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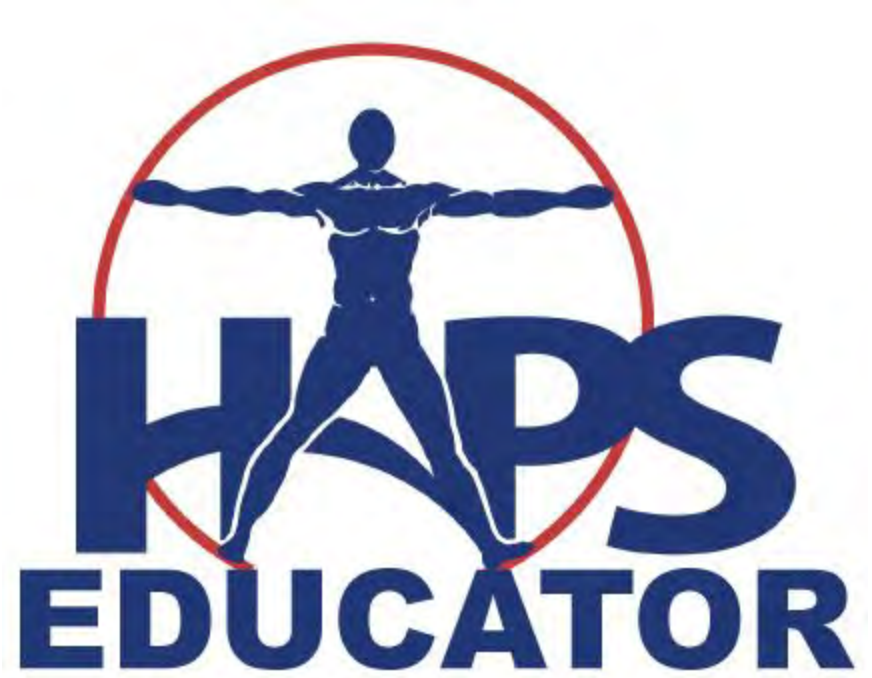

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Making a Significant Mid-Career Change as a Female in STEM Academia

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Abstract

A gender gap in science, technology, engineering, and mathematics (STEM) exists. Fewer females enter academia or advance to senior level positions in academia than the number of females who earn advanced degrees. There are many reasons for this, but common themes include disproportionate responsibilities for childcare and imposter syndrome. For some females, this may mean a reluctance to undertake a mid-career change. In this article, I relate my experience with a mid-career change and how I adapted to a new academic environment with new responsibilities. In doing so, I realized that my current approach is not much different than my previous approach and I was able to adjust to teaching professional students and mentoring graduate students in research after having spent 20 years at an undergraduate teaching institution.
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Key words: undergraduate, graduate, dental, gender, women, career change

Introduction

After a 20-year career of teaching human anatomy and physiology at a community college, I accepted a tenure-track position with a research component at a school of dental medicine. Many females in the STEM field experience barriers throughout their career. Such barriers include, receiving fewer grant awards as well as being encouraged to accept higher teaching and service loads than comparable male faculty. In addition, many females experience imposter syndrome. Imposter syndrome (or, imposter phenomenon) originates from a 1978 study (Clance and Imes 1978) of extremely successful females who, despite their accomplishments, still felt insecure and not deserving of their successes. Overcoming imposter syndrome, and other barriers to females in STEM academia, is achieved through explicit attempts to develop a network of support and being willing to accept certain vulnerabilities that accompany new career prospects. In this article, I will explore the gender gap in STEM academia and how I am navigating a mid-career transition. I will relate what others say about mid-career transitions and share my own experience and provide what I hope is useful insight to other females considering similar career transitions.

STEM Gender Gap

In STEM academia, there is a gender gap. Females hold only 22% of full professorships at doctoral universities with R1 designations—those that meet certain criteria in research activity and expenditures (Lerchenmueller and Sorenson 2018; Carnegie Classifications of Institutions of Higher Education). Among medical schools, only 18% of department chairs and 17% of deans are held by females, yet females represent 50% of health care professionals (Lewiss et al. 2020). Furthermore, analysis of data published by 130 U.S. universities demonstrated that only about 22% of them had a female as president, while approximately 39% of deans and provosts at these universities were comprised of females (Silbert et al. 2022)

Possible Causes of the STEM Gender Gap

A 2019 report from the Council for Graduate Schools indicated that acquisition of higher education degrees is not a limiting step for females entering academia—60.1% of master's degrees and 53.1% of PhD degrees are awarded to females in the U.S (Council of Graduate Schools 2020). Rather, the gender gap appears to be due to fewer females with advanced degrees entering academia entirely or advancing to senior level positions in academia.

Fewer females entering academia appears to be due to either self-selection or external forces. In a 2011 study (Goulden et al. 2011), 44% of females reported that child-related concerns prevented them from applying for tenure-track faculty positions with a research component. Yet, when married females with young children do apply for tenure-track faculty positions, they are 35% less likely than males to be hired (Ysseldyk et al. 2019). Thus, there are also external forces that prevent females from entering academia. As further illustration of this, in a 2012 study, a greater number of male-identified job applications were ranked higher than female-identified applications when compared to the same application pool that was gender-blinded (Moss-Racusin

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et al. 2012). Among the gender-blinded applications, it was revealed that a greater number of female applications were ranked higher than male applications.

Some females who have entered academia have not advanced to senior level positions, despite decades of experience. This contrast between the number of higher education degrees awarded to females and the number of academic positions (both entry level and senior level) held by females is referred to as the "leaky pipeline." Somewhere along the line, females leave the path toward full professorship in academia. The underlying causes of this gender gap are numerous and complex, but the common factors are childbirth and childcare. Females disproportionately engage in childcare and domestic responsibilities (Cardel et al. 2020). For example, a pre-requisite for tenure in many academic institutions is receipt of federal grants, yet females submit fewer than 30% of all NIH grants and make up only about 30% of grant awardees (Hechtman et al. 2018). Publication is also a pre-requisite for advancement to senior levels in most academic institutions. Morgan et al. (2021) reported that female computer science faculty, on average, published 17.6 fewer papers than male faculty for up to a decade after having a child. However, they report that the effect of becoming a parent on *total* productivity over a person's career is relatively small.

Although childbirth and childcare may be a conscious choice by females in academia, other causes of the gender gap are more subtle and may partially contribute to imposter syndrome. For example, much emphasis is often placed on recruitment of novice female faculty into academic medicine. These faculty are reported to receive significant mentorship and career-development focus, often by older male faculty (Carnes and Bigby 2007). However, as these female faculty advanced toward mid-career having made significant scientific contributions, they were reported to be marginalized by the same previously supportive male faculty. Kaatz and Carnes (2014) proposed that this could be due to the females being a perceived threat to the advancement of the male faculty.

The past decade has also seen an overall decline in academia culture (Gewin 2022), partially due to less pay despite an increased workload. This is particularly true in that there are a greater number of administrative tasks such as more required trainings and increases in required institutional documentation that accompany scientific laboratory research. Fewer than 60% of faculty reported satisfaction with their job partly because they felt that they were receiving a constant stream of 'constructive' criticism (Woolston 2021). For females experiencing imposter syndrome, this continuous constructive criticism can create a perception that they are not deserving of their position and is particularly damaging. In a 2021 article providing academic career advice to graduate students and junior faculty, Jennifer Snodgrass, a tenured, full professor at Appalachian State University wrote, "Imposter syndrome never really goes away" (Snodgrass 2021).

Academia is a setting in which faculty are continuously held to a high standard in both teaching and research. In particular, researchers are under substantial pressure to be self-motivated in order to acquire funding for and to advocate for their work. This constant push to improve and expand is one reason why the academe is a major source of new ideas, new discoveries, and inspiration for the world. However, by the same token, this environment can initiate and exacerbate imposter syndrome in females. To help reduce the gender gap in STEM academia, academic institutions need to do more for females in STEM fields, including fostering re-entry into research positions by mid-career or returning females.

How to Navigate a Mid-Career Transition as a Female in STEM Academia

Making a significant career transition as a female over 40 years old, whether it is re-entry into a research position, or a total career re-launch after a hiatus, requires a network of support. Those undergoing a mid-career transition face a paradox of having previous job experience but are entering a new environment. Higher education institutions often approach entering, experienced faculty the same as they do novice faculty members (Cherrstrom and Alfred 2020). Mid-career transitioners reported their age as a detriment—they felt that on day one they were already behind in goal achievement when compared to their same age peers with tenure. In a study that followed female midlife career changers ages 35-60, the following recommendations emerged: 1) regardless of prior success, females need support and encouragement, 2) it is critical to take specific actions to create a supportive network at a new institution, and 3) it is extremely helpful to draw on prior experiences and apply them to a new position (Cherrstrom and Alfred 2020). In the next segment, I will highlight how I have implemented these three recommendations.

Regardless of prior success, females need support and encouragement

My husband and I are both PhD biologists and, two decades ago, were on the job market for faculty positions at liberal arts colleges. At that time, I was 8 months pregnant with our first child. Initially, I found work as an adjunct faculty member at three separate college campuses and spent more money on gas and childcare than I earned. After the first year, I accepted a position at a local community college and over the next 20 years, earned tenure and eventually full professor status. Even though I loved my job, I decided to apply for a physiology tenure-track faculty position at a nearby dental school. I found the prospect of teaching more advanced physiology and re-launching a research program to be an appealing challenge.

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I began my new position in June 2020 at the height of the COVID-19 pandemic. My first year of teaching at the dental school was all virtual, and through student feedback, learned that most students found my teaching ineffectual, which significantly reduced my self-confidence. To help counter this, I sought input from my female department chair, a female colleague with 30 years of experience at the dental school, and a female colleague with 5 years of experience at the dental school—all three of whom have been encouraging, have offered helpful advice that helped boost my self-confidence, and gave me specific guideposts for teaching dental students. For example, they suggested I specifically relate physiological concepts to dentistry. To do this, I created vignettes called, "A Dental Moment" to highlight application of certain concepts to dentistry during didactic lectures. These vignettes have received positive feedback from students.

It is critical to take specific actions to create a supportive network

A 2014 article titled, "Taking a break from the lab: Can it really be done?" (Skok 2014) provides some pointers for re-entry into the research lab such as finding a mentor to support you. I was able to quickly identify a mentor when I arrived at the dental school. Her career path was very similar to mine, and she had established a research program at the dental school after a career hiatus. Her guidance and insight have been essential to me in these first few years. We have collaborated on several projects, submitted a federal grant proposal together, shared undergraduate mentees in our labs, and have become good friends. With her help, the help of my husband, and the help of my former PhD advisor, I have promising research projects underway in my new lab.

It is helpful to draw on prior experiences, and apply them to a new position

I learned a lot about myself and my teaching philosophy during my first two years at the dental school. I have learned that, for me, 'teaching is teaching is teaching.' In my previous position, I centered my physiology teaching around the Core Concepts of Physiology framework (Michael and McFarland 2011; 2020). However, I had a misconception about what teaching first year dental students would entail. I mistakenly and incorrectly thought that these students would have a solid grasp of the fundamentals of biological sciences, and to be clear, many do. But some students arrive as first year dental students from diverse undergraduate paths. Many first-year dental students that I have taught have approached the biomedical didactic courses at my school with some reluctance because they view the information within as not relevant to them as future clinicians. However, the fundamental knowledge they acquire is important for them to have a working understanding of human health and disease. But beyond this, critical thinking and problem-solving is an important competency for dental students according to the American Dental Education Association (ADEA). As Chirillo et al. (2021) point out, incorporation of the Core Concepts of Physiology teaches "pattern recognition", which allows for effective clinical thinking. As further evidence of the need for ensuring a strong set of fundamentals for health professional students, Bordes et al. (2021) reported that first year medical students held misconceptions regarding cardiovascular physiology and Badenhorst et al. (2021) demonstrated that retention of certain misconceptions by medical students continues throughout the entire medical curriculum. By utilizing the physiology core concepts framework, students learn over-arching concepts, then layer in particular details. To assist student with this layering in, I assign critical thinking questions as homework, present case studies during didactic lectures, and administer exams that contain application-based short answer written questions—all techniques I used with community college students.

After two years, I understand the first-year dental students at my institution much better. I have been able to apply my prior experiences with community college students to my new situation. Students excel when there is a framework for learning such as the Core Concepts of Physiology. Such a framework allows students to fully incorporate information into their knowledge base to be able to problem solve. Using the Core Concepts of Physiology has been substantial in my progression as a professor; by having this framework, I feel more confident because it provides a built-in structure on which to build my lectures. It feels like a safety net so my self-view as an imposter has begun to wane a little.

To Shrink the Gender Gap, Systemic Change is Needed

When a former colleague informed her provost that she was expecting a second child, he conveyed his disappointment to her that her productivity would decline and she felt undermined by him. Indeed, Kaatz and Carnes (2014) report that "top down" solutions stemming from upper administration help slow the leaky pipeline much more effectively than those that place the onus onto the female faculty members. For example, implementation of gender-bias training, mentorship, sponsorship, and leadership training and providing internal grants to faculty with family care responsibilities have all been reported to enhance female faculty retention and advancement (Lewiss et al. 2020).

In Australia, many universities have implemented programs, called Phased Return, that allow individuals returning from long-term primary caregiver duties to restart at an 80% effort level for 40 weeks while continuing to receive 100% of their salary (Laver et al. 2018). In addition, many Australian universities have flexible work arrangements, child-friendly office space, and breast-feeding rooms. These universities

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also offer Career Interruption grants up to $10,000 that a faculty member may receive more than once and can be used for activities that support the return to work such as course buy-outs, or conference attendance. There are re-entry grants in the U.S. that are by funded the NIH; however, to be eligible for these grants, the career interruption must be 8 years or less. Universities in the U.S. should consider implementing, or expanding, a broad diversity of programs that support female faculty facing family care obligations.

Conclusions

Females returning to STEM academia due to a career transition, such as mine, or a return to academia after a hiatus need extra support and mentoring. This type of support gave my self-confidence a needed lift. Female faculty should trust themselves to develop and nurture the qualities needed to earn a master's or doctoral degree: being courageous, being tenacious, and being self-motivated. I have found that I have been able to transition from teaching undergraduates to being able to challenge dental students. First year health professional students, such as dental, medical, or pharmacy students still need reinforcement of core and all foundational concepts. I have found I need to confirm what the first-year dental students have learned earlier, reinforce this, and then guide them through application of the concepts to their specific content area. I have also been able to re-launch a research program that, while still in its infancy, has the potential to be strong. I have been significantly guided by my research mentor at my new institution; without her input, I would have been incredibly lost and behind. In the end, many faculty members, including me, encourage students during challenging times to persist and not waver from their goal. Female faculty should apply that sentiment to themselves as well as their students.

About the Author

Cinnamon L. VanPutte earned a PhD at Texas A&M University in 1998. In 2000, she joined the faculty at Southwestern Illinois College where she remained until 2020. In June 2020, she joined the faculty at Southern Illinois School of Dental Medicine where she teaches physiology to first year dental students. Her research lab focuses on the effects of microbiome depletion on thyroid function and their relationship to periodontal disease. She is one of the authors of Seeley's Anatomy & Physiology and Seeley's Essentials of Anatomy & Physiology (McGraw-Hill), which emphasizes development of critical thinking skills.

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