research group in the Department of Physiology & Pharmacology at Texas A&M University: Students studied the mechanisms of toxic action after engineered nanomaterial exposure. From left to right: Michael Berg, Aishu Sooresh, Christie Sayes, Niveeta Bangeree, and Amelia Romoser

With more than a decade of experience in the fields of nanotechnology and nanotoxicology, I have authored numerous publications, including original research, invited reviews, and book chapters. I am a member of the Society of Toxicology and recently served on the Scientific Advisory Board for the EPA's FIFRA Program. In addition, I serve as Associate Editor for *RSC Toxicology Research* and on the Editorial Board of the journals *Toxicological Sciences*, *Nanotoxicology,* and *NanoImpact*.

I received my PhD in Chemistry in 2005 from Rice University. My dissertation focused on the "nano-bio interface." In 2005, I joined the DuPont Company as Visiting Scientist and aided in the drafting of the DuPont-Environmental Defense Nano Risk Framework.

The 2008 Nano-Effects Working Group at Haskell Laboratory for Environmental Health at the DuPont Company: From left to right: Maria Donner, Christine Glatt, Christie Sayes, Brian Slezak, David Warheit, Carol Carpenter, Xing Han, and Diane Nabb

The 2007 Nanomaterial Aerosolization Team at the DuPont Company: From left to right: Michele Ostraat, Tracy Rissman, Kenneth Reed, and Christie Sayes

Daphne L. Schmidt Life is a journey with many pathways, and I attribute who I am today to a convergence of the paths that were chosen and the serendipitous opportunities that arose unexpectedly. Growing up in an Army family, I had the opportunity to live around the world as my father was stationed in places as far flung as Orleans, France, and the Panama Canal Zone. I truly treasured those experiences of living in completely different cultures, rich with traditions. They planted a seed of curiosity about the world and those that inhabit it that has continued to grow throughout my life.

I attended Virginia Tech, eager to study biology and psychology. While there, I had the opportunity to do some independent research with a psychology professor investigating the role of the thalamus on information processing. This was my first taste of pure scientific research and I found it fascinating. But the time in the labs also helped me realize that I needed to find a career that involved not only science, but also interaction with people. So, after deep consideration, I decided in my junior year to transfer to the Medical College of Virginia to study nursing. It was the perfect fit.

As a newly graduated R.N., I specialized in pediatric nursing and worked in a special care nursery. The nursery attended to any returning newborn ICU infants and served as a step-down unit for the pediatric ICU. It was a high-charged environment that was demanding and exciting, and required the ability to work with multiple health team members and families. I learned a great deal about the complexity of mind and body interactions in health and the power of education to support positive outcomes. During this time, my husband was in medical school and once he graduated the Army moved us away from Virginia and had us crisscrossing between the hills of Texas, the hot sands of the Mojave Desert, and the whirlwind of Washington, D.C. and eventually back to Richmond.

While in Texas for the second time, I decided to make a career switch. We had three small children and although I loved the hospital environment shift work was challenging with on-call schedules and living far from family. I received my K-8/ Biology teaching certification from the University of Texas and proceeded on a new career path in science education. As a middle school science teacher in Arlington, VA, I coordinated the school science curriculum, student participation in the JASON Project, and the school science fair, and served as the regional science fair committee member and school liaison. In addition, I successfully applied for several grants to enhance the hands-on learning experiences of our students including a Biotechnology Institute's Genome Project Education grant, an NBC Weathernet weather station grant, and a School Greenhouse Project grant. In 2005, I received my M.Ed. in Administration and Supervision from the University of Virginia and shortly thereafter we moved to Richmond, VA.

Most recently, it was my privilege to serve as the Coordinator of Professional Development and Director of the Summer Regional Governor's School at the MathScience Innovation Center (MSiC), a STEM hub serving 12 school divisions in Central Virginia. I was charged with supporting the MSiC's consortium school division teachers with pedagogically and content-rich STEM education professional development. I was also the project lead for the Center's Nanoscience & Nanotechnology initiative, a program that grew to include a Nano Fellows Institute, short courses, conference model classroom lessons, and student enrichment programs. It was truly an honor to present our work in nanotechnology education to the Triennial Review of the National Nanotechnology Initiative at the National Academies of Science in 2015. Through collaboration with MSiC faculty and adjuncts, college, university, and regional partners, I worked to bring innovative concepts such as nanoscience into the classroom, building a framework of vertical learning experiences for both students and teachers in order to prepare students for future academic and market challenges.

An extension of my position at the MSiC was serving as liaison for our work with Challenger Center Headquarters. After the Challenger disaster in 1986, families of the Challenger astronauts banded together to form a foundation with the mission to continue the education goals of the Challenger mission. Rather than a statue or memorial, the families decided to develop space simulation learning centers that would teach and inspire youth to explore a career in space science and engineering. To date, there are more than 40 Challenger Centers around the world.

Stepping into one of the Challenger simulation centers is like visiting the Johnson Space Center. Students begin their mission in a briefing area, and then move between mission control and a space capsule conducting research experiments with their fellow "astronauts," analyzing it, and making decisions that will guide the mission to a successful conclusion. The MSiC has the only Challenger Center in Virginia. It was thrilling to be able to help bring new missions to our Center exploring everything from climate change and Earth systems, to cutting-edge Mars missions. We also partnered with Challenger headquarters on several grant projects developing virtual space exploration experiences, making an exciting learning opportunity available to more youth across the nation.

I have had the pleasure of working very closely with our regional PBS station (Community Idea Stations) and their Science Matters initiative, both coordinating hands-on activities with my MSiC colleagues to complement programming and serving on the Science Matters Leadership Team. Most recently, I was asked to serve as Chairperson for this diverse group of science and education leaders, committed to supporting the station's goals.

Professional affiliations include the Association for Supervision and Curriculum Development, the National Science Teachers Association, NASA AESP Professional Development Alliance, and the Science Matters Leadership Team. I was previously a James Madison University adjunct faculty member in the office of Outreach and Engagement for the Big Ideas of Nanoscience & Nanotechnology Fellows Institute at the MathScience Innovation Center.

Life is certainly an adventure, with one experience building on another and opportunities sometimes arising in the most unexpected places. I adore the thrill of learning something new and sharing ideas with others. Here's looking to the next great adventure!

Quinn A. Spadola I am Associate Director for Education and Outreach for the NSF-supported National Nanotechnology Coordinated Infrastructure (NNCI), Education and Outreach Coordinator for the Southeastern Nanotechnology Infrastructure Corridor NNCI site, and an Academic Professional in the Institute for Electronics and Nanotechnology at the Georgia Institute of Technology.

Prior to joining Georgia Tech, I was Education and Outreach Coordinator and Technical Advisor to the Director in the National Nanotechnology Coordination Office. I joined that office as an AAAS Science and Technology Policy Fellow in 2014 and joined the professional staff after completing my fellowship. There I worked to educate students, teachers, and the general public about nanotechnology through conferences, contests, networks, videos, and podcasts.

I was inspired to go into education and outreach while working on my Physics PhD, which I earned from Arizona State University in 2008. While at ASU, I became a Center for Nanotechnology in Society-Biodesign fellow. As part of that program, I established a monthly "Science Café" series in the Phoenix area. My goal was to provide an opportunity for interested, nonexpert adults to speak with scientists and engineers and nontechnical experts like lawyers, philosophers, and social scientists. Each conversation focused on a specific research topic and how it affects audience members' lives. Topics included nuclear power and our ability to assess risk, reconciling religious faith and acceptance of evolution, ergonomics in the military, and the future possibility of brain-machine interfaces. While I enjoyed my research, to me, creating opportunities for people to learn about and share their opinions on current research was so much more important and satisfying.

This experience is what led me to attend film school. My PhD gave me a strong scientific background, but not the skills to communicate with a general audience in an effective and entertaining manner. I earned an MFA in Science and Natural History Filmmaking from Montana State University in 2011. I have always been interested in going beyond the "gee whiz, that's cool" aspect of science outreach to include the politics and historical context behind science research. In film school I made videos that integrated science, my experience as a female scientist, and the historical context of gender and STEM.

The next step in my career was to become a AAAS Science and Technology Policy Fellow. Having started in 1973, this competitive fellowship program requires that scientists have a PhD and an interest in and understanding of the societal impacts of science. The purpose of the program is to place scientists and engineers in the federal government in order for them to learn about and contribute to policymaking. This experience allowed me to add an additional dimension to my understanding of the scientific research enterprise. This is also where I became formally involved in nanotechnology education and outreach. Working in this space combined my technical background (my research was on an AFM-based nanopore DNA sequencing method) and my desire to engage multiple audiences with science.

Being able to work directly with students, educators, and the general public in my current position is as satisfying as the Café conversations I helped to start back in graduate school. I hope to continue to inspire everyone from elementary school students to curious adults to learn more about science and engineering.

Nicole F. Steinmetz My inspiration to pursue innovative research reflects my time as a high-level athlete. I began competitive artistic roller figure skating at age 5, and practiced my skills alongside my school work. Competing for the German National Team, I gained top 10 positions in European and World Championships. I won gold at the German Championships (2000), and silver at the European Championships (2002). To achieve the highest rewards in internationally competitive sports one has to be creative and innovative, and extremely disciplined, and must also have the courage to take risks. Through training and competing in skating I achieved self-discipline, focus, dedication, unlimited enthusiasm, and a love of competition at the highest levels. My time as a high-level athlete had a great

impact on my scientific career. I learned to take risks and to be bold and daring when learning new and difficult jumps, and to always stand up and try again until I succeed.

My interest in bio-nanotechnology was sparked when, as an undergraduate student, I attended a lecture on the molecular farming of antibodies in plants using expression cassettes derived from plant viruses. I was immediately fascinated by the idea that we can reengineer nature's nanocarriers—plant viruses—and use them to target applications in human and plant health. I have studied plant virus nanotechnology since my undergraduate days, and during each step of my scientific training I focused on a different aspect of technology development. In my early work I focused on understanding how plant viruses interact with their natural hosts and I optimized molecular farming protocols for the production of pharmaceuticals in planta (Master's Thesis, 2003–2004, RWTH Aachen' Germany). During my PhD research as a Marie Curie Early Stage Training Fellow (2004–2007, John Innes Centre, Norwich, UK), I studied the development and nanofabrication of electronic virus-based arrays for applications in sensor and chip technology. As a postdoctoral fellow (2007–2010, the Scripps Research Institute, La Jolla, CA, USA) funded by an American Heart Association Fellowship and a National Institutes of Health K99/R00 award, I then turned toward medical applications and I established the design principles that allow plant virus nanoparticles to be used for in vivo targeting in mouse models of human disease.

This launched my career as an independent researcher. I started my faculty position at Case Western Reserve University School of Medicine and joined the Biomedical Engineering Department, where I was promoted through the ranks of Assistant Professor (10/2010), Associate Professor (07/2016), and Full Professor (01/2018). I held the George J. Picha Designated Professorship in Biomaterials and served as Director of the Center for Bio-Nanotechnology. In 2018, I joined the University of California, San Diego, as Professor of Nanoengineering. My research efforts have been recognized by many awards. For example, I was elected fellow of the American Institute of Medical and Biological Engineering (AIMBE) in 2017, and I was recognized as a 2016 American Cancer Research Scholar, a 2015 Young Innovator in Cellular and Molecular Bioengineering, and a 2014 Cleveland Crain's 40 under 40 Awardee. I have authored more than 150 peer-reviewed journal articles, reviews, book chapters, and patents. I have also authored and edited books on virus-based nanotechnology. We have been fortunate to land many research grants to support our research program. My research is funded through grants from the NIH and NSF as well as the Susan G. Komen Foundation, American Cancer Society, and American Heart Association. Over the past 8 years, I have attracted grants as principal or co-principal investigator exceeding $18 million.

Our research program focuses on the development and testing of plant virus nanoparticles with applications in medical imaging, drug delivery, and immunotherapy. I enjoy leading an interdisciplinary research program and team, bringing together an international group of postdoctoral fellows and students from the biomedical

engineering, chemistry, biology, botany, and immunology disciplines. My first PhD students, who graduated in 2016, are the co-authors of the chapter we have contributed to this volume. Amy Wen is now a postdoctoral fellow at the Wyss Institute at Harvard University, and Karin Lee is a postdoctoral fellow at the National Cancer Institute. Both were terrific students and colleagues in my laboratory, and set a high bar for other students to follow. I am sure they will have an immense impact as women leaders in the field of nanotechnology.

In addition to training the next generation of scientists and engineers in bio-nanotechnology, I am eager to make nanotechnology accessible to the general public. Toward this goal, we have taken an interdisciplinary approach that mixes STEM with the performing arts. In a collaborative effort between myself and Knight & Brinegar, a retro-forward musical-writing team, we developed "The Nanoman"—a project that bridges the fields of nanotechnology, gaming and graphic design, and theatre, to capture the concepts of drug delivery and cancer nanotechnology. Across various media platforms, our tiny superhero "The Nanoman" is on an important mission: "*Go, go, Nanoman: find and kill that tumor man!*" In video clips, music videos, video games, and live incarnations, we aim to make science accessible, entertaining, and enlightening. We use story, music, and interactivity to explain the challenges of current cancer treatments as well as the engineering principles that can be applied to enhance cancer therapy, with the ultimate goal of improving patient survival.

The fun on the computer screen, tackling cancer with superpowers, is the daily reality in our laboratory. Although we are still early in the development and validation stages, we have successfully demonstrated our virus-based cancer immunotherapies in various mouse models and even in the treatment of companion dogs diagnosed with late-stage melanoma, and we are driven and focused to move this technology toward clinical testing. Nevertheless, we have just scratched the surface of this technology and many more discoveries await us!

Evelyn N. Wang I grew up in an academic family where both of my parents received their PhDs from MIT—my mother in chemistry and my father in electrical engineering. I had two older brothers that excelled in math and science. While I also enjoyed learning, I spent much of my childhood playing the piano and violin. It was a way to help differentiate me from my brothers and it allowed me to express myself in another way, given that I was also very shy. I had the opportunity to perform a lot and also play in orchestras and chamber music, where I was able to form many strong friendships. It also helped me learn how to be a leader as I was the concert mistress for my orchestra for 3 years where we travelled to perform in many places around the world.

While I loved music, I knew that I would not pursue it as a profession. I chose mechanical engineering as an undergraduate at MIT because I thought that it could combine the elements of math, science, and artistry that I enjoyed. The breadth of the major allowed me to be exposed to so many things. Ultimately, I decided to pursue graduate school at Stanford University where I worked at the intersection of heat transfer and microelectromechanical systems (MEMS). Specifically, my research focused on new two-phase heat dissipation strategies using silicon-based MEMS devices for thermal management of integrated circuits. Graduate school was a wonderful time. While there were many moments of uncertainty, it was also a time that allowed for an intense focus on research, which I enjoyed. I was also fortunate to have tremendous advisors that gave me the flexibility to pursue my interests and yet gave me guidance when I needed it most.

After I received my PhD, I joined Bell Laboratories, Alcatel-Lucent, as a post-doctoral associate for 1 year. It was an incredibly eye-opening experience as I became exposed to another world of nanoengineered surfaces. I was fascinated by the ability to use such approaches to have fine control of interfacial phenomena. My exposure to this area opened up many new possibilities as I started my career as a faculty member in the Mechanical Engineering Department at MIT. While I never anticipated being back at MIT, it felt like home when I returned. I had, again, tremendous support from my colleagues, the department, and MIT. I started my research program focused on using nanoengineered surfaces to enhance heat and mass transport processes. My work has since expanded to applications beyond thermal management, including energy conversion and water desalination, among others. The opportunities as a professor have been tremendous. It has given me the flexibility to explore curiosities and pursue research avenues that I find meaningful. I have been able to interact and learn from so many talented colleagues, students, and postdocs. I can truly say that it has been my dream job, and I have been very fortunate to have the opportunities that have guided me towards this path.

Amy M. Wen My journey that led me to research in nanotechnology was directed by fortuitous events and fantastic mentors. My primary passion since I was young has been in problem-solving. I highly enjoy the “Aha!” moments that come when finally solving particularly challenging puzzles, especially ones that require either tricky and unusual or simple and elegant approaches. All throughout my schooling, my family and teachers have all wholeheartedly encouraged my interest. Moreover, they went above and beyond to provide additional resources for my classmates and me, such as using their spare time to conduct sessions on interesting topics such as game theory. Their enthusiasm fueled my own and led to exciting opportunities, including a chance to represent my state of

North Carolina at the American Regions Mathematics League competition. It was a gratifying experience to participate as part of a tremendously talented team and also to be able to contribute one of the top scores that led to our success against over 100 teams both nationally and internationally.

While I enjoyed the challenge of participating in competitions, I also wanted to do more and utilize my problem-solving skills to reduce and prevent human suffering from disease. The solution was obvious when I became aware that a university just a few blocks away from my high school had a nationally recognized program in biomedical engineering. Biomedical engineering was the perfect blend of the problem-solving aspects of engineering being used to address the scientific challenges in healthcare and medicine. As an undergraduate at Duke University, I had the opportunity to participate in the Pratt Research Fellows Program, which matched labs interested in training interns with students interested in particular labs' research. I was drawn to Dr. Ashutosh Chilkoti's lab, where bioinspired elastin-like polypeptides that self-assemble to form micelles were being used for drug delivery. Under the guidance of a graduate student mentor, (now Dr.) Wafa Hassouneh, I used molecular cloning to introduce calcium-sensitive regions so that the micelles could be triggered to release drug cargo specifically within cells due to lower intracellular calcium levels. This was my first exposure to hands-on research in nanotechnology and really sparked my curiosity and drive to continue working in a similar area in graduate school.

I was captivated by Dr. Nicole Steinmetz's lab at Case Western Reserve University because I thought her research using plant viral nanoparticles was a unique, largely unexplored approach with some interesting advantages I wanted to explore, such as their monodispersity and ease of manufacture. I would also be able to continue with the theme of applying bioinspired nanoparticle platforms for therapeutic applications. While Nicole had an extraordinary record of accomplishing a lot of amazing and high-quality science in the past, there was some hesitation because she was a new professor and the lab was not yet established. One of the deciding factors that led me to select her lab anyway was the invaluable advice Wafa gave me, which was that at the end of the day it is excitement over your research that gives you the motivation to work harder, not necessarily the seniority of your professor or the location of the lab. I was extremely fortunate that not only was the research stimulating, but Nicole also proved to be an exceptional mentor. Beyond providing research guidance, she also served as an example of how to get a new lab running, offered many opportunities for collaborations, provided a supportive environment of fellow researchers (including our co-author Dr. Karin Lee and proofreader of this biography Dr. Neetu Gulati), encouraged us to present our work at conferences, advised us on writing fellowships and grants, and overall strengthened my passion for research. Under her mentorship, I was able to work on a number of different projects studying aspects of nanoparticle design, shape, payloads, and targeting for the development of virus-based nanoparticles for both drug delivery and imaging applications, with the support of training grants and predoctoral fellowships from the American Heart Association (AHA) and the National Institutes of Health (NIH).

When searching for postdoctoral positions, I sought to expand my skill set to supplement my experience with nanotechnology. In particular, I wanted to tackle the challenge of streamlining the translation of discoveries made in the lab into the clinic. While my graduate research provided a lot of experience with in vitro cancer models and in vivo mouse models, it was clear that a scientific gap exists in translating the results from such experiments into humans. Although there are established animal models that are known to be more predictive of clinical efficacy, the results are often still inaccurate due to intrinsic differences between humans and other species. Therefore, I was keen to join Dr. Don Ingber's group at the Wyss Institute for Biologically Inspired Engineering at Harvard University for my postdoctoral training in order to learn methodologies that could more accurately recapitulate human biology. As part of my training in his lab, I have recently been awarded an NIH postdoctoral fellowship to investigate how different environmental factors affect the development of pulmonary fibrosis in a microfluidic lung-on-a-chip model and to utilize insights gained from the model for discovery of novel therapeutic approaches. The biomimetic microsystem more closely recapitulates human physiology by integrating fundamental mechanical cues from the lung microenvironment, such as tissue-tissue interfaces, fluid flow, and breathing motions, and our results can be used to complement and minimize the use of animal models when testing for safety and efficacy.

In the future, my goal is to combine my background and experiences in nanotechnology and disease modeling to advance understanding and develop strategies for the diagnosis and treatment of diseases. I am extremely grateful for the friendship and support of an excellent group of friends, colleagues, and mentors, and I aspire to reciprocate in kind by providing an encouraging and supportive environment wherever I go. I have come a long way from my roots in unraveling relatively straightforward puzzles with known solutions to now tackling more complex and open-ended challenges where solutions are yet to be discovered, and I am even more excited and passionate now to do my part to solve these problems.

Mona Zebarjadi My grandfather was living in a small rural area of Iran, called Ferdows. The world "Ferdows," means heaven. Perhaps because this was the only relatively green spot in a vast desert. Half of my family members still live there. My grandfather used to think that girls should stay home and therefore did not allow his girls to attend school. An earthquake apparently changed the faith of the family. The family lost their house and chose to move to the city to rebuild their path of life. After moving to the city, my grandfather was convinced that he should let his girls go to school. He did so for all his girls, but it was too late for his oldest daughter, my mom.

As a kid, I used to draw a lot. I never felt that I am talented in that regard, but I was enjoying the mindfulness of it. Our neighbor, seeing my passion, introduced me and my family to one of the masters of oil painting in the city, Mr. Shahbazi. I went to his class for a semester before my family realized that we cannot afford the tuition. Mr. Shahbazi though told my family that he will teach me free of charge. I became a long-time student of him and only learned about the arrangement when I was at college. Mr. Shahbazi was a great person and I soon took him as my role model. It was amazing to watch him paint. As soon as he was holding his brush, he was in a different world, not hearing anything else. I always wished I had such a passion for something, anything. I was determined to find my own brush.

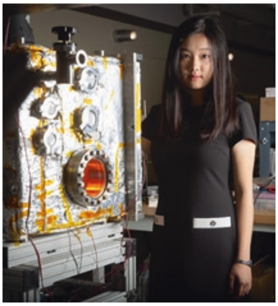
At school, I knew I was good in math and physics, but I also knew that was just relative to other students, so I did not think of myself as being especially talented in that regard either. I did not have a passion for math as I looked at it as only a tool, but I always enjoyed physics concepts so I chose to study physics. I was accepted in Sharif University, the top engineering and science school of Iran, allowing me to continue my education free of charge. So I left my family and moved to the capital. It was a very difficult experience. Back in high school, I did not have to study outside of the classroom but it was very different in college. Sharif University had a strange environment. Apparently, some of the students would enter thinking too high of themselves and rude to the faculties. So the educational system was designed to make sure to communicate well that you are not as good as you think. Perhaps that was necessary for some, but for most others such as myself with very little self-confidence, it was just overwhelming. That policy along with many family problems caused a deep depression that persisted in my first 2 years of studying. I was constantly seeking medical advice but because of the side effects of the medicines, I did not allow myself to be on them for long. I am not sure why I stayed, perhaps because I did not want to go back to my family considering that the only thing waiting for me back home was an unwanted marriage. There was no point in switching my field either as there was nothing else that I liked more than physics. I started painting again which helped me significantly with my depression. My grades also got better over time and I finished my bachelor with a GPA well above the department average despite my shaky start.

At that point, most my friends were applying to get acceptance from schools in other countries because of the unhealthy economy as well as social restrictions in Iran. I soon realized that leaving the country unmarried was just impossible with my parents. So I decided to enter the master program. A friend who is now a faculty in the United States suggested that if I work with a professor in the United States for my master thesis, I might be able to build a bridge. I surely did not share all my problems with her, but I realized that if I work with this originally Iranian professor, Prof. Ali Shakouri, for 2 years and if my dad feels secure enough, he might let me go. So I accepted the project, thinking I will do it no matter how hard it is, and I actually did it. I reached to a point that my co-advisor in Iran suggested me to go to Turkey as an exchange student to learn Monte Carlo technique (which I needed for the project) from the experts.

Growing up, we never had a family trip to anywhere except for northern part of Iran where my dad had a hotel deal offered by his bank. So this was my first trip outside of the country. I spent 2 months in Turkey under the supervision of Prof. Bulutay. Nothing in the world was better than that 2 months. I quickly realized that I can take care of myself! Prof. Bulutay assured me that I am safe in the campus. So I dared taking lonely walks in the middle of the night. I was working hard and enjoying myself at the same time. I was working sometimes until 2 am and was walking home without any fears. I was going to all sorts of concerts, ballets, and classic music thinking I will never have the chance to do anything like that again in my life. At the end of the 2 months, I had a lot of results and all three advisors were happy with the outcome of my work. I think that was the first time that I thought it is possible for me to stay in the field. It was the first time that I truly enjoyed what I was doing and my achievement. This was the brush that I was looking for.

Many ups and downs have happened after that. I moved a lot and I changed my school, and my field a lot. But once you have your brush, everything is much easier. The rest is just catching up with the ever-changing flow of life.

Many would tell you that you should dream big. But what if you are in an environment that you do not even know what dreaming big means? What if you cannot find your brush? What if you do not even know where to start? Being a faculty member at University of Virginia today, having two lovely boys and a great scientist as my husband, I feel very lucky. I grew up in an environment where I did not even know what it means to be a faculty, a researcher, or an engineer. I was unable to answer when people asked me what you want to be when you grow up. I was too shy to ask many questions. All I knew was what I did not want to be. I never dreamed big! All I did in my life was to try really hard to choose the best option available to me at the moment and to be grateful for it. I did not have much guidance growing up and perhaps that is one of the reasons I am extremely grateful to the mentors that I found later on in my life. The world is a big one and a small one at the same time. Some would know where they want to be early in their life and some finds it only at a later age. No matter where you are from, if you do choose the path that you think is right for you and not the ones that others try to impose to you, you will find the mentors that you truly need.

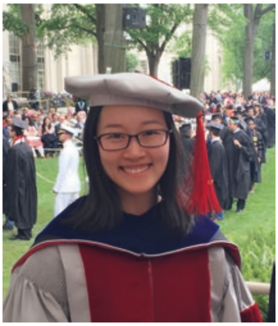


Yajing Zhao I want to make my academic path a unique adventure. Upon middle school graduation, I made one of the biggest decisions in my life—I attended the Special Class for the Gifted Young of China (SCGYC) program at Xi'an Jiaotong University, which allowed me to experience college life starting at the age of 15. The SCGYC program enabled me to largely bypass the traditional exam-centric curricula in normal Chinese high schools, and instead gave me significant room to explore knowledge of interest, such as discussing advanced mathematics problems with classmates, and conducting scientific experiments in university laboratories at an early age. In retrospect, my experience at SCGYC not only let me make treasured friends with talented peers, but also preserved and advanced some of my characteristics such as curiosity and fearlessness.

Choosing my undergrad major was another important decision I made that will influence my life. Math and biology have always been my interests since I was a little kid. However, I ended up choosing energy and power engineering as my undergrad major due to two considerations. First, my undergrad school is most well known for its engineering programs, while math and biology majors are not as highly regarded. Second, energy seemed to be the most attractive field to me among all the engineering programs. At that point, I did not realize how much my choice of undergrad major would influence my career path. Looking back, it was the moment when I journeyed down the road of studying thermal engineering. All the professional training I received, and all the academic mentors and peers I interacted with during my undergrad years, gradually cultivated in me my expertise in heat transfer, fluid mechanics, and thermodynamics.

I started my undergrad research by working on thermo-economic analysis of geothermal power plants. Geothermal energy as a source of sustainable energy is expected to make an increasing contribution to energy supply in the near future. However, there has been a trade-off in the energy efficiency of geothermal power plants and their economic benefits. Thus, I spent months developing a model to analyze and optimize both the thermodynamic and economic performance of a geothermal power plant system. My undergrad research experiences kindled my passion for advancing the frontiers of energy science, and made me believe that I am competent to explore the unknown in this field. In this case, it became a natural progression for me to pursue graduate study where I would be able to reach my full potential.

My life at the Massachusetts Institute of Technology has been a magical journey. I got to know and became greatly impressed by Professor Evelyn Wang's work through MIT News when I was a sophomore. Getting into MIT and joining Evelyn's lab is like fulfilling a dream. At graduate school, I became interested in enhancing condensation heat transfer via micro/nanoengineered surface designs. Traditional condenser surfaces, such as those used in power plants, usually form a millimeter-thick condensate film due to the high surface energy of common condenser materials. This condensate film poses an intrinsic barrier to heat transfer and therefore limits the energy efficiency of the overall system. Recent advances in nanotechnology and fabrication enable us to design and fabricate micro/nanostructured surfaces whereby we can manipulate the wetting behavior of the condenser surface and improve the condensation heat transfer performance. Previously I have worked on slippery liquid-infused porous surfaces (SLIPS) for condensation of low-surface-tension fluids. My current work focuses on utilizing capillary pressure generated by hierarchical porous surfaces to enhance condensation of water. With a deep appreciation for nature and wildlife, I am also passionate about bio-inspired surface designs for various energy-related applications.



Yangying Zhu With a curiosity for science and architecture, I attended Tsinghua University in China for my undergraduate study majoring in mechanical engineering, where I studied heat transfer and energy-efficient heating and cooling technologies for buildings. Through class and research intern opportunities, I realized that understanding the fundamentals at the small scale is a key to improving the macroscopic system-level performance. I decided to pursue a PhD in mechanical engineering focusing on microscale thermal and fluid transport. This journey completely opened my eyes to the beauty and power of micro/nanotechnology. I developed skin-inspired surfaces with microscopic "hair" arrays that can dynamically tilt in a magnetic field to manipulate fluid and light. I also applied microstructured surfaces to enhance heat transfer for cooling high-power electronics. It was fascinating to learn that small structures can make a big impact. I also enjoyed being a researcher and loved brainstorming with colleagues and mentors to find creative solutions. What excites me most is the process of searching the answers for the unknown and making new discoveries.

As a scientist, I believe that energy storage and clean energy technologies are crucial for energy and environmental sustainability. After I graduated from MIT, I worked as a postdoc in the Materials Science Department at Stanford exploring heat and mass transport problems in batteries and electro-catalysis systems. Even though energy storage and conversion are new fields to me, the research skills I obtained in my PhD training allowed me to define an interesting problem to investigate and learn related knowledges along the way. I recognized that many future opportunities lie in the interdisciplinary area. As I move forward to start my independent research career, I hope to build a program that intersects the fields of thermo-fluid engineering and materials science for more efficient thermal management and sustainable energy solutions.

I am fortunate that along this journey, I am accompanied by many female peers and mentors who are my role models. Inspired by them, I volunteered to mentor high school students from Thayer Academy on their science internship at MIT, during which I introduced to them basics of nanotechnology, including fabrication techniques and imaging tools to visualize microscopic material structures. It felt very special for me to see their curiosity and excitement because my own interest in engineering originated from high school when a few MIT undergraduate students taught us over a summer course to build an airplane model. In my future career, I hope to share my passion with more young women, and to encourage them to explore the beauty of science and engineering.