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Environmental Scientist, Environmental Science Associates, Berkeley, CA (1982–1984)
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Joanne Berger-Sweeney has conducted research on the neurobiology of learning and memory. With interests in behavior, pharmacology, toxicology, and the cholinergic system, her scientific work has focused on Alzheimer's disease and Rett syndrome. She did the proof-of-concept work on Razadyne, one of the most widely used Alzheimer's drugs in the world. She transitioned to academic administration, where she became the first African American and the first woman to serve as president of Trinity College since its founding in 1823.

Joanne Berger-Sweeney

Early Years

Growing Up in La La Land

I was born and raised in Los Angeles, in a close-knit and supportive family. I loved skateboarding, beaches, my family, and movies, and I especially loved musicals. Our home was filled with music as my mother played the piano and organ beautifully. To me, growing up in L.A. was a privilege, and I believe it was, in great part, why I have a bright and sunny attitude about life.

Los Angeles was a complex and interesting multiracial environment. You could go throughout different parts of the city and encounter people of all races and ethnicities. This was in the 1960s and 1970s, well before that kind of diversity seemed to spread throughout the rest of the country.

My parents placed a high value on education and encouraged my budding career as a scientist. I've always had a love of science and math, although there were no other scientists in our immediate family. My father, Paul Sweeney, was an attorney, and my mother, Arminta Parks Sweeney, served as executive director of the Angeles Girl Scout Council. My two brothers, Paul and John—eight and seven years older than me, respectively—followed our father's footsteps into the legal profession, and today they are both practicing attorneys in Los Angeles.

Family History

Throughout my childhood and high school years, my mother would wake me up each morning by whispering in my ear, "You can be anything you want to be." From as far back as I remember, I was aware that our family had a proud history of involved and engaged African American citizens. On my father's side, I can trace back to my great-great-grandfather, Jacob Pruett, who spent 40 years of his life in slavery and then became one of the first African American men ever to vote in the United States. Jacob's granddaughter, Alberta, was a trailblazer as well—she was the first African American invited to serve on the board of the Girl Scouts of New York City. Alberta's husband, my grandfather, was one of the first African American men to graduate from Oberlin Seminary and was minister of the largest Black Methodist Church in Harlem in the 1950s and 1960s.

On my mother's side, my second cousin was the poet Sterling A. Brown. My mother's parents were both college educated, and I was told that my maternal grandmother's parents attended Clark College in Atlanta (now

Image 1: With my mother, Arminta Parks Sweeney, as a young child, circa 1960

Clark Atlanta University)—one of the country's first historically Black colleges—when it was a two-year college, after slavery. So, I believe that on my mother's side, I am fourth-generation college educated, and on my father's side, I am at least the third generation to attend college. In other words, education was highly valued and promoted in our family.

I learned my family's history through stories that were shared to give us pride in who we were and where we came from because, of course, there might be external influences telling you that maybe you're not as smart as someone else. I think my parents felt it was particularly important to instill that sense of pride in their children, so that each of us knew where we were from and hence would gain a sense of how far we could go. The expression "I am where I am because I stood on the shoulders of giants" conveys well what my brothers and I learned growing up in our family.

My father grew up in Harlem and was a basketball star in his youth. He served in the military before heading to Atlanta to attend Clark College, where he met my mother, a fellow student, who was born and raised in Atlanta. She was younger than my father but a year ahead of him at Clark because his military service delayed the start of his college career. After my mother graduated at age 19 with her bachelor's degree, majoring in sociology and minoring in music, she earned her master's degree in sociology at Atlanta University while my father finished his undergraduate degree. My brother Paul was born while my parents were still in Atlanta, and then they moved to Washington, D.C., where my father attended Howard University School of Law. My brother John was born while they lived in Washington, D.C., and it was seven years later that I would appear on the scene, after my family had established new roots in Los Angeles.

Go West!

Family lore has it that on the day my father graduated from law school in 1954, he packed up his bags to drive cross-country to set up life in Los Angeles. My mother, with the two boys in tow, took the train to join my father a little later. My father felt that California was the land of opportunity, where our family would be perceived differently than they were in Atlanta, D.C., or New York City, where he was raised. My cousin, who is a lawyer who studies lawyers, has reminded me of how few Black lawyers there were in the United States at that time—about 2,000 in the 1950s. My father graduated number two in his law school class at Howard, where Thurgood Marshall, the first Black U.S. Supreme Court justice, was an alumnus. My father, a few years later, was taught by some of the same professors as Justice Marshall.

My parents became deeply involved in the fabric of their new California home. My father's first job was at the Urban League before he went into private practice. My mother spent most of her career working for the Girl Scouts before eventually becoming executive director of the Angeles Girl Scout Council. They both had deep roots in the church and depended on community. Social networks existed long before Facebook, and my parents were very successful in using theirs to help themselves and others. My parents took risks and seized the opportunities that their education afforded them. They developed and used their networks to the fullest, and those networks supported their children and inspired them to learn.

Church and Civil Rights Movement

I was raised during the civil rights movement, and we attended one of the largest and most prominent Black Methodist churches in Los Angeles, Holman United Methodist Church. We regularly welcomed well-known guest speakers, including the Reverend Dr. Martin Luther King Jr., Archbishop Desmond Tutu, and the Reverend Jesse L. Jackson. These leaders came to speak at our church, where our preacher was the Reverend James Lawson, a well-known civil rights activist. I grew up thinking that going to church was a social justice and civil rights activity. At some point, my brothers stopped going to church, and my father was no longer attending by then—my parents divorced when I was around 13 or 14 years old. But my mother and I continued attending every week. It was a very proper, dignified service with classical music and African American spirituals, but no gospel music, and it was a very important part of my upbringing, particularly with that focus on engagement and activism.

Early Love of Science

At school, my propensity for science was apparent from an early age. I felt a great sense of anticipation before dissections in science class, finding it

Image 2: Attending service at Holman United Methodist Church with Rev. James Lawson, civil rights activist, bottom left, 2015

fascinating to see how all the different parts of a frog's body worked together. At some point in either middle or high school, I received a math and science award sponsored by Bank of America. I also recall another, though less formal, moment of recognition during middle school. We were typically seated alphabetically, and it so happened that sitting next to me was the cutest guy in the class, a basketball player who eventually went on to play professionally. I always did well on tests, which I would say is self-perpetuating; when you do well, you think you're smart, and so you continue to do well. I remember this handsome classmate looking over at my exam, and I thought, "Fine, go ahead, you're cute." At the time, it struck me that when you're smart, people pay attention to you—including the cutest guy in the class, even if it's just to take a look at your answers.

Girl Scouts

Being a Girl Scout was a formative and tremendously positive experience for me. I started as a Brownie and continued all the way through the Senior Girl Scout level. Because my mother led the region's Girl Scout Council, it probably would have been embarrassing if I did not remain a Girl Scout, but I enjoyed it, and it was one of those activities that shaped how I saw the world. I grew up in a Black neighborhood and in a Black church, and Girl Scouting included going away to camp, where I would interact with people from many different backgrounds. Those experiences gave me a love of outdoors, campfires, and camp songs. In L.A., you're 30 minutes from the ocean and an hour from the mountains, and those are wonderful places to go camping.

Of course, I also sold cookies and actually had an unusual cookie-selling experience, no doubt because of my mother's role with the organization. I had the opportunity to go on *The Carol Burnett Show* to sell Girl Scout cookies to the star, which was great fun. Somewhere in the television archives, I expect there's footage of that segment of Carol Burnett graciously

receiving a Girl Scout cookie delivery from 13-year-old me and me graciously accepting her cash!

High School

Before junior high school, my family moved from Baldwin Hills, where many Black doctors and lawyers lived, to Inglewood, where L.A.'s airport is located. We moved because of Inglewood's excellent public schools, which at the time were primarily white, so that I could enroll in a better school. After we moved, however, Inglewood experienced the phenomenon that was referred to as "white flight." One of the first weekends we lived there, someone rang our doorbell and my mother opened the door to find a woman on the front step who looked shocked to see my mother. Apparently not knowing what else to do, the woman handed my mother a flyer and walked away. The flyer read, "Keep our neighborhood white." My mother, who had a great deal of confidence, simply said, "How ridiculous that is." I was very much attuned to how my mother handled that kind of situation.

When I began attending Morningside High School, the student population was more than 60 percent white, and by the time I graduated, it was down to less than 20 percent. Funding for public schools decreased significantly as white residents moved or enrolled their children in private or parochial schools. This also was the time when gangs were starting in L.A.; the Crips and the Bloods were making their presence known in my high school when I was in my sophomore and junior years.

My mother begged me to transfer to a parochial school. But I knew all my classmates, who watched out for the "smart one," I had close friends I did not want to leave, I was a cheerleader, and I was determined to remain at Morningside High through graduation. Later, I realized that it probably was the reputation Morningside had about three years before my graduation—as one of the best schools in the state of California—along with my high grades that must have factored into my being accepted for admission by Stanford University and Wellesley College. By the time I graduated from Morningside High, its reputation was no longer the same, not by a long shot.

American Field Service Experience in Malaysia

My mother was always looking for activities that would broaden my horizons. One such opportunity came during my senior year of high school, through the AFS-USA student exchange program, then known as American Field Service. I went through an extensive interview process, at the high school level and up to the national level, which included being asked questions about current issues and civics. The program invited two students from Morningside High to participate, and I was the second one selected.

Applicants had been asked to indicate countries where they were interested in being placed, and I believe I listed France, Italy, and Spain, but I was selected to go to Malaysia. That location assignment may have had to do with AFS's process for determining matches, which included asking how we would handle different theoretical situations and then matching an individual's characteristics with a host country and family. AFS must have determined from my responses that I was a student who would be able to acclimate well in Asia.

Leaving L.A. for Malaysia was my first big travel experience, and this was in the mid-1970s, very different from today, when people hop on planes to go all over the world. Before then, the one time I had been out of the country was with my family on a visit to Tijuana, Mexico, just over the southern California border. The trip to Malaysia was long; we flew first to Seoul, South Korea, and then to Hong Kong before arriving in Malaysia. After we were picked up at the airport, unfortunately, the car we were riding in struck and killed a bicyclist who was traversing a large, unlit highway. It was a dramatic and unsettling way to arrive in the country. But I soon met my very welcoming Malay hosts, a Muslim family in the town of Seremban, 40 miles south of Kuala Lumpur, and I believe that experience changed the course of my life.

The father in the family was the head of state for Seremban, and, because there is no separation of church and state, he was both the religious and the governmental head of state. It was a more formal environment than I was used to, and the family guided me about certain rules and what was polite. We ate with our hands at meals, and we would use or pass items only with our right hand because the left hand was considered dirty. We washed at least twice a day because it was hot and muggy and also because it is very much a part of the Muslim prayer ritual.

I learned that the population in Malaysia is made up of Malays, the native people; Chinese, who emigrated there; and Indians. I realized during my stay that the Malay people knew I wasn't Malaysian, and they assumed I was Indian. The Indian people knew I wasn't Indian or Chinese, and they assumed I was Malay. Nobody thought I was American because for them, Americans were white. While I was there, they didn't know quite what I was or where I came from, but everyone was warm and friendly.

Among four children in my Malay family, the eldest was a daughter who also was an AFS student and had gone to live with a family in Europe while I was hosted by her family. The next oldest was a daughter about my age, who helped shepherd me around, and she had two younger brothers. I attended high school there for about a month until the summer recess began; it was part of the British system of school, and we wore school uniforms. Most days after school, I played badminton with my best friend.

I think it was toward the end of my stay that I heard that a number of host families did not want to host a Black girl from the United States and

that my host family was one of the few families willing to take a student regardless of race. Living overseas with a family from a different culture—and a different religion, in the case of my AFS family—really broadens your perspective. It opens your mind and opens your heart in such a way that you cannot go through life and think, "I don't want people to immigrate to the U.S.," or "I have a prejudice against people of Muslim heritage." Living side by side with a family, when they have taken you in as a high school student, changes your perspective on life and what it means to be a global citizen, to be engaged with other people in the world.

The experience also sparked a travel bug in me and kindled a desire to live in different places, something I would later do in Paris, Edinburgh, and Zurich. I also have had two opportunities to serve on the AFS-USA Board of Directors, and my daughter, who lived in Ghana one summer through the AFS program, also has served as a young member of the AFS Board of Directors.

But back to when I was selected as an AFS student, I remember that I had to miss the last stretch of my senior year of high school because of the program's timeline. I was the salutatorian of my class at Morningside High, and my best friend was the valedictorian; I still remember how incredulous her mother was that I would miss being there in person for graduation. But that is what happened because I was on a plane to Malaysia before graduation. And my best friend from high school and I are still good friends.

My Undergraduate Years

My mother thought that it would be very cool if her smart, unconventional daughter from Los Angeles attended one of the prestigious Seven Sisters women's liberal arts colleges on the East Coast. For a Black girl from L.A. in the 1970s, this was indeed an unconventional choice. I also had a bit of my father's sense of adventure—that desire to set off for the opposite coast—so, at the age of 16, after returning from Malaysia, I flew cross-country to attend Wellesley College. I had never been to Massachusetts before I stepped off the plane to matriculate at Wellesley.

My mother had put me on the plane in Los Angeles, and my brother, Paul, picked me up at the airport in Boston. Paul had graduated from Columbia Law School and was working as an attorney in Washington, D.C. Because he was on the East Coast, it was arranged that he would come up to Boston to deliver me for my first semester at Wellesley. I still remember Paul driving me through different parts of Boston and how different it all looked in contrast to L.A. It was almost as if there were lines and barriers: this was the white neighborhood, this was the Black neighborhood, and this was the Irish or Italian neighborhood. In L.A. in the 1970s, I hadn't seen anything that felt as stark as that. Also, I remember I was struck by the sight of so many old buildings, including when we drove past Harvard University. But, Wellesley, I was pleased to find, was beautiful in spite of its old buildings;

the campus was spread across 500 acres, including a lake, and I thought, "Thank goodness I chose this place."

Life isn't always easy, and things don't always go as planned. Sometimes, you need to figure out how to get back up when you are knocked off your feet. In November of my first year at Wellesley, my mother died unexpectedly of an aneurism at the age of 46. I was 3,000 miles from home, and I had just turned 17 that fall. My mother had been the most supportive mom you could imagine. As I experienced that devastating loss, Wellesley surrounded me like a mother and supported me through a very difficult time.

My mother had instilled in me that I could be anything I wanted to be and that I could do anything I wanted. And, despite a D in my first chemistry course in my first year of college, I was not going to be deterred from being a scientist. So, it was a rough start at Wellesley, but I plugged along and got back on my feet. I soon discovered my passion, in part due to some good luck. In my sophomore year, Wellesley hired a young, enthusiastic assistant professor in the Biology Department to teach in the emerging field of psychobiology. This professor, Howard Eichenbaum, spoke very fast, especially for a Californian like me. He was extremely smart and enthusiastic, and he wanted to figure out how memory worked. His enthusiasm was infectious, and my imagination was captured.

Liberal Arts Values

As an undergraduate, I also became infused with liberal arts values, developing skills involving communication, critical and analytical thinking, and teamwork and leadership, as well as a deep sense of civic responsibility. In liberal arts education, breadth is as important as depth, and it leads you to bring together ideas that nobody ever thought of bringing together before. The liberal arts are about empowerment and mentorship and knowing that people really care about you and your development. Wellesley was a powerful liberal arts sisterhood.

I also had the opportunity to do hands-on experiments as an undergraduate. I still remember what happens when you stimulate the hypothalamus of a live animal, as I suspect anyone who is a behavioral biologist will remember as well. I was a solid B student. I wasn't an academic superstar, but I graduated in the first full class of psychobiology majors because I was willing to try something new and interdisciplinary.

Graduate and Doctoral Studies (and Work in between)

After my undergraduate years, I went back to California and completed a master's degree in public health in environmental health sciences at the University of California, Berkeley. After completing my studies, I worked at ESA, an environmental engineering consulting firm in Berkeley, and

consulted for several years. At ESA, I was an environmental analyst splitting my time between office work and fieldwork while evaluating hazardous waste sites and wastewater quality in agricultural runoff. I had been advised not to start working, with the warning, "You will never go back to graduate school." But I did not mind making an unconventional choice. And I believe that working outside of the academy—since most of my career has been in academia—included some of the best years in my life and instilled in me the importance of careful analysis, delivering your product on time and on budget, and customer service.

After about three years of full-time work, I decided to go back to pursue a doctorate at Johns Hopkins University in a newly formed program in neurotoxicology, the study of poisons that affect the brain. I saw this program as combining a bit of my undergraduate background in psychobiology/neuroscience with my master's field of environmental toxicology. My first laboratory rotation at Hopkins wasn't the best. I struggled with some of the medical school courses, and my first rotation adviser told me that I might consider doing something else, in other words, not being a scientist. But I didn't listen, and I found a new adviser.

Lucky Rotations

My second rotation, I was lucky. That rotation was in the Department of Psychology on the Homewood campus of Johns Hopkins, with Professors Gary Wenk and David Olton, which led to my first publication in neuroscience. In addition, I had fun doing the work, which was the start of my focus on the cholinergic system and memory. That continued to be a theme of my research for more than 30 years. More important, I was beginning to learn the principles of good science and expecting the unexpected result. David Olton also made me a much better scientific writer.

In my next step toward becoming a scientist, I was very, very lucky. My third and final rotation was in the laboratory of Dr. Joseph Coyle (see volume 10), who was the head of the Child Psychiatry Department. He had appointments in neuroscience, public health, toxicology, and pharmacology. Yes, he was a bit of a wunderkind at Hopkins.

Great Scientists and Human Beings

In Joe Coyle's laboratory, I started to see an important pattern. Of course, we scientists look for patterns, and I learned that great scientists can also be great human beings. In that lab, I met great human beings who worked competitively and cooperatively while pushing the frontiers of science. Our weekly lab meetings were critical thinking experiments for all of us. We gained insight into various projects, and we spurred one another to excel. It was a team effort. I learned the difference between hypothesis-driven science and descriptive

science, as well as the importance of each in a particular situation. Also, in Joe Coyle's lab, I had the opportunity to work with one of the most creative and caring mentors, Christine Hohmann, who was a postdoc in the laboratory. We continued to probe the cholinergic system, this time primarily in development and understanding how cholinergic dysfunction could be involved in conditions as diverse as Down syndrome and Alzheimer's disease (AD).

Merging Research Interests

In the mid-1980s, there was evidence that cholinergic dysfunction was associated with AD. But it was not by any means an accepted theory that manipulating the cholinergic system would have any effect on the course of the disease. I had been working in Joe Coyle's lab on an AD model, which consisted of making small, discrete legions of the basal forebrain of rats.

We were beginning, at that time, to understand acetylcholine that acts as a neuromodulator in cortex; a neuromodulator modifies the excitatory or inhibitory effects of a primary neurotransmitter. Small, discrete legions of the basal forebrain and medial septum disrupted the broad diffuse cholinergic projections to the neocortex and hippocampus, respectively, mimicking the diffuse cholinergic losses in neocortex and hippocampus that are seen in AD. There also was evidence that these small, discrete basal forebrain lesions in rats caused changes in behavior, specifically working memory deficits. And a hallmark of AD is deficits in working memory or short-term memory. Therefore, we hypothesized that enhancing cholinergic functions in cortex would alleviate memory deficits in AD.

Also, a note about modeling a human disease in nonhumans: First, you need to think about what aspect of the disease you wish to model—the behavior, the neurochemistry, the neuroanatomy, or the genetics. Different models will serve you well, depending on which of those different areas you aim to address. Rarely will you find a nonhuman model that mimics the full plethora of human disease characteristics.

In Joe Coyle's lab, I found the perfect lab to merge my interests in behavior, pharmacology, toxicology, and the cholinergic system, and I ended up staying in his lab for my dissertation.

When Bonnie Davis, MD, approached Joe Coyle about testing the effects of a long-acting acetylcholinesterase inhibitor, for which she had the patent, we hypothesized that it could boost the cholinergic function as a treatment for AD, and we had the animal model in which to test this new drug, galanthamine.

As a side note, I share here the formation and breakdown of the neurotransmitter acetylcholine to better understand the effects of galanthamine. Acetylcholine is formed in the presynaptic terminal by the enzyme choline acetyltransferase. It interacts postsynaptically with nicotinic and muscarinic receptors. It is degraded by acetylcholinesterase in the postsynaptic terminal.

Therefore, blocking acetylcholinesterase should prevent degradation of acetylcholine and boost cholinergic functions.

The drug galanthamine is a selective, competitive, reversible, long-acting cholinesterase inhibitor that also stimulates nicotinic receptors. It is able to pass through the blood-brain barrier and boost central cholinergic functions. It turned out to be effective clinically and was approved by the Food and Drug Administration in 2001. It continues to be used to treat individuals with AD. Galanthamine went through a couple of name changes and also is known pharmaceutically as Razadyne. For a number of years, it was one of the most widely prescribed drugs to treat AD in the world. It may seem obvious now that cholinesterase inhibitors improve cognitive function in some patients with AD, but it certainly was not easy to publish papers at that time about the cholinergic system and AD. I remember we had a paper rejected from *Science* because it didn't support the plaques and tangles theory of AD. But with 924 clinical trials and 7,740 papers between the 1980s and 2020, the majority of studies indicate that cholinesterase inhibitors induce an improvement in cognitive function in mild to moderate AD.

Proof-of-Concept Work

When I think back on being a second-year graduate student, I remember how we would get a little white vial of powder, labeled galanthamine, and we had to figure out how much to use, what to dissolve it in, what dose and route of administration were appropriate, how long it was effective, and, foremost, whether we had a good model of AD. This was what I did as a graduate student; I conducted experiments probing the cognitive and neurochemical effects of an acetylcholinesterase inhibitor and the dose response curves and medicinal chemistry of altering different functional subgroups on the galanthamine molecule, and I examined the effectiveness of the newly designed drugs. I was looking for appropriate doses and timing and routes of administration to maximize beneficial effects of the drugs while minimizing side effects. I also was examining fundamental principles of the involvement of the cholinergic system in working and reference memory. Based on my work in graduate school, I had four papers published between 1988 and 1991 showing that galanthamine was effective in reversing the working memory deficits induced by focal basal forebrain lesions in rats, and that was the proof of concept that galanthamine was behaviorally relevant and effective in an animal model with minimal side effects. Simultaneously, I was teasing out the effects of the cholinergic system on different aspects of memory. I found this work incredibly exciting, and both of these are important themes in my later research. I was interested in basic research questions that had clinically relevant implications.

It was those early animal experiments, combined with the strong will of Bonnie Davis, who had the patent for galanthamine, that were critical in moving the drug through the pharmaceutical medicine machine to become a

clinically relevant treatment. Only years later did I understand that the work that I had done in graduate school was clinically relevant and served as proof of concept for this treatment for AD. And if you ask me whether my scientific work was basic research, I would say, "Not always." If you ask whether it was translational research, I would respond, "Sometimes." Indeed, the dichotomy between basic and translational research often is irrelevant. And if you ask me if this scientific work had an impact, I would say, "Absolutely yes." Was it exciting? I would respond, "Enthusiastically yes!" Whether or not galanthamine was a cure for AD, it certainly helped millions and millions of people.

Heeding Some Advice (but Not All)

A second theme of my dissertation work that had a long influence on my career is something that came about through discussions with Christine Hohmann, one of Joe Coyle's postdocs at the time and my day-to-day supervisor. She shared with me that the genome of the mouse was being mapped. "If I were you," she said, "given your interest in behavioral neuroscience, I would focus on mouse behavior rather than rat behavior." And that led me to become a neuroscientist with an expertise in mouse behavior, which subsequently led to one of my favorite titles among my scientific publications, "Mice Are Not Little Rats," with Karyn Frick, but that comes later.

Also, while I was part of Joe Coyle's laboratory, I met another one of his postdocs, Laure Ory-Lavollée, who was a pharmacist and a native Parisian. She convinced me that I wanted to do a postdoctoral fellowship in France. In the meantime, others were telling me I should not do a postdoc in Europe because it would be difficult to reenter the U.S. scientific market. But I really wanted to live in Paris. I mentioned earlier in the section about growing up in L.A. that I loved musicals, which includes the classic *An American in Paris*. Who wouldn't want to live in Paris after watching Gene Kelly and Leslie Caron dance around the City of Lights? So, off to Paris I went, to the INSERM, the National Institute of Health and Medical Research.

However, heeding some of the advice that I had received, I negotiated up front with the French laboratory that I would need to come back to the Society for Neuroscience (SfN) meeting each year to maintain my contacts in neuroscience and to be a part of the U.S. scientific network.

Postdoctoral Study

American in Paris

It was an unconventional but thoughtful choice to go to Paris. I had a wonderful life there. I also fell in love with someone who would later become my husband. I did some good science in the laboratory of Dr. Yvon Lamour—yes, his last name does mean "love" in French. I continued to work on the

cholinergic system—this time the neurons of the medial septum, which project to the hippocampus. And I used in vivo electrophysiology techniques to understand the bursting patterns of these cells, with the generous support of my mentor there, Marie-Hélène Bassant, who was a much better electrophysiologist than I would ever be. As a side note, it is just as important to find out what you are not great at doing as to understand what you do well. Electrophysiology was not my strong suit.

After two years in my postdoc in Paris, I saw an ad in *Science* magazine for an assistant professorship at Wellesley College, my alma mater. It was the position that Howard Eichenbaum, my former professor and mentor, was vacating—he was leaving for a position at the University of North Carolina at Chapel Hill (UNC). At that time in 1991, as I was completing my postdoc in Paris, I interviewed at research-intensive universities and liberal arts colleges, as well as at a major pharmaceutical company. I liked the people with whom I interacted at Wellesley College the most; they articulated a good balance between work and personal life. I knew I could do world-class science there because Howard, my predecessor, had done so, and I thought it offered me an appropriate work-life balance. Although several colleagues questioned my ability to pursue a high-quality research career at a liberal arts college, I chose this unconventional path. In 1991, I returned to Wellesley as an assistant professor of biology, and Howard, my predecessor and undergraduate adviser, helped me negotiate my start-up package as he was leaving for his new role at UNC. He was a mentor, through and through.

Science at a Liberal Arts Institution

My Own Family and My Own Lab

I loved science, but I also wanted a full, well-rounded life. Six months after arriving for my position at Wellesley, I married my life partner, Urs Berger, a fellow scientist whom I met in Paris. Urs is now a retired neuroscientist and music archivist, and we have two wonderful children, Clara, 27, and Thomas, 23. And back in the 1990s, women in science were sometimes told that you weren't supposed to have children, at least not if you were serious about research. Also, we heard, "Never, ever bring your children to a scientific meeting." But I did …

As a faculty member, I understood that I had chosen to pursue a career at a liberal arts college and that I would need to devote time to teaching and to my students; it wasn't a research university. I realized that to succeed, I would need to integrate my teaching and research as much as possible. Also, I recognized that a focus on AD was not really conducive to research at a small liberal arts college. This research was highly competitive, required too many resources, and moved at a pace that I was not likely to be able to keep up.

But I had a few strategic advantages, including many smart, enthusiastic undergraduate students. Also, animal per diem costs were considered as part of the overhead at Wellesley. In other words, I didn't have to add animal per diem costs to my external research grants; I could write smaller, lower cost grants to do my behavioral work. Those were two important factors, especially for someone interested in behavioral neuroscience, which is very labor-intensive and very animal-intensive. I wanted to continue my focus on the cholinergic system, learning and memory, and pharmaceutics, and, of course, to use mice as my model organism—although I would do an occasional experiment in rats. Also, I knew that to continue doing cutting-edge research, I was going to have to rely on having collaborators inside and outside of Wellesley College. I chose to focus on research quality over quantity.

Amazing Students

I had an amazing resource at Wellesley: bright, ambitious, hardworking undergraduate students. The first student who came to work in my Wellesley laboratory was Beth Buffalo, who earned a doctorate and went on to serve as chair of physiology and biophysics at the University of Washington. Others who came to or through the laboratory, or with whom I had interactions, included Anne Churchland, PhD; Dorothy Jones-Davis, PhD; Laura Schaevitz, PhD; Darlene Gabeau, MD/PhD; and far too many amazing women scientists than I can name here. My experience was a case of the students being smarter than the professor—and, for professors reading this, it really is okay if your students are smarter than you are.

Image 3: Alongside bright, talented students and collaborators at an SfN meeting, circa 2000

New Collaborations, Discoveries, Publications

In 1992, shortly after my return to Wellesley College as a faculty member, Doug Lappi and Ron Wiley approached me with a new tool that they had developed. It was an immunotoxin that could specifically target cholinergic cells of the basal forebrain of rats. Other toxins that I had worked with as a

graduate student damaged both cholinergic and noncholinergic cells in the basal forebrain. Here was an opportunity to target cholinergic cells and test the hypothesis of whether the memory impairments were associated with lesions to cholinergic neurons or more general neuronal loss in the region.

Working with Stephan Heckers, a brilliant anatomist as well as a neurologist, I hypothesized that the cholinergic neurons in the medial septum and nucleus basalis were critical to working memory in the rat. But, I was wrong. And at that time, it was big news that the basal forebrain cholinergic system, when damaged specifically and discretely, did not induce working memory deficits. It appeared that the loss of cholinergic projections to the hippocampus and neocortex was not sufficient to induce the memory losses that I had documented previously in my graduate work. This new immunotoxin tool allowed us to ask and answer a question definitively, and we were able to publish this novel finding in the *Journal of Neuroscience*. And so, here, three years into this unconventional choice of pursuing a research career at a small liberal arts college, I had a publication in a prestigious journal. This discovery, along with others, led to successfully receiving a National Science Foundation (NSF) Young Investigator Award. This unconventional career choice definitely was paying off.

I also want to mention some very special fellow researchers with whom I worked in the early 1990s: Mark Baxter and Karyn Frick. Mark was a graduate student at UNC at the time and was interested in the immunotoxin research on the cholinergic system and memory that we were doing. Karyn soon joined the laboratory and was my first postdoctoral fellow at Wellesley College. Both had come from David Olton's lab at Johns Hopkins, and our scientific connections led to friendships that continue today. Now Karyn is a distinguished professor of neuroscience at the University of Wisconsin-Milwaukee, and Mark is a professor of pathology and comparative medicine at Wake Forest University.

Rett Syndrome

Another topic of my research was Rett syndrome, a genetic disorder primarily affecting girls. By the late 1990s, the MECP2 gene that was associated with Rett syndrome had been identified. What was critical for me happened in 2003, when Rudolf Jaenisch, the geneticist at Massachusetts Institute of Technology (MIT), created a mouse model in which this gene, Mecp2, was deleted, and he described it as a mouse model for Rett syndrome. I had published papers as a graduate student suggesting that the cholinergic dysfunction in the developmental period was associated with Down syndrome and Rett syndrome, but here was an opportunity to test the hypothesis in a genetically modified mouse. Rett syndrome is a rare developmental disorder, and I thought at the time that working in the Rett field was less crowded than AD and the learning and memory fields. I had a chance to

do important work, even at a small liberal arts college. It was important to find the right niche.

Persistence

A related story demonstrates the role of persistence in science. I had read in *Nature* magazine about Jaenisch's mouse model for Rett syndrome. Because I had developed an expertise in mouse behavior, I thought that perhaps this was a niche for me. So, I first sent an e-mail to Jaenisch, proposing that I behaviorally test his Mecp2 mice. I sent numerous e-mails for three months, but I just couldn't get through to him—he was simply too busy. However, I was very nice to his assistant every time I called. Eventually, she called me and said, "I am going to make this meeting happen." And when I got Rudolf Jaenisch on the phone, he could not have been nicer. He agreed immediately to give me four to six breeding pairs of his Mecp2 mice. Of course, this was a different era; he put the mice in containers and sent them off in a taxi cab from MIT to Wellesley, which was about a 30-minute ride. This provided me with an incredibly precious resource, Mecp2 mice, and that was the foundation of my colony for the next 10 years.

Generalization in a Hyperspecialized World

We published about 20 manuscripts on Rett syndrome, pharmacology intervention, and how to improve behavior, neurochemistry, and neuroanatomy. First, we showed that Mecp2 mice replicated many of the behavioral and neurochemical characteristics of girls with Rett syndrome; in other words, they were a good animal model of the condition. Then, over a course of about 10 years, I, along with numerous collaborators, looked at cholinergic drugs to improve behavioral and respiratory symptoms in Mecp2 mice and developed potential therapeutics in humans. I was at the right place at the right time with the right skill set and enough persistence to contribute to the collaborative research efforts to improve the lives of girls with Rett syndrome. At this point, most people would say my work was translational. But I was constantly reading and thinking about basic mechanisms, blurring the lines between basic and translational studies. One thing that is clear is that when you study a disease, you can't have a narrow focus. There were cholinergic deficits in girls with Rett syndrome, but there were also a number of other neurochemical abnormalities. I needed to understand numerous aspects of brain development, metabolic regulation, and respiratory functions to contribute to research that would improve the lives of these girls. Through my research on Rett syndrome, I became a more broad-based scientist, providing careful analysis of the evidence, reformulating hypotheses when the data didn't fit the original hypothesis, and describing what I found, even when it didn't fit my hypothesis. I was as adamant about

publishing negative results and results that didn't fit our hypothesis as I was in publishing evidence that fit our predictions.

Throughout my career in neuroscience, I have felt a pressure to "Specialize! Specialize! Specialize!" "Become an expert in a very narrow field." But as a person with a liberal arts background, I saw the value in generalization and breadth and in making unexpected connections in a hyperspecialized world. David Epstein's book *Range: Why Generalists Triumph in a Specialized World* really resonated with me. I believe that the zigzags in my early career and taking the time to discover my personal strengths and letting my interests propel the breadth of my research have served me well, both on the bench and in academic administration.

People and Structures Matter

Returning now to the people and structures that helped make my career in science. I must mention Drs. Jim Townsel and Joe Martinez, who were such an important part of my research life and keeping me involved in cutting-edge research during summers at the Marine Biological Laboratory (MBL) in Woods Hole. They cofounded, and led for many years, the SPINES Program, which originally referred to the Summer Program in Neuroscience, Ethics, and Survival Skills, and now refers to the Summer Program in Neuroscience, Excellence, and Success. This program focuses on educating graduate and postdoctoral fellows from underrepresented backgrounds to succeed as leaders in neuroscience. I taught in a primarily undergraduate student setting at a liberal arts college, so the summer program provided an incredible opportunity to interact with and influence graduate students and postdoctoral fellows. I took on an assignment that many researchers would avoid, teaching students English grammar and how to develop a persuasive, clearly written scientific argument.

Jim and Joe were excellent neuroscientists who cared deeply about creating a stronger, more diverse population of neuroscientists for the future. I will not try to list the successes of the SPINES program and the hundreds of outstanding neuroscientists who have been touched by this program and our special summers together at the MBL.

My scientific career also was very much a family affair. Without the support and patience of my husband, with whom I fell in love in Paris, and our kids, I could not have spent long hours in the laboratory or dragged them around the world to scientific meetings and sabbaticals in Zurich and Edinburgh. As a side note, my last sabbatical in 2008 was with Richard Morris in Edinburgh, which was an incredible life experience. Additionally, Joe Coyle continued to support and mentor me throughout my career, and I continue to have scientific and personal collaborations with Christine Hohmann, who is a beloved professor at Morgan State University.

Image 4: My husband, Urs, and our two children at SfN, circa 2003

Another important element of my success was my ongoing involvement in the SfN. As an associate professor at Wellesley, I was director for a training program for diversity in neuroscience. From there, I was elected onto Council, was treasurer for SfN, and served as chair of the Professional Development Committee, as well as on the Committee on Committees, nominating other people to committees. Currently, I serve on the SfN's selection committee for the Gruber Neuroscience Prize. My association with SfN has given me as much in development opportunities as I have given service to SfN.

Transition to Administration

In 2004, I left teaching and bench science full time to pursue an administrative career, primarily because of a desire for a broader impact beyond the bench and beyond science. It was an unconventional choice to leave a successful career at the bench to become an administrator. For 10 years, I did retain an active laboratory, combining it with my administrative work. One of the reasons that I decided to move into administration was that I saw in my classes so few Black women—Wellesley is a women's college—and I wondered what I could do to change that, not only in my lab but also across the institution. I saw administration as a way to innovate, to create, and to push my agenda of excellence forward, at a faster pace and to a broader audience.

I served in administration at Wellesley for six years and then became dean of the School of Arts and Sciences at Tufts University, a position I held for four years. My fabulous postdoc, Laura Schaevitz, came with me from Wellesley to Tufts. Laura is now senior vice president and head of research at Recursion. You may note a recurring theme of this chapter is working with smart, dedicated mentees, who have continued on to very successful careers in science.

Also, I believe that my skills as a scientist were quite helpful in my becoming an administrator. These include the abilities to analyze a problem deeply, to base decisions on research and data, and to experiment, in other words, to try something new to see if it works. Analyzing nonverbal behaviors was another useful skill that transferred from the laboratory to higher education leadership. In the lab, I watched a great deal of rodent behavior and had to infer the meaning; now I am more likely to watch nonverbal cues in humans and infer meaning of human behavior.

When you think of leadership, words that likely come to mind are strength or power. When I think of leadership, I think of a funny video you may have seen—it was originally a Super Bowl commercial for a technology company—where workers are in the process of building a plane while flying it. That's my view of leadership, building a plane while flying it. Leadership is exhilarating, scary, complex, and never boring. It is sometimes frustrating but also often satisfying.

In 2014, I became the president of Trinity College, one of the premier liberal arts institutions in the country, located in the capital city of Hartford, Connecticut. I left my laboratory behind and found my new home and the opportunity to shape higher education at Trinity, primarily an undergraduate liberal arts institution. We also have a small Graduate Studies program—including the opportunity to earn a master's in neuroscience—and we are one of the few liberal arts colleges with an engineering program. All of us at Trinity—in the administration, faculty, and staff—are focused on our mission to prepare students to be bold, independent thinkers who lead transformative lives.

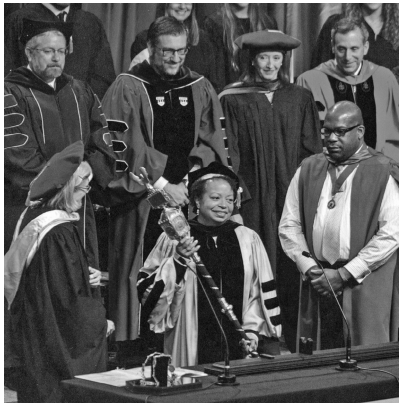

Image 5: My inauguration as the 22nd president of Trinity College, 2014

About administration, I like to say that it is not about having power; it's about taking responsibility. To share some examples of what success looks like to me in my current role: I see it in a smart, curious, and engaged student body of 2,000-plus students. As well, since I arrived at Trinity, we have increased by 50 percent financial aid for undergraduate students and dramatically enriched the socioeconomic, racial, and international diversity of our student body. Success also means more engaged, community-oriented faculty and staff who help to shape those transformative lives. And we've been able to increase faculty of color at Trinity by 14 percentage points in the past three years. Success also means focusing on student outcomes. Six months after graduation, 96 percent of the students in the Class of 2022 knew what their next step was going to be—employment, graduate education, or fellowship. Success also means balanced budgets because that is something that you have to think about as an administrator.

Also, for me, success means extending Trinity College's connections beyond our campus. During the past year, we have celebrated Trinity's bicentennial year with the theme "Committed to the future since 1823." Throughout our yearlong celebration, we are taking time to examine and discuss our college's past, present, and future identity, both internally and as part of our wider communities, including within our home city of Hartford and more globally. In recent years, ways in which we have strengthened our connections in Hartford and beyond include the establishment of an innovation center and the Liberal Arts Action Lab, part of Trinity's Center for Hartford Engagement and Research. We also have forged a unique partnership with the global technology firm Infosys—an unprecedented collaboration between a liberal arts college and a global tech giant.

While I have served as Trinity's president, I have had wonderful opportunities and recognition along the way, including being elected to the American Academy of Arts and Sciences. I have been honored as a top Women in Business leader in Connecticut by *Hartford Business Journal*. And I currently serve as chair of the board of directors of Hartford HealthCare, the second-largest outpatient and hospital system in the state.

Obviously, I believe in getting involved and trying to make changes from the inside. I have tried to live out Wellesley College's mission of "Women who will make a difference in the world." And I have always remembered my mother's words of encouragement about being able to be anything I wanted to be.

Mine is a story of science, and I hope that it is also clear that it is a story of scientists—people who influenced and shaped me, befriended me, collaborated with me, and were my promoters. As well, my journey is a reflection of my parents' story and their pioneering spirits. I was one of the only African Americans graduating from Johns Hopkins with a science doctorate my year. I was the first African American woman to move through the ranks

to become a tenured full professor in biology at Wellesley College, the first African American to be elected to the Council and then treasurer of the SfN, and the first woman president and the first African American president of Trinity College.

To paraphrase David Copperfield (title character of the Charles Dickens novel), I might ask, "Am I the heroine of my own life?" Or as Isaac Newton might have pondered, "Am I standing on the shoulders of giants?" I tell young and aspiring neuroscientists that they need to be the heroines or heroes of their own stories. Don't try to live someone else's life.

Lessons Learned

I offer here some of the lessons that I have learned:

- Your mentors don't have to look like you; they do need to care about you and promote you. They need to open doors and networks to support you.
- Administration isn't about power; it's about responsibility.
- Generalization has its advantages.
- Most important, help others along the way.

As much as I have enjoyed my career in the research laboratory, I recognized that I needed to do more to be satisfied. I had the possibility to do more, and I seized some of those opportunities to move beyond the bench. I was prepared to do so because I had taken on progressively more responsibility as part of my scientific career, including with the SfN. I felt that I could innovate, create, and, yes, disrupt more as an administrator than as a bench scientist. And, quite honestly, I felt that my science career, at the time I moved away from the bench, had already made a significant impact and helped millions of people with AD and Rett syndrome.

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