THE ART OF THE SCIENCES THROUGH THE LENS OF UNDERGRADUATE RESEARCH

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INTRODUCTION

I have always been a year younger than my peers, desperate to prove I measured up to them, meaning anything that could serve as a competition—from memorizing the unit circle to mastering a combination of challenging tap dance rhythms—has naturally manifested as such in my brain. Academics, of course, were the foremost concern in my life when my twin and I both accelerated past the eighth grade into high school from seventh, and I was eager to challenge myself with tough high school math classes (my favorite) and advanced placement courses. From 8am to 3pm I was a student, working through my lunch breaks and free periods on all homework assignments so that once 4:15pm came around, I could dive head first into my dance classes that would last until nearly 10pm on weeknights. Then, I would go to bed and start all over the next morning. This drive to be my best self in all facets and the focus I gained from this rigorous schedule served to propel me through school and allow me to succeed when I put my mind to something.

At some point early in my sophomore year of high school, a friend introduced me to Music and Memory, a student organization at Ball State through which Burris Laboratory School students could also volunteer to provide music therapy to nursing home residents with Alzheimer's and dementia. This was my first exposure to creative arts therapies, and looking back, it was the primary catalyst that propelled me toward the current path I am on now.

The use of the arts in aiding the physical and mental healing process of adults was a new idea to me in high school, but once a friend pointed out that I could go on to pursue something similar to this music project called dance/movement therapy, it all clicked for me. Coming into Ball State as a freshman, I still was not quite sure how to combine my love for dance with my ever-present desire to care for others. I knew I could learn about dance/movement therapy through a Master's program after graduating, but I did not know what that would mean for these next few years. After several major changes and picking up a dance performance minor the day before classes started that fall, I somehow made my way to now, as a double major in Nursing and Pre-Dance/Movement Therapy (an Integrated Studies major I created through the Honors College—that's a story for another day).

I have been extremely blessed in being a recipient of several life-changing scholarships. I am now a college senior and the inaugural recipient of a named, paid fellowship. Through this fellowship, I have applied for and received permission after a full review from the local hospital's Institutional Review Board to begin a research study in the Neonatal Intensive Care Unit. This study is exploring the physiological safety of movement and music using a Mamaroo baby swing for newborns suffering from withdrawal due to maternal drug use, known as Neonatal Abstinence Syndrome. In addition, I have presented information about safe sleep and the use of movement and music to help similar infants to mothers in Meridian Health Services' Maternal Treatment Program alongside a Neonatal Nurse Practitioner, applied for grants to fund the donation of Mamaroo swings to these mothers, and attended conferences about Neonatal Abstinence Syndrome and the use of creative arts therapies with this population.

In my next phase of life, I will be moving to Melbourne, Australia, for 10 months to pursue much different research in the Genome Stability lab at St. Vincent's Medical Institute for Research through a Fulbright scholarship. I will be exploring new treatment methods on the biochemical level for a rare disease called Fanconi anemia (FA). Because the cellular processes of FA are so similar to various cancers, this research offers hope for furthering cancer research, too.

Needless to say, though I am truly just beginning the process of completing undergraduate research, and in a completely different light than microbiology, I have failed more than I have succeeded and am grateful for the opportunity to pass along what little knowledge I have gained from the hurdles along the way.

THE DOS AND DON'TS OF UNDERGRADUATE RESEARCH

First and foremost, the first and most important step I took to accelerate the research process was to find an excellent—not just great—mentor. A few things specifically ensured I did this:

- I reached out to potential mentors whose research interests me. Whether current or past pursuits, the wisdom these individuals can pass down through a short, simple face to face conversation is immense. So, send that email to the address you found online, or reach out to that person your nutty professor nudged you toward. The worst thing that could happen is they don't respond. And, if that happens, show up to their office. Be persistent about gaining the best background information on the subject or project you are most interested in—it can only help you be better.
- I became comfortable with casually bringing up my research ideas with anyone who would listen. I can't specifically remember how long it was between the first time I thought about newborns suffering through drug withdrawal and actually engaging my mentor for the first time, but I can recall the most receptive people who I bounced ideas off of in the mean time. Not everyone will understand your idea, especially for those in the microbiology field, but you never know who will ask the right questions or spark the "ah-ha" moment when you mention your most specific interest and its applications to broader topics. For me, it was my psychiatric and mental health nursing clinical instructor who stood with me several Wednesdays in a row and happened to nod her head at the right times and egg me on when I doubted that my idea of using movement with newborns could be viable as a research topic. That instructor ultimately pointed me toward my eventual mentor in this endeavor.

The worst mindset I had during the process of developing an undergraduate research project was that if I worked harder and faster for more hours than I already was, that the whole cycle would magically speed up. This was problematic simply because so many factors were out of my control along the way. From the beginning, I knew that however I went about this, it would require the collaboration and careful leadership of dozens of moving parts, beginning with putting together a research team. Although individuals working as lab assistants do not necessarily have to assemble their own team, learning how to navigate these environments with opinions and viewpoints of people vastly different than yourself is beyond necessary. From team members, to research boards approving your work, to advisors and sources of funding, learning how to communicate with and make decisions as a part of something larger than yourself is integral to the success of your project.

It could be argued that communication is one of the most important pieces of any endeavor, but when it comes to research, it is everything. Communication has a role in applying to be a part of the project, proposing the steps to the project or dissecting the instructions for the research work, and finally, of course, documenting and disseminating the work you have done. While I do not believe there is a one-size-fits-all recipe to effective communication, I do know that patience, conciseness, and knowing your audience can solve most problems faced.

MASTERING THE ART OF SCIENCE

As an undergraduate, I have found power in connecting my interests across the lines of various classes and subject matters. From jazz dance technique class to my pediatric nursing courses, and even throughout my 5-week summer abnormal psychology course, I found that I learned so much more when I became confident enough to inquire about my interests, and to approach my peers or my professors who may help me connect the dots I am seeing. I was first urged to apply for a named, paid fellowship by a friend who recently graduated from BSU who is also a recipient of a scholarship which pays for full tuition, room, and board, and instantly knew I wanted to take advantage of the opportunity by at least applying. For several weeks, I struggled to choose which of my pursuits would best fit this fellowship. It wasn't until nearly two weeks before the application deadline that I knew what I would write a 10-page proposal about, and it

connected almost directly to the major I had created for myself: exploring a very physiological problem through an artistic approach.

I know a lot of people who are undergraduates and took years to decide what single major they would pursue. For me, I always knew I would need more than one major, but that it was likely it would be best if I was able to combine several. Dozens of my friends had played a sport or had a relatively "artsy" extracurricular activity that took up most of their time in high school, but most of them had all but abandoned this main love of theirs for a more typical career path by the end of our freshman year. Even my best friend had told her dad she wanted to be a teacher, but was faced with the statement that it wouldn't make enough money, so she should choose another path. While this may seem like an either-or decision for her, I was not so willing to give up my biggest pull—dance—to help people as a health care professional. So, I sought out the circumstances necessary to create my own path, which of course came with its own set of challenges.

My background as a competitive dancer taught me what I believe a lot of scientists, even undergraduate research lab assistants, should know. Pushing yourself out of your comfort zone while remaining open to constructive criticism, and then using that feedback to continue to grow, can be a game-changer in an environment as self-driven as research. Whether in a kinesiology, microbiology, or creative arts-based pursuit, being able to continuously make adjustments to your thoughts, actions, and words can be the difference between completing a project with your head barely on straight or reaching the finish line with a successful result and fresh energy to pursue the next set of experiments. Shaping yourself to best fit your passions, your vision for your future, and the requirements for a project you desperately want to be a part of is vital to research. I had never completed my own literature review before this research, nor had I presented my ideas in front of a board of community professionals with the hope that they would give me the green light instead of stopping my project in its tracks. These were two of the biggest growing experiences for me. Along with the task of forming the research team, these experiences will help me endlessly in my future. If I had not adjusted my mindset going into this project, knowing that I would have to do hard things I had never even tried before, I would not have gained approval. I can imagine that lab work is similar—whether you have executed an experiment before or not, it is nearly guaranteed that you will be a professional at the research task at hand when completed. All it takes is to have the courage and drive to begin, and the passion to continue to see it to the end.

FINDING YOUR FOCUS: THROUGH YOUR LENS

One of my outstanding literature classes in high school taught me that everyone sees life in general, as well as individual conversations, through a certain lens. Whether this lens is one of gender, race, class, or even profession, we all have a certain lens through which we automatically view most things. We all also have the potential to switch our lenses to match that of someone else or of a new perspective, theory, or ideology of our choosing. I know there is extreme value in viewing one thing through several different lenses, and that this can offer a new perspective otherwise unseen through our initial lens. I have also learned lately that focusing on your passions and pursuits is impossible without the consistency of a personal lens.

For example, a white, snowy background can turn red or blue with different pairs of sunglasses on, but you wouldn't want to wear a different pair of glasses to attempt to perform different parts of a single experiment on the snow, as this could cause skewed results and inaccurate data collection. For the same reason, I have tried my best to gather all of the information available to me about newborns withdrawing from various drugs and the causes and treatments used for them. I began from day one of my undergraduate career forming my own individual lens through which I have been able to take into consideration the psychological and physiological causes of addiction in the mothers. Addiction competes with a mother's drive to do her best to keep her baby healthy, in order to best empathize with her when asking for her consent to enroll her three-day-old child in a research study. If I were to listen to one physician's biased opinion that all of these mothers, like his first patient who came in high to visit her baby, are simply addicts who have no hope of providing a good life for their child, I would not see another mother's sobriety. If I were to listen to one counselor's viewpoint that every mother with an addiction can be helped with an opioid agonist, I would not hear another mother's opinion that it did not work for her. If I were to simply believe that the

current line of treatment for babies with Neonatal Abstinence Syndrome—treating their symptoms with morphine— is the best and only option there will ever be, I would be cheating babies with mild symptoms of a drug-free neonatal period. If I were to take any one biased opinion and take it as truth, use it as my lens, I would not be able to contribute to literature on these topics to hopefully improve the treatment and outcomes of these mothers and their children.

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