

Invited paper

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When passion meets purpose: love for chemistry drives female Jordanian professor

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Abstract: What summons this writing today is shedding light on my lifetime merits (Dr. Abeer Al-Bawab) leading up to becoming the first Jordanian woman to receive the IUPAC award. *“I would like to say that I am the first Arab, but an Egyptian Academic Prof woman beat me to it”*. As an organization that has existed for 102 years and which oversees the discoveries of many chemical stories and research, including that of the Periodic Table and Avogadro numbers, IUPAC and its nominations are certainly not to be taken lightly. It is my honor to receive this award and be selected among a prestigious group of scientists to have received this award. It is my hope that this writing inspires other aspiring chemists and scientists. Finally, it is my hope that my story exemplifies that when you are equipped with a strong passion for science, no adversity can stand in the way of your success.

Keywords: Award; chemistry; IUPAC; IUPAC distinguished women in chemistry and chemical engineering; STEM; women; women in science.

Introduction

When I was asked to write about my journey in the world of Academia and Chemistry, I imagined it will be easy to recall my curriculum vitae (CV) in written paragraphs, then I realized that this topic was not easy to summarize. I started to see how my career years were set in just a perfect way, one that I do not wish to change or modify in any way. Firstly, I will attempt to recall the reason behind my desire to study chemistry and how I pursued that dream. After that, this paper will outline my scientific pathway, local activities, and social impact work. Finally, I will attempt to convey my message of how our entire life can be a battle; a battle we are able to dictate with our willpower and passion towards good.

The beginning of my journey in the world of chemistry

I did not always like school, but I thrived in science and math from an early age. In high school, I received my first national award on account of my full score in Chemistry subject test and with honors from the Jordanian Chemical Society (JCS). Back then, I dreamt of becoming the president of this society one day, and 28 years later, there I was serving as the president of the Jordanian Chemical Society for a four-year term. Until this day, I remain a member of its board.

As a young female in the 70 and 80s in Jordan, the opportunity to be in a laboratory was an easily accessible experience, yet this did not stop me from studying Chemistry at the University of Jordan. After just

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three years, in 1991, I finished my bachelor's degree ranking the first in my class. Following my undergraduate studies, I pursued a Master and PhD degrees in Applied Physical Chemistry at Clarkson University in the United States. My education is particularly impressive and unique given my cultural background, where it is uncommon for females to pursue STEM subjects and particularly navigate such interest within the realms of academia. I set that goal for myself and determined to return to Jordan and work within the field, making contributions to the literature through cutting-edge research and mentorship of young students to support them in their studies, *e.g.* [1–8].

In conjunction with my STEM studies, I gained my professor title early, and quickly proved my expertise, values, and unstoppable ambition through hard work. I spent 20 years as a professor at the University of Jordan, serving as a mentor for undergraduate and graduate students, and supervising over 20 PhD and master students, *e.g.* [9–18], while actively participating in research with a focus on the interdisciplinary approach to science.

My research has culminated in around 80 peer-reviewed publications in high standard international journals and conferences, most of which tackle a very specific emerging field of research and its applications in the real world. The topics that my research explores range from colloid chemistry, which is my PhD specialty [19–50], drug delivery [51–59], environmental chemistry [60–65], conservation in culture heritage [66–72], wastewater treatment [73–79], research management [80], solar energy projects [81, 82] education research [83–85], and natural extracts [86, 87]. All of these projects were conducted over the past 20 years. This body of work is the result of around 30 nationally and internationally funded projects totaling up to approximately \$4,150,000, *e.g.* [88]. In reality, it is uncommon for Jordanian professionals to consistently seek international funding; however, I understood early on as director of the research center at The University of Jordan that it would ensure the results I needed. After six years of managing a research center at The University of Jordan (Hamdi Mango Center for Scientific Research HMCSR) [89], my scientific and financial reports delighted all board members. Additionally, my trajectory at HMCSR included housing my own laboratory, which focused on material chemistry and nanoparticle research, serving as director of the HMCSR for 6 years, a promotion to becoming the dean of Academic Research for two years at The University of Jordan, and creating major research groups, including the Nanotechnology Research Group and the very first Management of Solid Water Research Group [65].

Professor Badran, A former prime minister of Jordan, President of Petra University (Jordan), and head of trustee at The University of Jordan, **asserted** that in the six years during which I directed the research center at the university of Jordan, “I [Professor Badran] realized that I was facing a female scientist strongly dedicated to academic education and research management experience.”

Later, I served as the general director for the Jordanian Research Fund (the first woman to take that position) [90, 91]. Additionally, and in 2014, I was appointed to serve as a member in the Higher Education Reform Experts (HEREs) in Jordan. Later, I moved on after three years to become the chairperson for this valuable group for higher education in MENA and Europe (HEREs) (again being the first woman to take this position) [92].

Scientific legacy

In addition to being an avid researcher and scholar, a loyal professor, and a leader in the scientific world, I am also a voracious communicator. I have been issued one patent [93], co-authored two books [72, 94] and four book chapters [51, 79, 95] and been an influential participant in many conferences, *e.g.* [63, 67, 71]. In addition, I was editor-in-chief for multiple international and local peer-reviewed journals, *e.g.* [96]. I made it a priority to attend all local and global conferences, forums, and meetings relevant to my studies and research interests. Throughout My life, I have traveled to over 40 countries to attend, chair, lecture, or moderate various conferences and workshops, *e.g.* [97].

Local activities and social impact work

While I am fully committed to my research and continue to be involved in the global STEM landscape, I try my best to prioritize and incentivize the local scene in Jordan. I am deeply involved in the Jordanian academic community, and consistently ventures to educate the youth on the basics of research and manuscript writing. Some of my leadership roles include serving as President for Jordanian Chemical Society as voluntary work, leading as former Vice Chairwoman for the Association of Jordanian Women Academics (AJWA) [98] and actively participating in the Board of Trustees for private university (PSUT).

In 2014, I was elected for two terms, as the **first female president**, for the Jordanian Chemical Society, which was established in 1976. During my time, I tried my best to encourage young generations and educate communities on the importance and benefits of chemistry. I was the founder of the American Chemical Society (ACS) professional chapter in Jordan [99], after serving several years as active member, facilitator, moderator and even organizer for many events inside Jordan and outside. Worth mentioning is the workshop for the **Global Chemists' Code of Ethics workshop (GCCE)** [100], which led to the producing booklets or brochures in many languages; English, Arabic, Turkish, Urdu, Hindi, Pashto, Bahasa, and Tagalog, some ethics of codes were written as GCCE Guide for Use by National Policy Makers [101], GCCE Guide for Use by Industry and Export Control [102], GCCE Guide for Use by Academia [103]. Finally, there was a published book with title of "Responsible Conduct in Chemistry and Research and Practice: Global Perspectives" published by ACS [104]. My responsibility was to document the code of Ethics in my beloved country Jordan and Middle East with the title of "Responsible Conduct of Research and Challenges in the Middle East". Before this workshop I participated in workshop with Organization of Prohibition Chemical Weapons (OPWC) and the IUPAC [104], where the distribution of this knowledge was through booklets written in many languages.

I am fortunate and blessed to be able to say that my impact has been recognized many times, formally through multiple prestigious awards and nominations, including the Arabic Women Power for Change in 2019 [105], Women in Science Hall of Fame by the American Embassy in 2014 [106], Arab Women Award in Science and Technology for Development from the League of Arab States, Arab Women Organization [107], and many others. When receiving such awards, it is always my hope that this recognition demonstrates globally, and more importantly locally, **what Arab women can achieve**. It is always my hope, through every award or recognition I worked for, to be able to inspire young Arab women that when we aspire, we can achieve.

In summary and borrowing from the words of others "Dr. Al-Bawab "undoubtedly demonstrates the highest levels of commitment, maturity, excellence, and academic achievements. She embodies the ambition of **the Middle East** by actively being a member of the community, mentoring the younger generation, and making a tangible impact by fostering an environment that encourages young women to excel in **STEM** fields and research."

What is often left in the shadows of a woman of such caliber is a role that is of no less importance to my character and identity; as an Arab woman: a family bearer – wife, mother, daughter – and a human being attempting her best to be pouring love into the world she inhabits.

Personal life with professional dreams: a balancing act

Graduating from university in the early 1990s, it was uncommon for woman to travel and pursue education abroad. However, with the support of a very loving husband, I managed to travel and settle in Upstate New York at Clarkson University. I arrived there with no scholarship in hand, and I was financially incapable of funding my own studies. However, with strong support from a loving partner and dreams that weighed the world, I took initiative to meet with various professors and mentors until I was finally presented with a chance to prove myself in a Chemistry Laboratory at Clarkson. After 6 months, I was to receive the verdict whether I can get a scholarship and pursue my PhD.

Fast forward years later, I received the scholarship and continued making steady progress towards my academic dreams. However, I insisted that those dreams will not stand in the way of my personal life, and that I will not compromise my role as a wife and mother. Each one of my four sons was marked by an academic milestone. I gave birth to my eldest during my PhD studies, the second while defending my dissertation, the third after receiving my appointment as an associate professor, while my youngest son was born after I applied for full professor position and during a sabbatical year where I was deep into my research. While many people viewed my decision to be a mother during such times as a challenge, I viewed it as an opportunity of making my life – and my husband's – more beautiful during a journey for education and achievement. The role of a mother, in my opinion, is by no means mutually exclusive with her professional and academic dreams. I worked full-time as a mother, and my children grew up to flourish in the professional and academic world and are currently pursuing their dreams. Unlike common belief at the time, I got married, having the privilege of raising a family made my life – and dreams – more beautiful, not more challenging. I did not have to compromise one aspect of my life over the other, and it is my sincerest hope that our society continues to find ways for women to achieve what they aspire for without compromising roles.

This whole life is a battle

In September 2020, amidst the COVID-19 pandemic, I was nominated by four academics for the IUPAC award. By February of the following year (2021), I received news of my winning. However, two years prior to the immense happiness and privilege I felt winning this award, something happened that may have changed my priorities indefinitely: doctors found a lump in my liver, which quickly manifested itself as an extremely rare type of gallbladder cancer named Cholangiocarcinoma.

My husband, Prof. Ahmad Al-Ajlouni, has always been my biggest supporter with my studies, children, and work outside the home. He stood to the occasion and continued his role as my greatest supporter throughout this cancer. I never fell into the trap of fear and surrender because “he never allowed me to succumb to the disease.” Throughout the course of my illness, which continues to this day, he drives me to University and encourages me to remain an active member of the society. “I used to go to the university after chemotherapy sessions, follow up with my students and give my lectures. Thank God, things went wonderfully despite the circumstances” Dr. Al-Ajlouni, was “not only a husband, but also a friend, a brother.” Only 5 % of people survive this rare disease, and he always said that my wife would be a member of that percentage. “Statistics should always be seen in a positive light, not against us,” he always clarified.

In the last three years, I had gone through multiple stages of chemotherapy, immunotherapy, and radiotherapy. In July 2020, I had undergone my first surgery, which lasted for over 6 h at Mayo Clinic. During that specific surgery, over half of my liver was removed, as well as portions of my lymph nodes to ensure that the cancer didn't spread. This year (July 2021), another portion of my liver was removed. It was a profoundly hard time to me, my family, and my students. However, my love for science and my desire to continue achieving, and hopefully inspire, was again exemplified during these surgeries. To the surprise of everyone in the pre-operation room during one of my surgeries, I insisted on having access to my laptop to submit a paper for publication, moments before being anesthetized in preparation for surgery. I walked out of that surgery with a paper submitted for publication, as well as profoundly high morale ready to fight what cancer brings next.

My illness put a hold on my former dreams. Today, I dream of defeating cancer. My second dream is to be next to my family in the future. I genuinely believe everything happens for a reason – and that cancer has intruded my life not merely to disrupt, but perhaps to redirect me towards something bigger.

I was awarded an award, “*But she was the one who gave everyone around her love, attention, and distinction, to be surrounded in every step of her life by a great aura of supporters, motivators, those who knocked at the gate of her knowledge, thought and mind, and her smile which did not leave her forehead and face that radiated light, innocence, and love too.*”, notes Al-Jazeera news channel in their latest interview with Al-Bawab [108].

Final words

My extensive list of achievements speaks to what I have been blessed to be able to achieve, and the transcendental impact in the world of STEM and its surrounding. However, what is not quantifiable is the pure passion, love, determination, and commitment that I seek to pour onto every other part of my life as well. Behind the scenes, I do not merely perceive my career as a job, **but more as a heartfelt passion and a life-calling.**

With arguably one of the most aggressive cancers that can challenge a human being in our times today, I will continue to work on multiple fronts. It is my hope to be able to exemplify every day to the Jordanian youth the essence of hard work, inspiring women all around the country, and advocating for and inspiring those battling cancer all over the world. I promise that my cancer is not here to stay, and that this cancer is merely present to redirect my calling and expand my perspective, allowing me to do what I can do best: to continue to give endlessly for others, and to inhabit this earth with a smile every day.

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