

# ASPB Pioneer Member

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Growing up in Tehran as the fifth child in a large family of six siblings, I sadly observed the disparities in freedom between my brothers and myself, especially as the third daughter. While they enjoyed outside liberties, I found myself burdened with household chores, yearning for the independence and autonomy that societal norms restricted for females. Seeking solace from these pressures, I turned to books, particularly those penned by women authors, such as the influential Italian journalist Oriana Fallaci, who epitomized confidence, freedom, and independence. Inspired by her, I dreamt of a career in journalism, though I was acutely aware of the impracticality of such aspirations in my native country. Nonetheless, deep within me, I knew I had no choice but to forge my own path towards independence and control over my destiny. Despite facing numerous challenges, I ultimately triumphed, albeit knowing that serendipitous events also played a significant role in shaping my journey.

### **From the Salt Lake "Maharloo" to Plant Biology**

I recognized that higher education held the key to achieving my dream of independence. With this goal in mind, I successfully passed the university entrance exam and enrolled at Pahlavi University in Shiraz, an institution with an Americanized curriculum delivered entirely in English. However, despite taking this significant step, I



remained uncertain about the academic path that would best suit my personality, provide economic independence, and ultimately bring me fulfillment. This uncertainty was exacerbated by the prevailing attitude within my family and society, which deemed degrees outside of the medical or engineering fields as less valuable. Specifically, pursuing a degree in plant biology was often perceived as a futile endeavor, dismissed as a choice reserved for those deemed incapable of achieving more prestigious and meaningful careers.

My uncertainty persisted until a transformative moment during a field trip in my second year at university. While exploring the scenic surroundings of Maharloo, a Salt Lake in southern Iran, I was captivated by the sight of halophytes thriving in the high salt content environment. This encounter sparked a deep interest in understanding how these plants could survive under such extreme conditions and how their resilience could be harnessed to support the growth of other plants in similar environments. This pivotal moment set the course for my professional journey and ignited my passion for researching halophytes.

To pursue this newfound passion, I began teaching biology part-time at a private high school, catering to girls aged 15-17. This position afforded me the flexibility to pursue my studies while simultaneously acquiring valuable teaching experience, enabling me to ignite interest in my students for a life of independence.

### **Sussex University-UK**

Working part-time as a biology teacher and a teaching assistant allowed me to save enough funds to travel to the UK in search of a laboratory specializing in salt-loving plants. Admittedly, this was not a meticulously planned endeavor, as access to information was limited without the widespread availability of the internet at the time. In my naive optimism, I simply believed I could arrive in the UK and inquire about available opportunities. Nonetheless, my search led me to a lab at Queen Mary's College in London, where the principal investigator accepted me. However, I soon realized that I would be the sole researcher focusing on halophytes, which was not an ideal situation.

Before officially committing to this position, I embarked on a trip with my cousin to Worthing in the south of the UK, where his family lived. Along the way, we passed by Falmer/Sussex University, and the picturesque surroundings instantly captivated me. Eager to explore, I requested a stop and ventured into the university campus. Making my way to the Biology Department, I boldly inquired about the Plant Biology department and the availability of a halophyte laboratory.

Despite interrupting the secretary's



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preparations to leave on a Friday afternoon, I pressed on with my query, oblivious to any perceived rudeness. To my relief, she confirmed the presence of a renowned department with numerous physiologists and biochemists specializing in ion transport and halophytes. She also mentioned Professor James Sutcliffe as the department head, though he was currently traveling. However, she assured me of his return on Monday, suggesting that I schedule an appointment then.

With renewed hope, I arranged to meet with Professor Sutcliffe on Monday, marking the beginning of my journey into the world of halophytes at Sussex University.

### **Iran-Military service**

After completing my PhD, I returned to Iran in 1977, intending to visit briefly before embarking on postdoctoral studies in the United States. However, during this visit, I explored potential job opportunities and applied to the National University of Iran. To my surprise, shortly after the interview, I was offered an Assistant Professor position at the university, despite having informed them of my plans to pursue a postdoc in the USA. Nevertheless, I accepted the position and commenced my role at the university in September. Unaware of the mandatory military service for female PhD holders working outside the home, during the Shah's regime, I found myself summoned to attend military school in October. Thankfully, due to already securing a job at the National University, I was allowed to attend military training from 6 AM to 2 PM, followed by fulfilling my teaching

duties at the university from 4 PM to 9 PM.

However, my aspirations were abruptly interrupted by the upheaval of the Iranian Revolution, resulting in the closure of not only the military barracks but also many other institutions such as universities. The sudden shift in the government dashed my hopes of remaining in my homeland. It became painfully clear that despite my education, my freedom would be restricted, and my scientific ambitions stifled under these circumstances.

### **Germany**

Therefore, I made the decision to obtain a student visa for Germany and embark on a new chapter away from my home country. In Germany, I relied on the savings accrued during my student years in Britain, supplemented by the limited funds I had from my previous work at the National University. Enrolling in German language classes, I concurrently harbored ambitions of securing a position in a laboratory setting.

After some persistence, I eventually landed an unpaid position in Klaus Apel's lab at Freiburg University, where research centered on photomorphogenesis. Despite the absence of financial compensation initially, this opportunity proved invaluable. It allowed me to fully immerse myself in the field, deepen my understanding of light perception and phytochrome, and contribute significantly to the scientific literature by publishing several papers elucidating the enzymatic processes involved in chlorophyll synthesis. Over time, my dedication and contributions were duly

acknowledged, resulting in the progression to a part-time paid role within the lab. This marked a significant step forward, offering some semblance of financial stability while affording me the opportunity to continue pursuing my research interests. Ultimately, my perseverance and unwavering commitment culminated in a Habilitation position at the University of Kiel, a position akin to a tenure-track role in the United States. This milestone not only marked the pinnacle of my academic journey in Germany but also served as a catalyst, further igniting my passion for advancing knowledge in the field of plant biology.

### **USA**

The emergence of molecular biology sparked my enthusiasm to delve into this novel discipline, particularly within Peter Quail's lab, which was renowned for its groundbreaking research in biochemistry and molecular biology related to photomorphogenesis. Eager to expand my expertise, I embarked on a one-year sabbatical, venturing to Quail's lab in Madison, Wisconsin. However, despite my initial excitement, I soon realized my shortcomings in effectively utilizing molecular biology techniques. Recognizing the need for further training, I requested a non-paid extension of my sabbatical in the USA. Unfortunately, my extension request was denied. Faced with this setback, I made the difficult decision of resigning from my position at the University of Kiel.

Undeterred, I persevered in my pursuit of advancing my knowledge and skills in utilizing molecular techniques within the realm of photomorphogenesis. I transitioned to a postdoctoral fellowship in Quail's



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lab, which had in the meantime relocated to Berkeley. During this period, I made significant contributions to the field, including the cloning of the first monocot phytochromes in rice and the identification of a transcriptional regulator of phytochrome known as GT2. Additionally, I authored several impactful papers that furthered our understanding of photomorphogenesis and its underlying mechanisms.

### Industry

After several years in Peter Quail's lab, I decided to explore the realm of industry. I successfully secured a scientist position at Calgene, a biotech company located in Davis, CA. Joining their lipid group, my focus was on researching unusual fatty acids with the goal of producing medium-chain fatty acids at economically viable levels in agronomic crops.

Coincidentally, this transition aligned with the birth of my son, providing me with renewed energy and optimism for the future. Despite stepping into unfamiliar territory within plant biology, my newfound role as a parent fueled my determination to confront the challenges head-on.

During my tenure in the industry, I made substantial contributions, resulting in the generation of 11 patents and 15 manuscripts. Much of my work centered on the cloning and characterization of enzymes responsible for medium-chain fatty acid production. Additionally, I authored three papers detailing the characterization of condensing enzymes from *E. coli*, including the elucidation of the crystal structure of a major enzyme.

However, as time passed and following several years at Calgene, which was subsequently acquired by Monsanto, I found myself longing to return to academia. Despite my achievements in the industry, the desire to pursue an academic career resurfaced, driving me to seek new opportunities aligned with my passion for research and teaching.

### Academia: UC Davis

In 2002, I was presented with a remarkable opportunity: a faculty position at UC Davis. Stepping into an empty lab space for the first time was undeniably daunting, but my passion for academia and the prospect of working with students and postdocs, free from the constraints of industry, propelled me forward. Transitioning into this role, I shifted my focus to studying the regulatory mechanisms of plant stress responses.

Despite initial setbacks, including the emotional toll of grant rejections, my genuine love for the work fueled perseverance. Eventually, my lab's efforts bore fruit with the publication of a seminal paper identifying the plastidial retrograde signal, MEcPP. This discovery shed light on the induction of stress response genes, unveiling the intricate interplay between the plastid and nucleus. Furthermore, we elucidated the role of MEcPP in altering the phytochemical diversity of plants and reshaping the structure of the endoplasmic reticulum (ER).

In addition to my scientific endeavors, I played an active role in enhancing the academic landscape by assuming leadership positions within the university. As the chair of the designated emphasis in Plant

Biotechnology, I collaborated with industry partners to develop initiatives aimed at fostering practical experiences for graduate students. Through this program, we facilitated internships in industry, providing students with invaluable insights into real-world applications of their academic studies, thus bridging the gap between theory and practice. Furthermore, I took on the role of chair in the Plant Biology Graduate Program, where I initiated impactful changes to better equip aspiring researchers for success. One significant addition was the introduction of a grant writing class, designed to nurture essential skills essential for securing funding in the competitive academic landscape.

### UC Riverside

In 2016, I embarked on a new chapter in my career by accepting the position of Director of the Institute of Integrative Genome Biology (IIGB) at UC Riverside, succeeding Natsha Raikhel. This decision was motivated by the university's strong commitment to diversity, particularly among its student body. Since joining UC Riverside, I have worked tirelessly to establish a metabolomic core facility, enhancing our capabilities for conducting cutting-edge research, while unraveling the intricate mechanisms underlying retrograde signaling mediated by MEcPP. Our research has yielded novel insights into the pivotal role of this plastidial metabolite in orchestrating adaptive responses within plants, particularly in maintaining the intricate balance between growth and stress mitigation. This metabolite's presence in all plastid-bearing organisms and nearly all bacteria suggest its fundamental importance across a wide spectrum of life forms.



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By elucidating the mechanisms underlying the action of this metabolite, our findings extend beyond the realm of plant biology, offering profound implications for understanding adaptive responses in diverse organisms. This broader perspective holds promise for various fields of study, encompassing ecology, agriculture, and human health.

Thus, our research not only validates my decision to pursue plant biology but also underscores the critical role of this discipline in addressing multifaceted scientific challenges across different kingdoms. It exemplifies how insights gained from studying plants can have far-reaching impacts, illustrating the interdisciplinary nature of modern scientific inquiry and the interconnectedness of biological systems across various domains.

I am firmly convinced that my passion for plant biology, sparked by my fascination with salt-loving plants, and propelled by my steadfast ambition to flourish as an independent-minded female scientist, has been instrumental in surmounting numerous obstacles throughout my life. Immersing myself in the intricate world of plant biology not only deepened my understanding of nature's wonders but also provided me with a sanctuary where I could find solace and purpose amidst life's chaos. This discipline served as a catalyst for peeling layers of my identity, empowering me to embrace myself and assert my voice in a world that often seeks to confine and define. Indeed, the lens of plant biology enlarged my world, secured me a

career path, and paved the way for self-discovery and breaking free from societal constraints towards personal growth and fulfillment.

Yet, my accomplishments in academia form a finely woven tapestry, meticulously crafted with the brilliance of students and postdoctoral fellows who have collaborated with me. Their resilience, dedication, and hard work have been indispensable, without which my achievements would not have been realized. I am profoundly grateful to them and fervently hope that their unwavering determination, pursuit of freedom of thought and life, and relentless quest for scientific excellence will serve as an enduring source of inspiration for future generations of scientists.