The Biophysicist

An Unexpected Journey

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Scientists sometimes walk a fine line between exploration and expertise. We are always taught to ask questions and look for new and exciting ideas, but we are rewarded for in-depth analysis that can only come from narrowing interests. Although science becomes more multidisciplinary, it also becomes more niche driven. As a result, graduate students may often find themselves honing skills as researchers in highly specific fields for several years. A colleague I had stayed during part of his BSc, MSc, and PhD in the lab where we both studied. This period, spanning almost 10 years, made him a world-renowned scientist in physical virology and X-ray science. He became a specialist, and like him, many other scientists in Israel invested similar amounts of time in the same lab. The benefits of this approach are clear: students can gain great expertise and a deep understanding of their fields. What are the possible benefits and difficulties of changing a field midway?

I spent 5 years as part of a biophysical chemistry research group. In my bachelor's and master's degree, I obtained spectacular training in self-assembly. I focused on biophysical chemistry by taking elective classes, reading papers, and taking on related projects. To become an expert in my field, I developed a scientific tunnel vision. This approach bore fruit: I published my work, gave talks in conferences, and started to be acknowledged as a biophysical chemist. On the other hand, as time passed, it felt as if inertia started to influence me. Focus and expertise paved the way to routine and shortsightedness.

Although personally and scientifically everything was on the right track, I felt that a change was needed. However, change is difficult. Even after making essential decisions, such as location and scholarships, a big question remained: How far from your current field of study are you willing to venture? Staying in a very close field may result in doing more of the same. On the other hand, going too far may result in squandering skills obtained prior. In both cases, you start from scratch. My first instinct was to find reasons to stay. It is much easier to stay in your comfort zone.

After a year of doubts, I found what I thought I was looking for. Moving to an organic chemistry department in a different institute made everything feel new. Nothing was familiar. During my MSc, I worked on viral self-assembly, but my first projects at the new lab were on organic crystal manufacturing. Hence, I traded fitting curves on a computer to preparing organic crystals with different solvents. Milligrams of protein turned to grams of organic entities, and water was no longer a significant solvent. As time passed, I noticed something strange. Although everything was different, the questions I

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was asking were similar. I wondered about the van der Waals interactions in my system and how diffusion can affect the final product. I measured critical concentrations, even though there was no apparent need for them to answer the question at hand. When my system phase separated, it wasn't a failure but the start of an extended, in-depth analysis of interface energies. It was the same comfortable feeling of being in a faraway country and meeting people from your hometown.

Also, all of this was possible thanks to my mentor's open-minded approach. He not only allowed me to venture beyond the scope of my projects, but he also encouraged it and guided the projects in new directions. He decided to capitalize on my previous training and open a path that neither he nor I were sure we would walk when I first came to the lab. At the beginning of my journey, I could not pinpoint my interests. Still, thanks to my new environment and prior knowledge, it dawned on me that applying biophysical tools to problems in organic chemistry fascinated me, especially, the mechanisms of nonclassical crystallization in organic crystals and the kinetics of organic glasses. I build on my basic training as a biophysical chemist and expand it with new knowledge in organic chemistry to solve these problems. Though the molecules are different, the forces are the same.

This new approach to these problems made me somewhat of a rare bird in my department, which resulted in more collaborations. Suddenly, my X-ray proficiency became helpful for my colleagues, and projects they put on hold now became possible. Through the exploration and straying into uncharted territory, I could open possibilities that I could not imagine beforehand. Laying a foundation in biophysics and physical chemistry allows for scientific exploration beyond its scope. The skills obtained can be applied to various fields, such as biochemistry, molecular biology, organic chemistry, and more. As a result, when contemplating branching out to new research, students should not worry about having skills become obsolete. On the contrary, they can integrate into many labs, leading to breakthroughs in multidisciplinary science.