AFTER THE PH.D.:
PERCEPTIONS AND RESOURCES USED BY POSTDOCS
TO MAKE CAREER DECISIONS

By

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**ABSTRACT**

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The purpose of this study is to explore the messages and experiences described by postdocs during their education and training and how these messages influenced their respective career trajectories. Of additional interest is whether postdocs have access to resources that assist them in their career and professional development.  Postdocs want more information on career development strategies and pathways (Chen, McAlpine & Amundsen, 2015; Gibbs, McGready, & Griffin, 2015; Miller & Feldman, 2015) and higher education institutions want to find ways to support and help postdocs with more career and professional development programming (CGS, 2017).  In order to support postdocs, qualitative research is needed to help understand postdocs' perceptions of a career (e.g., work-life balance, work responsibilities, and other job attributes) and examine the factors that they encounter that affects their attempts to transition out of the postdoc into their chosen career path.

This research project involved open, semi-structured, in-person interviews with four purposefully selected participants in the biological sciences who were currently engaged in a postdoc position, had been in their positions for less than two years, and were currently in the process of looking for a full-time position. Participants were interviewed twice about their educational and postdoc training experiences, followed by a third interview to identify critical moments in their educational and postdoctoral experiences. Individual narratives were then constructed to represent these moments as major common themes in their lives.

This study found that participants transitioned into postdoctoral training immediately after completing their doctoral degrees to 1) acquire research experience and access information about faculty life, and test whether being a faculty member is right for them.  Some took postdoc positions 2) because no other work was available to them in their chosen career path or in the case of international scholars, 3) transitioned into a postdoc to buy more time to deal with immigration issues.  This study also found that 1) visa issues still hindered international postdocs transitions out of the postdoc and limited their ability to find jobs.  Also, postdocs wanting to transition to careers outside the academy, 2) had a harder time transitioning out due to lack of resources.  Finally, only postdocs who 3) asserted their agency and utilized an identity-trajectory framework, were able to transition out of their positions.

From this study, three themes also emerged that illustrate how postdocs interpret their education and training experiences, and the decisions they made about their career during that training:  1) faculty could only provide career advice on faculty careers, and 2) faculty were viewed as role-models for what work-life balance would be like working in academia and; 3) postdocs not wanting to pursue a career as a tenure-track faculty member, had to look outside their department for career support and advice, especially those looking for careers outside of academia.

Findings from this study fill in the gap in the literature, by providing a better understanding of postdoctoral career motivations and how postdocs find and use information to make decisions about their careers.  Results can also be used to directly develop and enhance programs and strategies that institutions are developing to help not only postdocs, but graduate students in general, prepare for careers outside the academy or to develop alternative paths to tenure-track faculty positions.

# ACKNOWLEDGEMENTS

First, I want to dedicate this work and acknowledge all the loving support of my partner, Robert, and all the personal and financial sacrifices he has made in order to support me in this endeavor. He was there for me when I needed him the most and I hope to support him in every way he has supported me in the future to come. I also want to acknowledge the sacrifices and patience of Timothy, who I will always think of as "my kid." He was with me at the beginning when I started this journey and no other person besides him, knows first-hand, the trials and difficulties we've had to face over the past decade.

I also wish to thank my mom, my brother, and sister and the rest of my family who have always supported me in whatever I pursue. In addition, this work would not have been possible without the editorial support of my best friend, and extended family member, Dawn. With her guidance, thoughts and ideas turned into frameworks and structures that helped to establish the foundation of this study and help me start on the path to becoming a scholar and researcher. I also want to thank my "running buddy" and best friend, Mary. Mary's wisdom and guidance helped me get through the doctoral program and was especially insightful in helping me transition from work to school and back to work again.

I am also grateful to all of those with whom I have had the pleasure and guidance to work with during this and other related projects. Drs. Kyle Greenwalt and Leslie Gonzales each helped me to find my voice as narrative researcher; Dr. Brendan Cantwell, the chair of my committee, who has guided me through this process and shown, by his example, what social science research is all about; and Dr. Marilyn Amey, who always believed in me and was sure to remind me I always knew "the right thing to do."

It is also critical I acknowledge and thank the wonderful women who shared their experiences with me and trusted that I would honor and share their stories with others, so postdocs who come after them can learn from their experience.  Your stories and experience are helping to show faculty, practitioners, institutions, and higher education in general, the value that comes from supporting and mentoring women in scientific fields.   I hope this study also reflects the lived experiences of their stories and, in hearing them, readers remain aware that their experiences are more nuanced and complex than any explication or meaning I have tried to provide.

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**CHAPTER 1:  INTRODUCTION**

For the past decade, I have been working directly with postdocs in higher education who have been looking for positions in academia and industry.  Postdocs are recent doctoral recipient scholars who are pursuing additional training or research after completion of their degree under the supervision of a senior researcher or faculty member (National Research Council [NRC], 1969).  Likewise, the term "postdoc" is used to refer to both the position and to the person who occupies it – a scholar can *be* a postdoc, as well as *do* a postdoc.  Previous research has highlighted the importance of the postdoctorate as additional training necessary to help recent doctoral recipients become independent, self-directed scholars; in other words, training to become faculty (Chen, McAlpine, & Amundsen, 2015; Horta, 2009; Roach, 2009; Sauermann & Roach, 2016).  As a career advisor I've heard stories first-hand from postdocs, who talk about feeling lost and abandoned with regards to career advice and guidance about what they should do next in their career, especially those who have chosen not to pursue a faculty career.   For those who have chosen a faculty career, many also described being forced to navigate a culture and career path that is secretive, competitive and unsupportive. As a self-identified first-generation, Mexican American/Chicano from southwest Texas, who is also having a similar experience, I can relate to this sentiment. It reminds me of a poem by Gloria Anzaldúa where she talks about Chicanos having to straddle borders*,*

> To live in the Borderlands means you are neither hispana, india, negra Española ni gabacha, eres mestiza, mulata, half breed caught in the crossfire between camps while carrying all five races on your back not knowing which side to turn to, run from…(Anzaldúa, 1999, p. 216)

Anzaldúa uses the term "borderlands" to describe "la mezcla", the growing population of individuals whose heritage comes from both Mexican and U.S. cultures. These individuals have learned to become a part of both worlds, the U.S. and Mexico, and whose cultural expectations they try to abide by (Anzaldúa, 1999, p. 216). Anzaldúa's words resonate with me and influence how I advise postdocs because, similar to Chicanos, postdocs must also straddle the borderlands between being a mix of both a student/trainee and an independent scholar. Many postdocs are also immigrant scholars who come to the U.S. and are expected to straddle multiple worlds: the culture and country of their homelands, the disciplinary and scholarly cultures of their academic disciplines and scientific communities, and culture and nuances of U.S. society in general.

A study looking at postdocs is needed because postdocs, graduate students, and other trainees have been asking for professional development opportunities that can prepare them for careers both inside and outside the academy (Denecke, Feaster, & Stone, 2017; Council of Graduate Schools [CGS] & Educational Testing Service [ETS], 2012; Ghaffarzadegan, Hawley, & Desai, 2014). Recent science and engineering (S&E) doctoral recipients, such as postdocs, have been especially vocal about the need for more professional development training, since many enter into these positions with the intent to go into tenure-track faculty positions, though few ever do (Sauermann & Roach, 2012). Colleges and universities have responded by trying to develop programs to help postdocs and graduate students prepare for careers outside academia, however, these programs only reach a fraction of their intended targets (CGS, 2017). Moreover, with the limited number of tenure track positions available, and academic careers being less predictable than they once were, there is growing research that focuses on how career interest, behavioral characteristics, and activities engaged by individuals, help them take ownership of their career trajectory (Grossman, 2018; James, 2018; Kuo, 2016; Rimer, 2015). In addition,

despite 40 years of research in the field, there is limited empirical research on the skills and competencies necessary to provide appropriate career and academic advising to adult learners (Menke, Stuck, & Ackerson, 2018).

As a practitioner, I have spent almost two decades trying to recruit and retain more URMs into S&E doctoral programs. Many of my students graduated from these programs and transition into postdocs, only for me to find out later that only about 21% of them actually move into tenure-track faculty positions after completion of their training, and that number is decreasing every year (Powell, 2015). I believe in order to provide better guidance and programming for postdocs, it is necessary to understand their perceptions of scientific careers (e.g. work life balance, work responsibilities, and other job attributes) and their self-appraised ability to apply for and attain professional full-time employment after completion of their training. This is especially important to the advisor and institution because the prospect of a postdoc attaining a tenure-track faculty position is small, and the ability of the advisor or mentor to convey disappointing news in a way that minimizes the distress to a future scholar would prove most helpful to the postdoc (Menke, Stuck, & Ackerson, 2018, p. 12). Research into scientific career perceptions would also be beneficial if the intent is to help postdocs shift their career trajectory towards another pathway in academia or find a different career in another sector (Menke, Stuck, & Ackerson, 2018, p.10).

I started this introduction talking about borders, and in many ways, this study can also be thought of as having been conducted along methodological borders. This qualitative study utilizes aspects of both social science research and humanistic inquiry, grounded in hermeneutics and phenomenology, and mixes them with literature from the biomedical sciences, higher education, psychology, and data from national surveys to provide context and insights into

participants' experiences as they transition from student, to trainee, to independent self-directed scholar. The aim of this study is to provide a holistic, nuanced description of the postdoc experience by listening and trying to understand how postdocs transition from trainees into independent self-directed scientist and academics.

In the following section, I start this study with a definition of terms, my research statement and questions.

## Definition of Key Terms

### Career

A career is defined as the sequence and combinations of work-related roles individuals occupy across their lifespan (Zacher, Rudolph, Todorovic & Ammann, 2018). Typically, this means an individual takes upon the identity of a particular occupation for a significant period of time, especially for the purpose of advancement.

### A Job vs A Career

The difference between a job and a career is that a job is simply a paid position whereas a career is a series of connected jobs or where one builds upon the skills gained in earlier employment with the intent to move into higher paying and/or higher prestige (or other types of benefits) employment opportunities (Super, 1980).

### Career Development

Career development is the concept that refers to the process individuals manage various tasks, behaviors, and experiences within and across jobs and organizations over time, with implications for employees' work-related identity (Zacher, Rudolph, Todorovic & Ammann, 2018).

**Academic Career Development**

Academic career development refers to the process by which academic scholars develop their work-related identity while working in research, teaching, and/or administrative roles in academic and higher education institutions (Zacher, Rudolph, Todorovic & Ammann, 2018). This includes how individuals learn to manage various tasks, behaviors, and experiences within and across jobs and organizations over time.

**Professional Development/Career Development**

Professional development is an ongoing process of reflection and review that articulates with development planning that meets individual needs and leads to personal growth as well as a development of skills and knowledge. (Fraser, Kennedy, Reid, & Mckinney, 2007). In this study, professional development and career development includes "the process whereby an individual acquires or enhances the skills, knowledge and/or attitudes for improved practice" (Mitchell, 2013, p. 390)

**Career Guidance**

"Career guidance is concerned with transitions within the education and employment system and with enabling individuals to build a coherent narrative that links their experiences of education and employment" (Hooley & Rice, 2018, p. 1). Effective career guidance helps contribute to an individual's career development.

**Statement of the Problem**

Working in academia is a unique career path, and while many disciplinary programs have similarities, different fields of study have their own distinct working conditions and require an individual to have different abilities and motivations for success (Zacher, Rudolph, Todorovic, & Ammann, 2018). Graduate education is seen as "crucial part" of the socialization process that

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helps prepare graduates for faculty careers and whose role in a student career development is to prepare them for the skills and expectations of a faculty position (Austin, 2002, p. 96). Likewise, the years spent in a postdoctoral experience in S&E fields is also time spent by a scholar to help them match their education, training and interests, with that of a senior level, in order to advance their training and acquire skills, in the hopes of increasing their chances of attaining a tenure-track faculty position (Committee on Science, Engineering, and Public Policy [COSEP], 2000). However, few graduate students, let alone postdocs, ever do attain a tenure-track faculty position. For example, Figure 1 shows how in 2015, 43% of S&E doctorates were employed in the higher education sector.
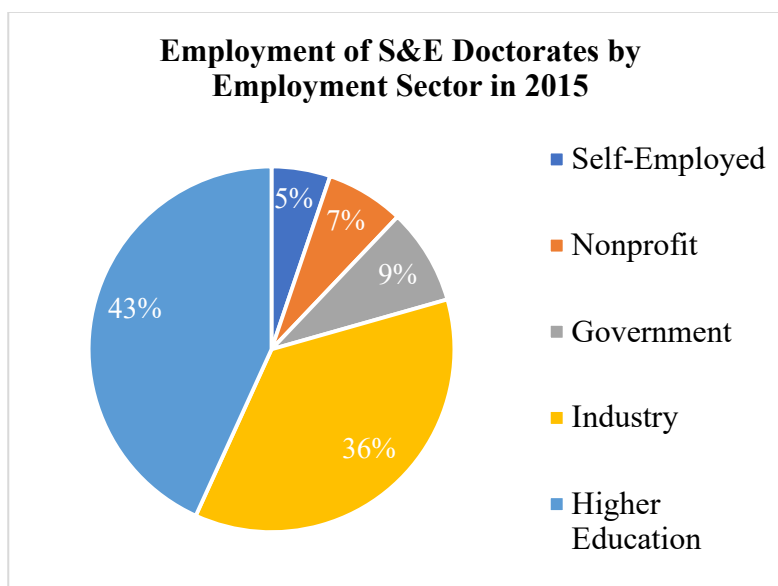


**Figure 1. Employment of S&E Doctorates by Employment Sector in 2015**. Source: Science & Engineering Indicators 2018, Figure 3-1. (National Science Foundation, 2018a)

However, of the 43% of S&E doctorate holders, only about 14% were in tenured or tenure track faculty positions, therefore, it is reasonable to approximate that 87% of all S&E doctorate holders were not in a tenure-track faculty positions (National Science Foundation [NSF], 2018a, Table 3-16). In addition, within this same timeframe, only an estimated 21% of

postdoctoral scholars went into tenure-track faculty positions after completion of their appointment (Powell, 2015).

Information on career pathways after graduation, in general, are hard to find using national data sets. Some national datasets, such as the Survey of Earned Doctorates (SED), track information on postdocs, however it does not track long-term career pathways or job placements after the postdoc. As such, this limits the usefulness of these surveys for individuals looking for job placement data and avenues of employment, especially when individual programs have such variability in their placement outcomes (Pannapacker, 2013). Furthermore, research has suggested that in some fields, like engineering, prospects for a tenure-track position are even harder to find (Larson, Ghaffarzadegan and Xue, 2014).

Research by Larson, Ghaffarzadegan, and Xue (2014) estimated that a tenure-track faculty member in engineering graduates (on average) 7.8 new doctoral students during their whole careers and only one of these graduates can replace that faculty member's position. An important implication is that the academic job market for tenure-track positions has become or is becoming, more and more competitive and PhD holders will have an increasingly hard time finding a tenure-track position. Research also seems to suggest, finding a job in general, may be difficult for not just postdocs, but all doctorate holders in S&E fields.

In 2016, 55% of all doctorate recipients did not have definite employment commitments after completing their doctoral degree (National Science Foundation [NSF] - National Center for Science and Engineering Statistics [NCSES], 2018, Fig. 4c). Since doctoral programs are geared towards training doctoral recipients for careers in academia, many doctoral recipients who do not find tenure-track positions immediately after graduation turn to positions outside of academia (Larson, Ghaffarzadegan, & Xue, 2014; Ghaffarzadegan, Hawley, & Desai, 2014). As seen in

Figure 1 above, more than half (57%) of all S&E doctoral holders where employed outside of academia with the largest percentage (36%) employed in industry. However, since graduate programs are geared towards preparing students for academia, specifically the professoriate, too often graduate students and postdocs, "are receiving little or no preparation in skills and competencies needed to thrive in non-academic careers" (CGS, 2017, p. 7). Therefore, higher education institutions and academic programs have been increasingly encouraged to do more to support the professional development of postdoctoral scholars (NAS, NAE, IOM, 2000 & 2014; National Postdoctoral Association [NPA], 2012 & 2014; NRC, 1981).

The Council of Graduate Schools released reports (Denecke, Feaster, & Stone, 2017; CGS, 2012) voicing concerns from government agencies, industry, and universities for the need to develop more appropriate and comprehensive programs to better prepare students and postdocs for careers both inside and outside academia. In addition, disciplinary associations and federal agencies have also joined the call to strengthen career preparation for students. The American Chemical Society [ACS] (2012), the Society for Industrial and Applied Mathematics [SIAM] (2012), the National Science Board (2015), and the National Science and Technology Council [NSTC] (2013), have all pushed for more professional and career development programs for doctoral students and postdoctoral scholars. Taken together, these associations, various reports, and some scholarly research has identified issues and concerns dealing with the career and professional development of postdocs: concerns with inadequate mentoring and advising from advisors and mentors (Denecke, Feaster, & Stone, 2017; CGS, 2012; Scaffidi & Berman, 2011; ); inadequate training for a variety of potential careers (Allum, Kent, McCarthy, 2014; CGS 2012; Gibbs, & Griffin, 2013; NAS-NAE-IOM, 2014); issues for postdocs transitioning from academic into non-academic jobs (Lin & Chiu, 2016); and a general overproduction of

doctoral recipients in general that has increased competition for positions (Larson, Ghaffarzadegan, & Xue, 2014; Xue & Larson, 2015).  Institutions, academic programs, and even individual faculty and staff have, in a variety of ways, tried to address these issues through programs and professional development training such as the Broadening Experiences in Scientific Training (BEST) Program funded by the National Institutes of Health.  The goal of BEST is to help participating institutions create or improve career development programs to prepare Ph.D. students and postdocs for careers outside of academia (Meyers, et al., 2015). Programs such as BEST, are designed to help individuals, like postdocs, prepare for a variety of careers. However, they only benefit a very small proportion of doctoral students and even smaller fraction of postdocs.  More importantly, programs like BEST are still relatively new and little information regarding their outcomes is available.  Practitioners who have sponsored BEST activities and evaluated their outcomes have also stated, "we will have to tackle the challenge of converting successful BEST initiatives into sustainable enterprises, likely in the face of shrinking budgets" (Meyers, et al., 2015, p. 7).  This statement highlights one of many problems being faced by institutions trying to address the professional development needs of postdocs and graduate students.

Results from the Council of Graduate Schools study, *Professional Development: Shaping Effective Programs for STEM Graduate Students* (Denecke, Feaster & Stone, 2017), revealed several challenges and barriers to institutional efforts to provide better and more comprehensive career and professional development services:  1) limited resources, both the ability to financially meet student and postdoc demand but also content experts and individuals with knowledge of different types of career paths; 2) selecting content for programming, especially since faculty who work the most with students and postdocs, have limited information

and experience on how to mentor or advise individuals for multiple careers; 3) lack of faculty buy-in and support for participation in professional development; and finally, 4) lack of student/postdoc interest and participation.  These last two challenges are especially important and specific to my research interest.

Many postdocs start out as doctoral students, and as graduate students, have access to an advisor, particularly during the final stages of the dissertation process (CGS, 2009).  Of respondents who reported to a recent CGS study, 67% reported having access to a mentor and mentioned career/professional guidance as being a topic of conversation between them.  In addition, a third of those respondents stated that "professional/career guidance by their faculty contributed to their completion" of their studies (CGS, 2009, p. 19).  However, some graduates in S&E fields, like engineering and math, were more likely to report needing more career/professional guidance than what their advisors provided (CGS, 2009, p. 33).  This is significant because an important element of a supportive program environment is the role of the advisor in preparing graduates for future work environments (CGS, 2009, p. 51).  These findings suggest additional research is needed to help understand the role and relationship between postdocs and their advisors.

While many respondents to CGS' study (2017) noted a challenge in meeting participant demand, others reported low participation and emphasized "the need to make students realize the importance of these programs" (p. 21).  As several respondents stated: "One of the biggest challenges is relaying the value in attending these programs" especially in light of "the time demands on students and their interest in participation in programming outside of their program is limited" (p. 21).  This was surprising given the fact that Postdocs themselves, have also talked about the need for professional development (NPA, 2012 & 2014; Sauermann & Roach, 2012;

Scaffidi & Berman, 2011).  Many postdocs take these positions to develop new skills that will aid them in becoming faculty (van der Weijden, et. al., 2016), which is necessary, especially in the S&E fields. Research from Cantwell (2009) shows that international postdocs come to the US for career and social mobility reasons and even more research by other scholars (Chen, McAlpine & Amundsen, 2015; Gibbs, McGready, & Griffin, 2015; Miller & Feldman, 2015) provides evidence that postdocs want enhanced career and professional development over the full course of their scientific training.  In addition, postdocs from all social backgrounds have reported significant declines in interest in faculty careers and increased interest in non-research careers (Gibbs, McGready, & Griffin, 2015). Research by Griffin et. al. (2015) found that female and under-represented minority (URM) scholars' interest in faculty careers, especially in the biomedical sciences, seemed to decrease as their training progressed (Gibbs, Basson, Xierali, & Broniatowkski, 2016).  These contradictory findings suggest additional research is needed to understand what barriers, physical, psychological, perceived or real, are hindering access to existing career and professional services on an individual's campus.

Research on professional development in graduate education has tended to focus on the socialization process in academic units.  Tierney (1997) and Austin's (2002) research reveals how academic units have both formal and informal activities that help graduate students socialize into the unit, and how this process is specifically designed to help graduate students create an identity as a scholar (i.e. faculty member) in that discipline.  Torres goes further to state that (2006) doctoral students learn "to play this game" even if they disagree or plan on not pursuing a faculty career, especially if it causes conflict with another part of their identity (Torres, 2006, p. 139).  I believe Austin (2002), Tierney (1997) and Torres (2006) are saying that the personal choices individuals make about how they define themselves and how they function within their

environment is part of the professional developmental process, however, this process can and does include career development. Therefore, I believe this means conflict between identity and career choice can occur and becomes increasingly complicated when an individual must simultaneously negotiate the expectations of their department (including that of their faculty advisor), their personal social and cultural identity, and their personal hopes and desires for any given career. According to Torres (2006), this process is even more complicated if the individual is part of a minority group (p. 135). Yet, while there is some research, to date there is little research that focuses on the developmental processes of postdoctoral scholars specifically, let alone their career and professional development.

Current research on how to advise S&E graduate students about career and professional development is limited, and for postdocs even more so. Cassuto (2016) states, "advisers can – and should – do plenty when their students struggle. But because we don't talk enough about how to teach graduate students in general…there isn't a lot of pedagogical guidance out there" (p.107). Most of the research on the postdoctorate is focused on describing the structure and nature of postdocs work within their research experience and job outcomes. Additional research is needed to help understand postdoctoral scholar's perceptions of a career (e.g. work life balance, work responsibilities, and other job attributes) and their self-appraised ability to apply, attain, and be successful in any type of job regardless of whether in or outside the academy. More specifically, research is needed that also examines what factors postdocs encounter within their work environment that affects their attempts to focus on their career and professional development. Research is also needed on the factors that postdocs think force them to focus solely on conducting research, including what kinds of messages, actions and activities they are being encouraged to participate in (or not) by their faculty advisor, academic unit, or institution.

By filling in this gap in the literature with experiences from postdocs transitioning into and out of their training, programs and policies can be created to better support and prepare postdocs for a variety of career paths, especially in an uncertain work environment and regardless of career paths.

## Purpose of the Study

The purpose of this study is to provide a holistic, nuanced description of the postdoc experience by highlighting the stories of current postdocs. The goal of this study is to provide the opportunity to hear from postdocs themselves about the experiences they deal with transitioning from doctoral students and trainees and into the workforce to become self-directed independent scholars, academics, and scientists.

## Research Questions

The main research questions that frame this study are:

1. What is the experience like to transition into and out of a postdoc?

2. How do postdocs interpret their education and training experiences, and the decisions they have made about their career?

## Significance of the Study

This dissertation study has the potential to have an impact on postdocs and faculty, staff and institutions who want to support them. Students themselves are looking for information on career pathways because they find information from their programs lacking. Magazines such as *Nature* and *Science* frequently and regularly provide forums for postdocs, graduate students, and alumni to speak and share their stories about the gap between PhD preparation and job expectations, especially for those needing to look outside of the academy (CGS, 2017). Articles such as "The Shrinking Ph.D. Job Market" (Jaschik, 2016), "What I lost when I got my PhD"

(Burton, 2016), and "Permanent jobs in academia are scarce, and someone needs to let PhD students know" (Nature, 2017) all help to contribute to an environment that suggests that not only a job, but a career, will be hard to get after completing a doctoral degree. As a career consultant, I have encountered postdocs that have referenced these sentiments in our advising sessions. Postdocs want information on career outcomes and information is scarce; and what little is out there, is not helpful (Chen, McAlpine & Amundsen, 2015; Gibbs, McGready, & Griffin, 2015; Miller & Feldman, 2015). As a professionally trained career consultant who works with postdocs on a regular basis, I think understanding scholars' motivations and career development is important in order to be able to advise them well. While previous research has indicated that many institutions exploit postdocs as cheap labor (Cantwell, 2011a, 2012; Cantwell & Taylor, 2015), there are some institutions that want to support and help postdocs and graduate students with more career and professional development programming (CGS, 2017).

In April 2015, CGS received 226 responses from institutions all across the U.S. (and some from Canada) which indicated that 62% of institutions offer formal professional development programs for graduate students and postdocs, outside the formal curriculum (CGS, 2017, p.17). However, some of their biggest challenges were selecting content that would be beneficial to their participants and lack of student and postdoc interest and participation. In addition, there was some speculation that students were reluctant to attend workshops or access resources because of "time demands and/or perceptions (real or imagined) that their advisor or other program faculty would disapprove" of their desire to find resources for careers outside of academia (CGS, 2017, p. 21). Findings from this dissertation study could help to provide a better understanding of postdoctoral career motivations and how postdocs find and use information to make decisions about their careers. Results from my study could be used to

directly develop and enhance programs and strategies institutions are developing to help not only

postdocs, but graduate students in general, prepare for careers outside the academy and/or

develop alternative paths to tenure-track faculty positions.

## Summary of Dissertation

In the following dissertation, I outline the parameters of my study which is situated in the

current literature and present the methodological plan of study.  In Chapter 2, I first examine the

current literature on postdocs, including an overview of career advising and professional

development. In Chapter 3, I describe how this study is guided by a constructivist approach using

narrative inquiry as my methodology.  In Chapters 4 thru 7, I present findings of this study, and

Chapter 8 includes a summary, implications, and future directions for research.

**CHAPTER 2: REVIEW OF THE LITERATURE**

The following is a review of the literature focusing on several aspects of S&E postdoctoral positions in the United States. This review begins with an overview of doctoral student professional development to provide context and a backdrop to the development of the postdoctorate as part of S&E training. Following this overview is information about the postdoctorate, specifically how many postdocs there are in the United States, how their roles are defined and the rapid growth in their positions. Following the overview of postdocs in the U.S., is an overview of some of the challenges postdocs face with regard to career and professional development in their positions and why this study is needed.

**Professional Development in Doctoral Education**

Doctoral students and postdocs believe the purpose of a graduate education is to develop knowledge and expand information in a given field while also preparing future scholars to become faculty within their chosen discipline (Cassutto, 2015; Fuhrmann, 2016; Fuhrmann, Halme, O'Sullivan, & Lindstaedt, 2011; Golde & Dore, 2001; Torres, 2006). Furthermore, because, "the goal of doctoral work is to create an identity as a scholar in the discipline" (Torres, 2006, p. 135) professional development in doctoral education is primarily focused on socializing doctoral students into the professoriate. In doctoral programs, graduate students typically begin to understand that professionalism means "learning how to publish" and that professional development in academia means subordinating themselves to a set of norms established by their advisors, and "doing what they say until you become one them" (Cassuto, 2015, p. 165).

Research suggests that professional development is an essential part of a supportive doctoral program environment (CGS, 2009). The problem, according to some researchers like Cassuto (2015), is that current doctoral professional development is solely focused on preparing

students for the professoriate, meaning faculty careers specifically and not for other areas where recipients actually end up as shown in Chapter 1.  Fuhrman (2016) states that postdocs, lack knowledge about the career options available to them and are insufficiently prepared to transition into their intended career paths due to the underlying culture of academe "which strongly values research-intensive academic career paths over other career outcomes and devalues career development as a distraction from postdoctoral research" (p. 872).  Fuhrman (2016) and Cassuto (2015) both emphasize that academic culture impacts both doctoral students and postdocs by discouraging them from taking their own actions around professional development and even going so far as to say it dissuades them from participating in campus programs not focused on preparing them for the professoriate. Moreover, of the little professional development programs that exists, most are developed for graduate students and postdocs specifically for preparing them for faculty positions (CGS, 2018).  One example of this type of program is the Preparing Future Faculty program.

The Preparing Future Faculty (PFF) program was launched in 1993 as a partnership between CGS and the American Association of Colleges & Universities (AAC&U) and is now "a national movement to transform the way aspiring faculty members are prepared for their careers" (CGS, 2018, para. 1).  PFF and other similar programs provide doctoral students and postdocs with opportunities to practice and observe faculty responsibilities at their current and other types of institutions in order for them to better understand and prepare for expectations of faculty positions (CGS, 2018).  One of the main reasons programs of this type have now been expanded to other institutions across the country, is due to their "effectiveness at providing a supportive program environment and preparing graduates for future careers" (CGS, 2009, p. 51).

In the *Postdoctoral Experience Revisited* (NASEM, 2014) two postdoctoral programs at the University of North Carolina (UNC) at Chapel Hill were described as benefiting URM postdocs in particular. Their Minority Postdoc Association was highlighted as an effective program bringing together URMs from across disciplines (not just S&E) to build professional networks and promote and support diversity and inclusion. The Carolina Postdoctoral Program for Faculty Diversity was also highlighted as one of the oldest diversity fellowship programs having supported 150 scholars; 131 of which were scholars teaching or working in higher education and 46 hired to work as faculty. Programs like these, and the ones described earlier in this study are aimed at helping to diversify the faculty through the use of postdoctoral positions, however, little empirical evidence is provided on whether these postdocs actually end up in tenure-track faculty positions because of their postdoctorate. Though preparing future faculty programs can be deemed somewhat successful, it is important to point out that these programs only help to further perpetuate the socialization process of doctoral students and postdoctoral scholars into the professoriate, though very few doctoral recipients, and especially postdocs, actually do.

Consistently, across surveys and various studies, 50% to 75% of postdocs take the position with an expectation of moving into a tenure-track position after completion (Huang, Cantwell, & Taylor, 2016; Powell, 2012; Sauermann & Roach, 2016). However, the number of postdoctorates who actually end up in tenure-track positions has steadily decreased, going from 37% in 2008, down to 30% in 2010, and declining further to 21% in 2012 (Powell, 2012). Research now suggests postdoctoral employment is not a guarantee into a faculty career but rather a holding bay for a scientific workers with little future advancement (Cantwell, 2009; Nerad & Cerny, 1999; Stephan & Ma, 2005; Zumeta, 1985). Additional research is needed to

understand how the interaction of race, gender and nationality shapes a URM postdoc's experience at attaining a tenure-track faculty position. This is particularly important since the postdoctorate has become the *de facto* next career step following completion of a doctoral degree (National Postdoc Association [NPA], 2014).

In general, postdoctoral training has been a concern for the research community for decades (NASEM, 2014). The National Academies has produced reports through their research arm, the National Research Council (NRC) in 1969, 1981, 2000, and 2014 that have all called for reforms to the postdoctoral system. In the 2014 report, *The Postdoctoral Experience Revisited*, the National Institutes of Health (NIH), the President's Council of Advisors on Science and Technology, the American Chemical Society, the Council of Graduate Schools, and other professional scientific organizations have expressed concern and hopes for improving the postdoctorate experience. What follows is an overview of postdocs in the U.S. to help expand the context and need for this study.

**Defining the Postdoc**

The postdoctorate is one of the most common positions recent S&E doctoral recipients move into after graduation and is one of the fastest-growing occupations in U.S. higher education (Cantwell & Lee, 2010; Cantwell & Taylor, 2015). A postdoctoral scholar is "an individual holding a doctoral degree and engaged in a temporary period of mentored research and/or scholarly training for the purpose of acquiring the professional skills needed to pursue a career path of his or her choosing" (NPA, 2017, what is a postdoc, para. 1). According to the National Postdoc Association, there are approximately 79,000 postdoctoral scholars involved in research in the United States (more than NSF's estimate) and state that this number is steadily increasing due to the fact that the postdoctorate has become the *de facto* next career step following

completion of a doctoral degree in many disciplines (NPA, 2014). Postdoctoral positions are typically taken by graduates right after completion of their studies (e.g., PhD, M.D., etc.) and often in close association with a distinguished mentor or colleague, (Curtis & NRC, 1969, p. v). While the key characteristic of a postdoctoral position is that it is a temporary position meant to help an individual prepare for a more permanent position in academia, usually a tenure-track faculty position, more and more postdoctoral scholars are staying longer in these positions, or taking multiple consecutive appointments, with the majority never even getting into coveted faculty positions (NPA, 2014). Unfortunately, with the number of postdoctoral scholars rapidly growing, the three aspects that were used to uniquely define the position - time-limited, mentored research, and career preparation – are slowly disappearing.   These positions are becoming lengthier with minimal mentorship and little if any career preparation (Cantwell, 2009; Gibbs, McGready & Griffin, 2015; Miller & Feldman, 2015; NPA, 2014;).

Traditionally, the years spent in a postdoctoral experience in S&E fields were meant to be time spent by a scholar to help them match their education, training and interests, with that of a senior level scientist, in order to advance their training and acquire skills necessary to enter an increasingly changing world of employment options (NASEM, 2000; NASEM, 2014). However, in many S&E fields, postdoctoral work is now seen as a prerequisite for any scholar looking for a tenure-track faculty position.  For example, in the physical sciences, such as chemistry and physics, most PhDs who plan to have research careers are encouraged to do postdoctoral work with a focus on research and publishing findings, while in mathematics the focus is on teaching as well (NASEM, 2014).  The variety and differing emphasis of work postdocs are required to do in their respective fields, also leads to postdocs being given a variety of titles depending on work, institution, and even funding mechanism.

The majority of the postdocs in the United States work in universities, but in many cases not necessarily with the title of "postdoctoral scholar" (NASEM, 2014; NPA 2012). This is partly due to different institutions using different titles to describe the work and functions they perform for their institutions. In 2011, the National Postdoc Association (2012) found that there were over 37 different titles assigned to scholars, many of which had a prefix of "postdoctoral" such as "Postdoctoral Fellow," Postdoctoral Scholar," "Postdoctoral Trainee." Other individuals have titles without that prefix "postdoctoral" such as "Research Associate," Research Fellow", and "Visiting Research Fellow" to name a few (National Postdoc Association [NPA], 2012). This variation in titles is due much in part to the very nature of the postdoctoral population, which is not a homogenous group. Doctoral scientists and engineers take postdoctoral appointments for a variety of reasons and at different stages in their careers, which means their responsibilities and privileges also vary tremendously. Some are given considerable freedom in selecting and working on a research problem; others are used as additional lab workers; some teach courses and advise students; some actually take courses; others have no involvement in the program of graduate education at all (Zumeta, 1985). With such variation, it is difficult to define the postdoctoral population precisely. Due to the complicated and diverse nature of the work and the different titles many postdoctoral researchers have, the definition of a postdoc has expanded to include individuals who hold a temporary appointment level, post-PhD or post-M.D., that is intended to provide continued educational and research experiences, usually through, though not necessarily under the direction of a senior faculty mentor (Zumeta, 1985). Some postdoctoral scholars work in a university setting teaching and/or mentoring students, working with little or no oversight, little interaction with other colleagues, and have little to no access to institutional facilities or benefits or work protections (NASEM, 2000, 2014; NPA 2012). For the most part,

postdocs are encouraged to focus on developing critical skills such as grant writing, critically reviewing manuscripts, publishing scholarly papers and presenting research at conferences (NASEM, 2000, 2014).

## Postdocs in the United States

In 1969, a federal report titled *The Invisible University* (Curtis & NRC 1969), found that the growth of postdoctoral positions was difficult to track due to the fact that different institutions not only use different titles to describe them but also their work and employment duties varied significantly by not only discipline but also by institution. Therefore, the authors strongly recommended a system be put in place to help track the growth of postdoctoral positions over time. Yet in 2000, after a follow up report was submitted, *Enhancing the Postdoctoral Experience for Scientists and Engineers* (National Academy of Sciences, National Academy of Engineering, and Institute of Medicine [National Academies], 2000) and in 2014, after publishing *The Postdoctoral Experience Revisited* (National Academies, 2014), a comprehensive system of tracking is still not available.   Since no single data source provides comprehensive information on the entire population of postdocs in the United States, to understand the landscape with regards to postdocs, researchers use at least three NSF surveys that need to be utilized in order to get some sense of the landscape:  The Survey of Earned Doctorates (SED) mentioned in Chapter 1, the Survey of Doctorate Recipients (SDR) and the Survey of Graduate Students and Postdoctorates in Science and Engineering (GSS).

The SED is a survey completed by all individuals who earn a research doctorate in any field upon graduation, so it captures those S&E doctoral recipients who have earned a research doctorate in a related field and provides some information on the proportion of graduate students who intend to go on to postdoctoral appointments (NSF-NCSES, 2017).  The SDR samples

research doctorate degree earners in the United States (based on the population from the Survey of Earned Doctorates) which provides information on the longitudinal workforce experiences of doctorate recipients (para. 1). In addition, the SDR covers residents who earned a science, engineering, and health doctorates in U.S. schools, however postdocs who received doctorate degrees from foreign institutions are not included.

Both the SED and the SDR only follow postdocs who earned their PhDs in the United States. In order to gain information on postdoctoral scholars who came to the United States after earning a degree elsewhere—which some have roughly estimated at about or over 50% of the total postdoctoral population, what little information there is, is available from the GSS (NASEM, 2014, p. 15). However, the GSS survey does not provide much demographic information and it provides no information on where the scholars received a doctoral degree. Unlike SDR, which collects data from individuals, the GSS surveys academic departments that offer graduate programs in science and engineering and certain health related fields, for counts of all their postdocs, regardless of where they earned their degree (NASEM, 2014). However, unlike the SDR, the GSS does not gather data on postdocs in nonacademic positions or in academic units that lack graduate programs, including many academic research centers. The GSS has collected data on postdocs annually since 1979 and provides the total number of postdoctoral appointees by demographic and financial support. The results can then be used to assess shifts in their appointments, but unfortunately, this survey does not include all postdocs employed in all disciplines, nor those working in industry or the federal government. In addition, data tends to be several years behind, but so far it is the best estimate of postdoctoral researchers in the United States.

**Number of Postdocs in the U.S.**

Although accurate data on the number of postdocs in the United States is hard to get, estimates are there are between 64,000 (National Science Foundation-National Center for Education Statistics [NSF], 2018a) and over 79,000 (NPA, 2014) postdocs working in science, engineering and health fields in the United States. For example, Figure 2 shows how over the past two decades, science and engineering fields have seen almost a double digit increase in the number of postdocs working in those fields.

**Growth of Postdocs in Science & Engineering Fields from 1994 to 2016**
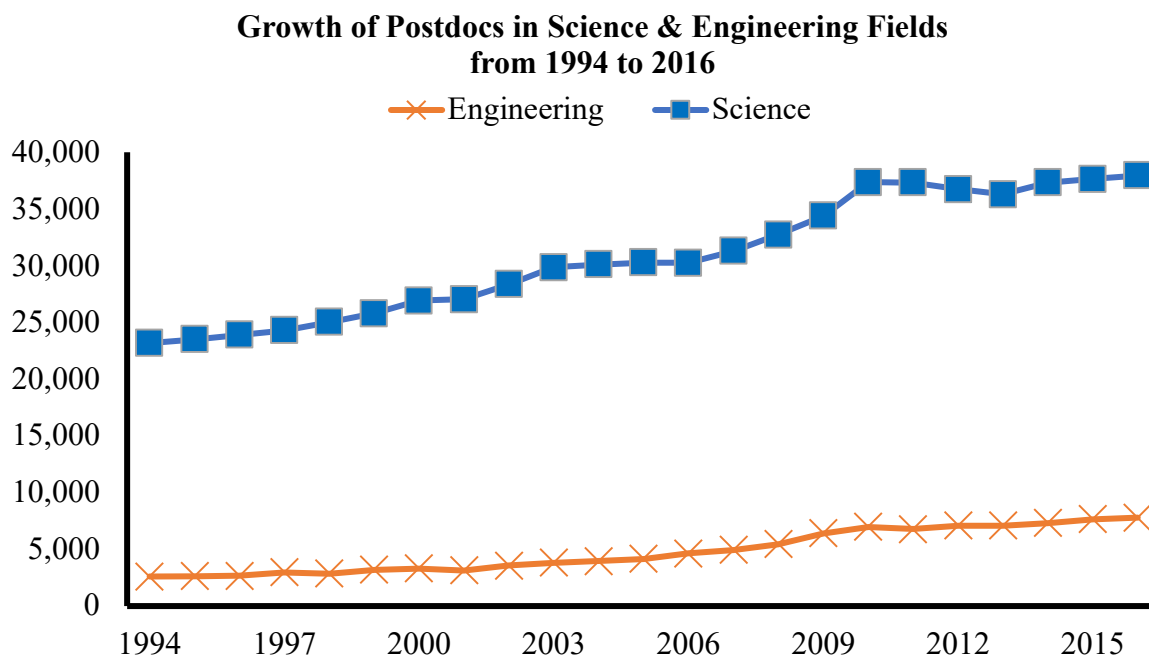


**Figure 2. Growth of postdocs in science and engineering fields from 1994 to 2016.** Source: Table 77: U.S. residing doctoral scientists and engineers on postdoctoral appointments, by selected demographic characteristics and broad field of doctorate. Retrieved from https://ncsesdata.nsf.gov/doctoratework/2015/html/SDR2015_DST_77.html.

These numbers also represent the dominant trend over the past 50 years, which has seen the expansion of postdocs across various disciplines. Since the 1970s, the number of U.S. trained postdocs working in the United States in S&E fields increased from 4,200 to over 19,200 in 2015, representing a 457% increase in these positions (NSF, 2018a, Appendix Table 5-14).

Many postdocs were (and still are) found to be working mostly in academic institutions, primarily in doctorate-granting institutions that conduct very high levels of research as seen in Table 1.

| Academic Institution Type | Postdocs (thousands) |
|---|---|
| Doctorate-granting, very high research | 14.1 |
| Other doctorate-granting institutions | 1.7 |
| Medical schools and medical centers | 2.2 |
| Other universities and colleges | 1.2 |
| Total All Academic Institutions | 19.2 |

**Table 1. S&E doctorate holders employed in academia in postdoc positions, by Carnegie classification of employer.** Source: NSF (2018a). Adapted from Table 5-20: Science and engineering doctorate holders employed in academia in postdoc positions, by Carnegie classification of employer and years since doctorate.

Within academic institutions, Table 2 shows how postdocs have been increasingly prevalent in the life sciences, physical sciences, and engineering, more so than any other fields.

| Degree field | 1973 | 1983 | 2003 | 2015 |
|---|---|---|---|---|
| Physical sciences | 7.1 | 5.4 | 6.5 | 6.8 |
| Mathematics and statistics | 0.0 | 0.8 | 3.0 | 2.4 |
| Computer and information sciences | NA | 0.0 | S | 3.3 |
| Life sciences | 5.4 | 9.3 | 11.1 | 10.4 |
| Psychology | 1.6 | 2.9 | 2.8 | 2.1 |
| Social sciences | 0.4 | 1.5 | 1.0 | 0.7 |
| Engineering | 1.6 | 1.7 | 4.0 | 5.5 |

**Table 2. S&E doctorate holders employed in academia in a postdoctoral position, by S&E degree field: Selected years, 1973–2015 (Percent).** Note(s): Physical sciences include earth, atmospheric, and ocean sciences; life sciences include biological, agricultural, environmental, and health sciences. Source: NSF (2018a).

Since postdoctoral experiences are supposed to be a focused research-intensive time during which a newly minted PhD recipient is to be working on establishing a research agenda, publishing and developing a professional network, it makes sense that most tend to be employed at doctoral-granting, research intensive universities. However, postdocs can also be found working in industry as well as government positions. For example, in 2015, the SDR reported that while 72% of all postdocs were working in academic institutions, there were at least 19%

working in industry, and 9% for departments sponsored by the federal government (NSF-NCSES, 2018).

## Origin of the Postdoctorate

In order to understand the rapid rise of the postdoc, it is important to understand the origins of this type of training.  The postdoctorate was first established in the late 1800s as an elective stage of advanced specialized training undertaken by new PhDs who wanted to hone their scientific skills prior to embarking on faculty careers. One of the first examples was in 1876, when the first president of Johns Hopkins University, Daniel Gilman, offered 20 fellowships to attract and support young men starting research careers, of which several already had PhD's (Curtis & NRC, 1969). Following this, in 1919, the National Research Council (NRC) and the Rockefeller foundation created the National Research Fellowship Program, which awarded over 1,300 scientists fellowships to complete postdoctoral research in physics and chemistry (Curtis & NRC, 1969; NAS, 2014). In the 1920s and 1930s, postdoctoral researchers quickly developed a scientific role which included managing the day-to-day research operations of laboratories, allowing faculty time to supervise other research, teach, obtain funding, and attend to other administrative tasks (NASEM, 2014).

In the 1960s, following World War II, funding for basic research at universities shifted from foundations and private industry to the federal government. Approximately 10% of doctoral graduates went on to a postdoctoral position with the majority of growth in the biomedical fields (NASEM, 2014). Following World War II, many of the problems that concern postdocs today, concerned them back then including, the need to support early research investigators in additional training, the need to provide them with support for career and professional development (in the past that was to gain entry into faculty careers, and now expanded career

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fields), the balance of teaching and research, the influence of sponsoring agencies, and finally, and what some would call the most important aspect, the responsibility of the colleges and universities in responding to these needs (Curtis & NRC, 1969).

As funding increased in the 1970s, so did the number of postdoctoral researchers. By the end of the 20th century, the postdoctoral research position had become an established component of professional training in many fields of science and engineering, and more were being hired in the social sciences and humanities (Curtis & NRC, 1969, NASEM, 2014). Since then, with the financial and administrative support of federal, industry, and higher education institutions, particularly research-intensive institutions, the pattern of postdoctoral education has expanded rapidly (Cantwell, 2009). While the value of postdoctoral researchers to the conduct of research remains clear, the value of this experience to postdoctoral scholars has become questionable for many.

### Reasons for Taking the Postdoctorate Since the 1970s

By the 1970s, postdoctoral appointments had become more closely related to academic labor markets than to scholarly interests since many new PhDs take postdoc jobs because other work is not available (Cantwell & Taylor, 2015; Chen, McAlpine & Amundsen, 2015; Scaffidi & Berman, 2011; Zumeta, 1985). Additional research suggested that individuals move into postdoc positions not only to acquire discipline-specific research experience but also to access information and mentorship about the scientific field they hope to gain faculty positions in, assuming they will receive support to plan strategically and make informed decisions about their future career decisions (Scaffidi & Berman, 2011). However, many are not successful, due to the view that postdoctoral positions are obligatory for graduate students interested in pursuing a research career and since many are low-paying, temporary positions, and foster little opportunity

for mentoring and professional development. (Bennett, & Griffin, 2014; Malcolm & Dowd, 2012; NASEM, 2000 & 2014).

As stated earlier, during the second half of the twentieth century, postdocs increased in absolute numbers and expanded beyond a few elite institutions to become a mainstay at American research universities. Given this change and expansion over the last 50 or so years, the postdoctorate has become a standard layer of academic employment. Several additional themes seem to be emerging around why scholars assume these positions, some of which include (but are not limited to): wanting to develop new research or lab skills, gaining access to particular technology, wanting to explore more in-depth or new research topics, and for the majority, it is "the next logical step" in their career trajectory towards becoming faculty (Huang, Cantwell, & Taylor, 2016; Powell, 2012; Roach, 2009; Sauerman & Roach, 2016). Such findings fall in line with literature by van der Weijden, et. al. (2016) whose research indicates that many postdocs take these positions to develop new skills that will aid them in becoming faculty, which is necessary especially in the S&E fields.

### Using Postdocs to Diversify the Academy

According to a 2015 report titled *Broadening Participation in America's STEM Workforce*, one of the grand challenges facing the nation is to transform the S&E enterprise at all levels to fully engage the nation's citizens – including women, under-represented minorities, and persons with disabilities (National Science Foundation, Committee on Equal Opportunities in Science and Engineering [NSF-CEOSE], 2015). Although African Americans, Hispanics, and Native Americans between the ages of 18-24 make up 34% of the U.S. population and graduate from high school at rates close to those of whites, they receive only about 14% of the undergraduate science and engineering degrees and only 5.4% of science and engineering PhDs

(Beede, et al., 2011). Despite efforts to improve representation of women, under-represented minorities, and persons with disabilities in science, technology, engineering, and mathematics (STEM) fields, progress has been insufficient to meet the increased needs and challenges of global competition (NSF-CEOSE, 2015).  Within many fields, the numbers of African American, Hispanic, and Native American STEM doctorate recipients are in the single digits or even zero. For example, in 2012, only six Hispanic women earned doctorates in computer sciences and no Native Americans earned doctorates in mathematics; women earned one-third or less of all doctorates in computer science and physical sciences, and African Americans, Hispanics and Native Americans each earned 3% or less; although women's participation in agricultural sciences, biological sciences, and social sciences has increased from 2002 to 2012 to roughly half of all doctorate recipients, African Americans and Hispanics still only earned roughly 3 to 6% and Native Americans earned roughly one half of one percent of the doctorates in these fields (NSF-CEOSE, 2015, pp. 3-4).

The NSF-CEOSE report contends that the under-production of PhD degrees in STEM is a problem because the increased involvement of under-represented minorities is needed for a workforce of the future that is being impacted by changing demographics, which in turn has implications for equity, national security, and educational needs (pp. 10-19).  Unfortunately, too few students from under-represented backgrounds are continuing throughout the STEM educational pipeline. For example, whereas PhD graduates in biomedical sciences grew more than nine-fold from 1980-2013, the number of under-represented minority assistant professors in biomedical departments only grew two point six-fold (Gibbs, Basson, Xierali, & Broniatowkski, 2016). Recent research by Gibbs, McGready, and Griffin (2015) show under-represented and minoritized individuals tend to lose interest in faculty careers at research-intensive universities

declined as training progressed. Gibbs, McGready, and Griffin (2015) also suggested that there are aspects of the environment or nature of faculty work, which causes qualified under-represented postdocs (and others) to choose other career paths. Therefore, many national agencies such as the NSF view the postdoctorate as a critical point in the pipeline for increasing the number of under-represented minorities into faculty positions (NASEM, 2000 & 2014).

In recent years, many national and private funding agencies have invested significant resources in order to help diversify the professorate and research workforce with the view that improving diversity is fundamental to advancing the various research fields (Gibbs & Griffin, 2013) and utilizing postdoctoral programs that target under-represented minorities as one of the promising practices to do so (Roach, 2009). In addition, the American Society for Cell Biology (ACSB) and the American Association for the Advancement of Science (AAAS) have funded programs and workshops that aim to help the career development of postdoctoral fellows to "better ensure their success" (Roach, 2009). Another example is the University of Michigan, which launched the LSA Collegiate Postdoctoral Fellowship Program to recruit 50 scholars with demonstrated expertise in diversity, equity, and inclusion and to provide a streamlined process for joining the tenure track at their institution (University of Michigan, 2018a). The focus of this program is to recruit and support "exceptional scholars who are committed to diversity in the academy and to prepare those scholars for possible tenure-track appointments in the College of Literature, Science, and the Arts;" in particular, the program is interested in scholars with a demonstrated interest in bringing to their research and undergraduate teaching the critical perspective that comes from their non-traditional educational background and/or scholarly understanding of the experiences of groups historically under-represented in higher education" (University of Michigan, 2018). Finally, the federal government has funded programs aimed

explicitly at broadening participation by under-represented minorities and other minoritized populations.  For example, in FY 2013, NSF spent over $607 million on focused and emphasis broadening participation programs; in FY 2014 the estimate was over $638 million; and in 2015 it was over $663 (NSF-CEOSE, 2015).

## Problems within the Postdoctorate

Throughout the literature on postdocs and postdoctoral training in higher education, questions and concerns from federal agencies and researchers, have changed little over time (Curtis & NRC, 1969; Jaschik 2016; NASEM, 2000 & 2014; Nerad & Cerny, 1999; NRC, 1981; Zumeta, 1985):  Is the length of time postdocs are remaining in training growing?  Are postdocs being compensated equally in the form of pay and benefits across disciplines and institutions? Are postdocs getting recognition in the form of authorship on publications and presentations by their PIs?  Is there a balance between the number of postdoctoral positions and the number of jobs that require postdoctoral training?  What jobs actually require postdoctoral training (e.g. additional/advanced training) beyond graduate education?  Are there scholars using postdoctoral positions as "holding positions" instead of "the next step" to a faculty position?  Is there an exiting of scientists, especially women and minorities, from the academy after a postdoc position and if so, why? Finally, what happens to postdoctoral scholars who don't get the jobs they aspire to?

By the 1970s postdoctoral appointments had become more closely related to academic labor markets than to scholarly interests since many new PhDs take postdoc jobs because other work is not available (Cantwell & Taylor, 2015; Chen, McAlpine & Amundsen, 2015; Scaffidi & Berman, 2011; Zumeta, 1985). Additional research suggested that individuals move into postdoc positions not only to acquire discipline-specific research experience but also to access

information and mentorship about the scientific field they hope to gain faculty positions in, assuming they will receive support to plan strategically and make informed decisions about their future career decisions (Scaffidi & Berman, 2011). Unfortunately, many recent graduates who do enter postdoctoral training, find themselves with little opportunity for mentoring and professional development (Malcolm & Dowd, 2012). For others, like under-represented scientists, bypassing these low-paying position makes sense, since many come out of their doctoral program with a heavy debt burden and wary of such positions (Gibbs, McGready, & Griffin, 2015). Some have also argued that this situation has also helped to increase the length of time postdocs are staying in their positions. (Stephan & Ma, 2005).

### The Perpetual Postdoc

The term "perpetual postdoc" is found in the NRC 1981 report, *Postdoctoral Appointments and Disappointments*. This report presented findings and recommendations based on a survey of postdocs in 1979, to "assess the changing roles of postdoctorals in research and higher education in the US" (p. 1). This report found evidence that many scientists were prolonging their "postdoctoral apprenticeships" because they could not find employment (NRC, 1981, p. 100). As part of the survey responses, one comment was by a postdoc in Chemistry, who had received his PhD in 1971:

> I got my degree in 1971 (FY1972). There are colleagues of mine still doing postdocs
> from that time because university/research jobs are not around. Disappointment and
> disgust abound. Expectations have not been fulfilled, and the era of the *perpetual postdoc*
> is upon us (p. 100).

Researchers argue that this rise is a result of the shift away from the view of a postdoc as a stepping-stone to faculty career to a holding bay (Nerad & Cerny, 1999; Yang & Webber,

2015). Cantwell's research (2009, 2011a, 2011b, 2012) further highlights that increasing privatization of higher education has shifted the notion of postdoctoral work from apprenticeships that lead to faculty careers to long term temporary workers with little or no future research career guarantees. This has given rise to the notion that postdocs are spending more and more time in these positions with little advancement.

The National Academies 2014 report *Postdoctoral Experience Revisited*, highlighted that "although the data is not definitive, the average length of time spent in postdoctoral positions seems to be increasing" (p. 1). Of the more than 40,000 postdocs in the US in 2013, 25% had been in their position (or a combination of positions) for more than 6 years (Powell, 2015). Powell (2015) provides a story of Sophie Thuault-Restituito, a postdoc for 12 years, an example of how the "perpetual postdoc" occurs:

> She had completed her first postdoc in London, then moved to New York University (NYU) in 2004 to start a second. Eight years and two laboratories later, she was still there and still effectively a postdoc. Her research on Alzheimer's disease was not making it into high-profile journals, so she was unable to compete for academic positions in the United States or Europe. She had two young children at home, and was dependent on outside grants to secure and pay for her position, she knew she needed something more secure. "My motivation was gone. I was done with doing research." So, in 2013, Thuault-Restituito moved into a job as a research-laboratory operations manager at NYU, where she coordinates building renovations and fosters collaboration between labs. She enjoys the fact that her staff position has set hours, as well as better pay and benefits. But at the time of the move, she mourned the loss of a research career

and she regrets the years wasted pursuing one. 'I stayed five years more than I should have,' she says." (p. 144)

This lack of opportunity to find permanent positions in academia as tenured faculty also provides a clue into why some scholars continue into second and even third postdoc positions. Unfortunately, research from Mishagnia (2009) found that individuals who held two postdoctoral appointments were not better off than those who just completed one. Furthermore, those who held more than two postdoctoral appointments were more likely to leave the science and engineering fields for good. This supports the hypothesis that postdoctoral appointments are probationary positions or "waiting lists" of a sort rather than extensions to doctoral education that provide additional training (Mishagnia, 2009, p. 24).

Another argument states that the growth and expansion of the postdoctorate is said to be related to "the massification of American higher education" (Zumeta, 1985, p. 13) and the transformation within institutions of higher education, which has shifted from a focus on teaching and knowledge production, to a focus on academic research for the sake of funding and increased competition through the globalization of higher education (Altbach, 2004; Marginson & Rhoades, 2002; Slaughter & Rhoades, 2004). Colleges and Universities have become heavily dependent on resources derived from externally funded research and in doing so, have agreed to conduct a growing volume of research in exchange (Cantwell & Taylor, 2015). Through this shift, postdocs have become "scientific employees rather than trainees, incorporated into capitalist modes of academic production as low-cost, high-yield scientific workers," especially international postdocs (Cantwell, 2009, p. 10). Because of this shift in labor, the reasons for taking a postdoc, have also come into question. Further research on postdocs points to the need for enhanced career and professional development over the full course of their scientific training

(Chen, McAlpine & Amundsen, 2015; Gibbs, McGready, & Griffin, 2015; Miller & Feldman, 2015; NSF-CEOSE, 2015).   This is especially important as the postdoctorate is now seen as a mode to help diversify the professoriate and increase the number of under-represented doctoral recipients going into tenure-track faculty positions.

**The Internationalization of Postdocs as a Scientific Workforce**

In 2009, Cantwell found that "international postdocs have become scientific employees rather than trainees, who are incorporated into capitalist modes of academic production as low-cost, high-yield scientific workers" (p. 10).  Cantwell (2009) describes an international postdoc as "an early-career academic working outside of [their] country of citizenship or permanent residence who typically requires a work visa as a condition of their employment" (p. 2). As the number of postdoc positions has grown, so has the number of international scholars that have come to the U.S. to fill those positions (Cantwell, 2011a). For example, Figure 3 shows how from 1963 to 2015, the number of temporary visa holders staying in the U.S. after earning a doctorate rose faster than those who were intending to leave.
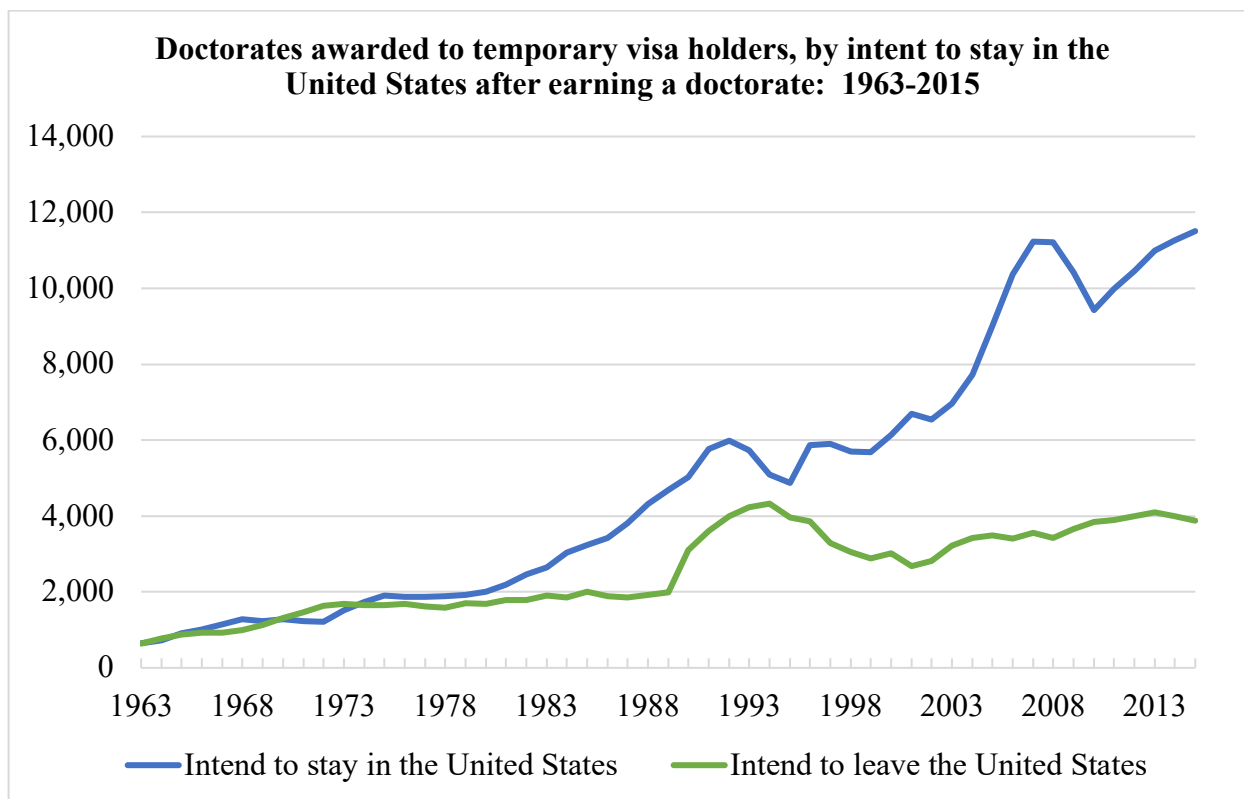
**Figure 3. Doctorates awarded to temporary visa holders by intent to stay in the U.S. after earning a doctorate from 1963-2015.** Source: (NSF, 2016, Fig 5a).

As faculty have shifted their focus to externally funded research, faculty have sought out postdocs, and in particular, international postdocs to help them conduct this research for multiple reasons: their low-cost, their employment is contingent on their PI's research grant funding, meaning they are directly supervised and accountable to individual faculty members, not the institution; they are not protected by the tenants of academic freedom so can be dismissed easily (Cantwell, 2009; Cantwell & Taylor, 2015). Evidence for the increased use of international postdocs comes from the SDR: since1980, the number intending to stay in the U.S. increased at an average rate of 5.4% and as a result, in 2015, the number of temporary visa holders intending to stay was three times greater than the number intending to leave, 11,508 vs. 3,885 (NSF, 2016).

In addition, Table 3 shows how from 2005 to 2015, temporary visa holders intending to stay were also more likely to take a postdoc position, reaching a high of 59% in 2010; among

temporary visa holders intending to leave the U.S. after completing their graduate degrees and

U.S. citizens and permanent residents, the share committing to a postdoc position also grew over

this 10-year period but never exceeded 40% (NSF, 2016):

| Year | All doctorate recipients | U.S. citizens & permanent residents | Temporary visa holders intending to stay in the United States | Temporary visa holders intending to leave the United States |
|---|---|---|---|---|
| 2005 | 35.5 | 31.9 | 50.8 | 24.8 |
| 2006 | 33.9 | 30.9 | 45.0 | 25.2 |
| 2007 | 36.2 | 32.9 | 46.4 | 31.0 |
| 2008 | 35.8 | 32.6 | 45.6 | 32.3 |
| 2009 | 37.9 | 34.4 | 49.5 | 34.5 |
| 2010 | 42.9 | 38.9 | 59.4 | 34.1 |
| 2011 | 42.7 | 39.4 | 55.9 | 33.8 |
| 2012 | 40.2 | 37.7 | 50.4 | 31.8 |
| 2013 | 39.4 | 36.9 | 48.9 | 34.2 |
| 2014 | 39.4 | 37.3 | 47.3 | 35.0 |
| 2015 | 39.7 | 37.5 | 48.3 | 33.8 |

**Table 3.  Postdoc rate of U.S. doctorate recipients, by resident type: 2005–15 (Percent).**
Adapted from NSF, 2016, Fig 6e retrieved from:
https://www.nsf.gov/statistics/2017/nsf17306/report/international-students-staying-employment-outcomes/postdocs.cfm

Further research (Cantwell, 2009, 2011a, 2011b, 2012; Cantwell, & Taylor, 2013, 2015;

Slaughter & Rhoades, 2004: Stephan & Ma, 2005) has shown that the increase use of

international postdocs can be attributed in large part to the increased dependence on external

research funds by universities.  As universities, especially research-intensive institutions, have

become more dependent on research funding to support their academic missions, they have

increased the amount of research conducted and employed more and more postdocs to conduct

much of that activity as a cheap source of labor (Cantwell & Taylor, 2015).

## Final Remarks

During the second half of the twentieth century postdocs increased in absolute numbers

and have expanded beyond a few elite institutions to become a mainstay at American research

universities. Given this change and expansion over the last fifty or so years, the postdoctorate has

become a standard layer of academic employment. Several themes seem to be emerging around why scholars assume these positions. Some of which include (but are not limited to) wanting to develop new research or lab skills, gaining access to particular technology, wanting to explore more in-depth or new research topics, and for the majority, it is "the next logical step" in their career trajectory towards becoming faculty. Research from Cantwell (2011) shows that international postdocs come to the US for career and social mobility reasons. Further literature on postdocs points to the need for enhanced career and professional development over the full course of their scientific training (NSF CEOSE, 2015; Chen, McAlpine & Amundsen, 2015; Gibs, McGready, & Griffin, 2015; Miller & Feldman, 2015). These findings suggest the need for departments and/or universities to implement more structured programs. However, what type of programs and who should deliver the content, including what content to deliver, are questions needing further study.

This literature also suggests there may be a misalignment between when career decisions are made and who is the most influential or helpful to postdocs in making these decisions. In much of the work and funding pushed by NSF and other governmental agencies, research mentorship is highlighted as a critical part of postdoc career development, especially for under-represented postdocs. However, for postdocs not interested in tenure-track careers or for those who change their mind during their postdoc experience, research mentors may not be the best individuals that postdocs are comfortable going to for advice. This is another area of research that could be explored, especially if the goal is to retain individuals in S&E fields regardless if they become faculty or not.

Finally, while many universities and faculty view postdoc positions as positions for those seeking advanced research training or as the default step after completion of a doctoral degree

towards a tenure-track faculty position, a large percentage of postdocs pursue these positions despite having interests in careers outside of research. These data suggest that there are postdocs who are not preparing exclusively for faculty careers or even careers in research. This reinforces the need to adapt postdoc training so that trainees can learn about and develop skills necessary for careers outside academia. Whether universities and faculty mentors should do more, or can, is another area of research that needs to be explored and is further rationale of the need for this study.

# CHAPTER 3:  METHODOLOGY

## Nature of the Study

This chapter outlines the methods used for this qualitative investigation using a narrative inquiry research method to gain a deeper understanding of how 4 current postdocs, interpreted their educational and scientific experiences and how they impacted decisions related to their careers. Previous studies have explored the role commodification of postdocs into a scientific workforce, but few analyze on the actual working conditions and relationships postdocs have with their mentors, and the messages they receive about future careers. Therefore, I developed a research process that kept the pre-structured design to a minimum, as I consider the social process that my participants were going through to be too complex, too relative, and too fluid to be approached with an explicit conceptual framework.  Rather I preferred the more loosely structured and inductively grounded approach to gathering data used through narrative inquiry. Using narrative inquiry as my methodology, which is grounded in hermeneutics and phenomenology, allows for participants to share their experience through the use of their stories and focuses on capturing the lived experience of participants in their own words, and with their own sense of meaning rather than the researcher (Josselson, 2011; Mishler, 2004).  As a result, a conceptual framework emerged from the research during the course of study and explained in the discussions section of this dissertation.

This chapter describes the purpose of the study, research design, sampling strategy and participant selection, the researcher's role, data collection procedures, data analysis and interpretation and evidence of quality.  In the following section, I start by addressing the purpose of this study and research questions and how they relate to the research design.

**Purpose of the Study**

The purpose of this study is to provide a holistic, nuanced description of the postdoc experience by highlighting the stories of current postdocs.   The goal of this study is to provide the opportunity to hear from postdocs themselves about the experiences they deal with transitioning from doctoral students and trainees and into the workforce to become self-directed independent scholars, academics, and scientists.

**Research Questions**

The main research questions that frame this study are:

1.  What is the experience like to transition into and out of a postdoc?

2.  How do postdocs interpret their education and training experiences, and the decisions they have made about their career?

**Research Design**

This study aims to understand the postdoc experience (i.e., phenomena) and explore what aspects of the postdoc research experience influenced participants' careers (e.g. contextual variables). Therefore, this project demanded a qualitative design since "in this situation, the researcher seeks to establish the meaning of a phenomenon from the views of the participants…and studying how it develops shared patterns of behavior over time" (Creswell, 2014, p. 19). In addition, for some individuals who may experience oppression during these phenomena under investigation, the qualitative design allows the researcher to collect stories of individual oppression using a narrative approach, where individuals are interviewed in-depth to determine how they have personally experienced oppression (Creswell, 2014).

I chose narrative inquiry as my methodology since it allows for participants to share their experience through the use of their stories, which can help the reader understand how working as

a postdoc helped to shape their daily lives and how it impacted them on throughout their academic training. Narrative research is grounded in hermeneutics, phenomenology, ethnography, and other literary analysis focused on capturing the lived experience of people in the words and terms of their own making and is utilized by researchers to theorize about those experiences in insightful ways (Josselson, 2011; Mishler, 2004). Narrative inquiry allows "the truth" to be constructed out of a participants account of their experience and doesn't need to rely on a factual record of what "really happened," instead focusing on how the participant understood and organized the events in their mind (Josselson, 2011, p. 225). Josselson (2011), quoting Mishler (2004), points out that "narrative telling is not mimetic; it's not an exact representation of what happened, but a particular construction of events created in a particular setting, for a particular audience, for particular purposes, to create a certain point of view (p. 226). Meaning making therefore, is generated by the researcher helping the participant make links between aspects of their life and through co-constructed analysis of the understanding and interpretation that arises between the explicit linkages. Meaning making is also not inherent in the specific act or experience described but is constructed through the social discourse that the participant experiences reliving and reinterpreting the event through the lenses of time and other experiences.

According to Van Manen (1990), in such research, we "attempt to accomplish the impossible: to construct a full interpretive description of some aspect of the lifeworld, and yet to remain aware that lived life is always more complex than any explication of meaning can reveal" (p. 18). This means, in narrative research, like phenomenological research, meaning is found embedded in the description of the situation and requires the researcher to analyze, describe and interpret that meaning (Van Manen, 1990). Therefore, I framed questions around critical

incidents in their lives, and in particular during their postdoctoral experience, that would help me to understand how they interpret their past to help understand their experience and some of the decisions they have made about their careers (Connelly & Clandinin, 2006). A critical incident is a story that reveals "a change of understanding or worldview by a storyteller" (Webster & Mertova, 2007, p. 73) and has the "right mix of ingredients at the right time and in the right context" (Woods, 1993, p. 102) that helps the storyteller explain a change in their perception about a particular event or phenomenon. "A critical incident is almost always a change experience" (Webster & Mertova, 2007, p. 75).

Finally, I chose narrative inquiry as my methodology because of the postdoctorate itself. A postdoctoral scholar is "an individual holding a doctoral degree and engaged in a temporary period of mentored research and/or scholarly training for the purpose of acquiring the professional skills needed to pursue a career path of his or her choosing" (NPA, 2017, what is a postdoc, para. 1). In addition, there are several aspects which uniquely define these positions: they are time-limited (temporal), they are supposed to occur under the tutelage and within the physical presence of a senior researcher (spatial), during which adviser explicitly and implicitly sets expectations for how the trainee should develop as a researcher (corporeality), and is practice for a career as an independent self-directed researcher (ie. faculty member) in an academic setting (relational). Van Manen (1990) provides a framework that allows for the study of the postdoctorate experience as a phenomenon in lifeworld through these four dimensions - spatiality (lived space), corporeality (lived body), temporality (lived time) and relationality (lived other) (Van Manen, 1990).

*Lived space* is what Van Manen (1990) calls "spatiality" (p. 102). When thinking of space, we usually think of mathematical space, such as the distance between cities. For Van

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Manen, lived space is more difficult to put into words, since the experience of lived space is largely pre-verbal and not ordinarily reflected on it.  An example of spatiality is walking into a cathedral and being overcome by a silent sense of the transcendental even if we ordinarily are not particularly religious or churchgoing (Van Manen, 1990, p. 102).

*Lived body,* or "corporeality" refers to what Van Manen (1990) calls the "phenomenological fact that we are always bodily in the world" (p. 103). When we meet another person in their landscape or world, we see that person first of all through their body, vs in ours, where we both reveal something about ourselves and we conceal something at the same time - not consciously or deliberately but rather in spite of ourselves.  For example, under the critical gaze of a football coach or trainer, a untrained athlete's body may turn awkward, their catching motions appear clumsy, while under the admiring gaze of new found lover or admirer, the body is seen as surpassing its usual grace and its normal abilities (Van Manen, 1990, p. 103).

*Lived time, or* "temporality" is subjective time as opposed to clock time or objective time. Lived time occurs when time appears to speed up when enjoying ourselves or slows down when bored during an uninteresting lecture or anxious, like in a dentist's or dissertation defense (Van Manen, 1990, p. 104).

The *lived other* or "relationality" is the relation we maintain with others in the interpersonal space that we share with them.  Van Manen (1990) states, "as we meet others, we approach them in a corporeal way:  through a handshake or physical impression that they are physically present to us." (p. 104).  An example of this is if we meet another person indirectly (e.g. via email or social media) we often form a physical impression of the person in our mind, which later gets confirmed or negated, when we meet them in person or acts differently from the way we had envisioned.

Van Manen's four dimensions "form an intricate unity we call our lives which can be differentiated but not separated (p. 104)." Since narrative inquiry involves the process of collecting stories from participants and focusing on their behavior, this becomes a meaningful and understandable process which can help researches understand the nuances and contexts of a participant's life (Seidman, 2006). In conducting narrative research, Seidman (2006) argues that "without context there is little possibility of exploring the meaning of experience" and interviewers who propose to explore a topic by arranging interviews with a participant through a one-time meeting whom they have never met, "tread on thin contextual ice" (p 17). Therefore, he recommends, and I am utilized, a three-interview approach which allows the interviewer and the participant to both place the experience in context and help provide depth and breadth to the experience. This process is outlined further below.

## Data Collection Procedures

This study aims to understand the postdoc experience (i.e., phenomena) and discover what aspects of the postdoc research experience influenced participants' careers (e.g. contextual variables). Therefore, this project demanded a qualitative design using narrative inquiry since it allows for participants to share their experience through the use of their stories and can help the reader understand how working as a postdoc helped to shape their daily lives and how it impacted them on throughout their academic training. There were three primary qualitative data collection types used in this study: a recruitment survey, interviews, and document reviews.

### Site Selection

Since the majority of postdocs work at doctorate-granting, very high research academic institutions (NSF, 2018a) an R1 land-grant university in the Midwest (MLU) was chosen as the primary research site for this study. I chose MLU because this institution was a participant in the

National Science Foundations (NSF) Alliances for Graduate Education and the Professoriate (AGEP) Program, which require institutions to focus on career and professional development opportunities for postdoctoral scholars on their campuses (NSF, 2013).

I chose postdocs from MLU because they were geographically accessible, and a relationship of trust had been established between myself and leadership at the institution, which allowed me to use reputational case selection and snowball sampling both of which are conducive for inductive, theory-building analysis (Miles, Huberman, & Saldaña, 2014). Because of the relationship I had developed as an experienced career consultant and advocate for postdocs, the MLU PDA allowed me to utilize their online network to solicit participants via a recruitment survey and helped me target individuals who had not met me or utilized PhD Career Services (reputational case selection).

**Recruitment Survey**

A recruitment survey (Appendix A) was developed both to recruit prospective participants from PRI and screen for a smaller group of participants. The survey contained a greeting, description of the research, and a list of questions that would be used in order screen for a smaller group of participants. A disclaimer was also provided that the study would involve three separate interviews lasting up to 60 minutes each. As stated previously, a total of 15 participants filled out the survey and purposeful and criteria sampling were used to identify the 4 four participants for this study.

**Participant Selection.** As stated previously, the recruitment survey included a disclaimer that that the study would involve three separate interviews lasting up to 60 minutes each. This resulted in 15 prospective participants completely filling out the survey and volunteering to participate for the study. However, I had previously advised 3 of the prospective

participants in the past, making only 12 participants appropriate for this study. In addition, all the participants identified as female, half were married, half were U.S. citizens and the other half (except for 1) was an international scholar from Asia. In order to make myself open to varied narratives that could arise from prospective participants, I had to exclude individuals in a compressed way. A purposeful sampling strategy (Merriam, 2002) was used to select 4 participants using socio-economic status, nationality, marital status and parental identity since the background literature identified these identities as salient features that could impact the postdoctoral experience and career pathways (Gibbs, McGready, & Griffin, 2015; Miller & Feldman, 2015). In addition, while trying to attain a diverse, rich, and nuanced set of narratives, but also wanting to provide some comparison between participants, I arrived at interviewing 4 postdocs educated in the same discipline – Biology; however, participants were all pursuing postdoctoral training in different sub-fields of the biological sciences - microbiology, epidemiology, plant biology, and genetics.

Part of the challenge of doing narrative research is discerning which experiences are influencing postdocs career trajectory as they are making decisions about their careers. The narrative method has the ability to encompass complex factors such as time and communication during times of transition (Webster & Mertova, 2007). However, in order to ensure more richness of the account, it required participants to have the ability to recall lived experiences with clarity. Therefore, additional criteria sampling (Miles, Huberman, & Saldaña, 2014) was used to select participants: 1) they were currently engaged in a postdoc position, 2) had been in their positions for less than two years, and 3) were currently in the process of looking for a full-time position. Utilizing these additional criteria, allows for meaning creation and validation through

participants experience based on more recent moments in time, and to reflect on these experiences to identify recurring themes within their career trajectory.

**Gaining Consent.** I contacted each participant via email to set up a time to meet for our first interview. I asked them for permission to send them an email with the consent form along with a description of the study (Appendix C). At the interview, I reviewed with them the purpose of the study and selection criteria and in accordance with the university's Human Subjects Review Board, I asked them to sign the consent form. In reviewing the consent form with them, I also outlined information regarding the benefits and possible risks associated with the research project and assured confidentially by asking them to provide an alias for the study. Participants were informed they could ask questions or end the interview at any time.

**Interview Process**

Since the purpose of this study was to gain a more nuanced understanding of the message's postdocs receive during their scientific training, the interviews were exploratory with open and semi-structured questions. Figure 4 shows how data in the form of narratives (stories) were collected from participants in a series of two in-depth interviews, lasting 45-60 minutes each and a follow-up third interview used to clarify individual narratives, reflect together with each participant on themes, and check for accuracy.
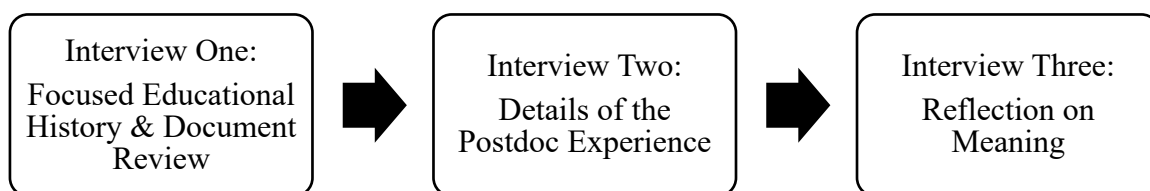


**Figure 4. Visual representation of the flow of interviews and how they are connected to each other.**

**Interview One: Focused Educational History.** The first interview established the educational context and background of the participant's experience prior to entering the postdoctorate (e.g. undergrad experience, family life, etc.). In this interview, I tried to put my participants' experiences in context by asking them to tell as much as possible about their post-educational history, from high school up until the time they graduated. In particular, I was interested in messages they received from family, friends, or society at large, about how they choose a career in science, and to reconstruct early experiences that they believe were related to how they became interested in their field. Prior research suggests support networks, family, and social economic status play a part in self-efficacy and how students, especially women in science, perceive their ability to do work in S&E fields and impacts their continued interest in pursuing scientific work (Gibbs & Griffin, 2013; Gibbs, McGready, Bennett, & Griffin, 2014; Griffin, Gibbs, Bennett, & Robinson, 2015). In asking participants to reconstruct the development of their interest in science, I asked specifically why they choose to become a postdoc and not only if they wanted to pursue a tenure-track faculty position but why. My goal in each first interview was to help participants "reconstruct and narrate a range of constitutive events in their past family, school, and work experience that place their participation" (Seidman, 2006, p. 17) as a postdoc in the context of their lives how that experience is influencing their career decisions as they move forward. I knew I was successful in this endeavor when participants were able to provide narratives that reflected Van Manen's (1990) four dimensions of the lifeworld – spatiality (lived space), corporeality (lived body), temporality (lived time) and relationality (lived other).

Since this study is also interested in understanding how participants make meaning of their situation as postdoctoral scholars and how that experience is influencing their future career

goals, additional "meaning-making" was done after the first interview through document analysis.

**Document Review.**   There are number of professional documents that postdocs prepare when going on the job search besides a CV, Resume or Cover letter.  This includes teaching philosophies, research, mentoring, and diversity statements. One additional item used as part of the professional development process is the use of Individual Development Plans (IDPs).  An IDP is a tool to help individuals assess their career goals and track their professional development as scholars and professionals during graduate school or traineeship (Denecke, Feaster, & Stone, 2017). I believed these documents along with others such as resumes/CVs, cover letters, and professional statements might be useful in helping participants to reflect on their experience and provide insight into some of the meaning postdocs are making with regards to their careers.  Information from these documents was also used to provide written examples of statements and words from participants and help to triangulate meaning.

I asked to review professional documents because as examples of their work, I have found that they help participants reflect on their current experience and helps to provide prompts for remembering events they may not readily recall.  In addition, I also asked to review the acknowledgements page of their dissertation, which also provided an avenue to pursue questions about mentors and others who they acknowledge as helping them grow as scholars in the field.

**Interview Two:  The Details of the Postdoc Experience.** The purpose of the second interview was to concentrate on the details of participant's experience as postdocs. The second allowed participants to reconstruct the details of their experience within the postdoc, by describing their experience with their advisor/mentor/principal investigator, looking for jobs, and any career and/or professional development resources they used to prepare and apply for those

jobs. During this second interview, the goal is to try to reconstruct "the myriad details of the participant's experience" (Seidman, 2006, p. 18) and specifically try to get a sense of what messages they get from faculty, friends, and even family. In order to put their experience in context I asked participants to talk about their relationship with their current PIs, past advisors, mentors, other students and colleagues and any once else inside or outside their research setting that may influence how they are making choices about what jobs and/or their or career. In this interview, I asked participants to re-create conversations (e.g. narratives) with individuals that they had, including conversations they overheard or where indirectly a part of, regarding scientific careers or any professional or career advice they or others they knew had sought. I asked them to also reconstruct *critical incidents* in their postdoctoral experience and tried to elicit specific details about what they were feeling and thinking about the experience in the moment.

Measor (1985) identifies three types of critical incidents, which he also terms *"events"*: personal, extrinsic, and intrinsic. Personal critical incidents are typically major instances, moments, or events pertaining to family, such as major illnesses, deaths, and births (Webster & Mertova, 2007). Extrinsic events are produced by historical and political events that might happen during the time-period the participant is describing which have had an impact on them (Webster & Mertova, 2007). Intrinsic critical incidents, however, occur within the natural progression of a career (Measor, 1985). Measor (1985) highlighted some examples as: 1) entering the teaching profession; 2) first teaching practice; 3) three years after taking the first job, etc. (Measor, 1985). Intrinsic types of critical incidents are moments this research study that were of particular interest in this study.

In eliciting critical incidents from the postdoctorate experience of participants, I tried to make the distinction between what Van Manen (1990) calls *incidental themes* and *essential themes*. After transcribing and reviewing the first and second interviews, I utilized horizontalism and free imagination as described by Cronin & Armour (2015) to identify themes and codes through holistic reading and rereading of the transcripts and utilizing the third reflective interview to review these findings with participants and manage bias.

**Interview Three: Reflecting on the Meaning.** In this study, I am sampling participants to get at the characteristics of settings, events, and processes that have occurred in their lives that have affected what trajectory they wanted to take their career in. Utilizing reflection through the lens of narrative inquiry is important because as Van Manen (1990) states,

> "an experience is temporal; however, life is experienced on a continuum. What we say now about a person, place or event, is given meaning in terms of the larger context, and this meaning will change as time passes" (pg. 19-20)

After reviewing transcripts from the first two interviews, including analyzing documents, the third interview provided the opportunity to bring themes to participants and ask them to reflect on the meaning of their experiences and check for accuracy or clarification. I also made time to focus on one specific question: now that you know what the experience is like, if you could go back in time, would you still choose the same career path? The focus of this question is NOT to gather whether participants were satisfied or rewarded by participating in their doctoral program or postdoctoral experience, but rather to try and gather how the factors in their lives interacted to bring them to their present situation. Part of the challenge of doing this type of research is discerning what are the psychosocial factors influencing postdocs career development and what are other factors, such as access to career services or professional training, that may be

influencing them. The combination of exploring the past to clarify events that led them to where they are now, and describing concrete details, established conditions for reflecting upon what they are now doing in their lives and what they want to do in the future.

This third session allows me to work with my participants, to reflect back on critical *incidents* and interactions that embodied the emerging patterns in this study to identify *critical moments*, the intrinsic types of and combination of critical incidents which provide "the right mix of ingredients at the right time and in the right context.. and is almost always a change experience" (Webster, & Mertova, 2007, pg. 73-74). I believe these *critical moments*, are the collected experiences from participants that represent the constructed and subjective realities that have the most influence on participants scientific career trajectory.

**Design of the Interview Protocol.** There is limited research in the area of professional development in doctoral education. Therefore, much of the theory that underlies the background of this study involved the use of Social Cognitive Career Theory (SCCT) to understand the concept of professional development. SCCT is a theory aimed at explaining three aspects of career development:  how academic and career interest develops, how educational and career choices are made, and how academic career success is defined (Fouad, 2007).  SCCT has been used in previous studies to explain significant amounts of variance in career choices of undergraduates in science and engineering and can help researchers by framing career attainment as a developmental process in which individuals make a series of personal decisions shaped by social and institutional context (Gibbs & Griffin, 2013). According to SCCT, career interests develop by three intricately linked variables: 1) self-efficacy (confidence in one's ability to be successful at a given task), 2) outcome expectations (anticipated consequences of one's actions), and 3) personal goals (Byars-Winston, Gutierrez, Topp, & Carnes, 2011).  SCCT can help to

explain that interests (i.e., do I want to do this?) that leads individuals to pursue a particular training path (choice goals) and then to undertake the courses of action necessary to attain that goal (choice actions) (Gibbs & Griffin, 2013). In other studies, SCCT has also helped to recognize the roles that personal characteristics (e.g., gender, race/ethnicity, disability status), learning experiences (e.g., access to role models, faculty or peer discouragement), and contextual supports and barriers influence self-efficacy and outcome expectations (Gibbs & Griffin, 2013; Gibbs, McGready, Bennett, & Griffin, 2014; Gibbs, McGready, & Griffin, 2015). Statistically significant relationships from self-efficacy and outcome expectations to interests and goals have been found for URM students in science and engineering and for biomedical and clinical researchers with ethnically diverse scholars (Byars-Winston, et. al., 2011) making it an appropriate underline my chosen methodology of narrative inquiry and for the basis for design of the interview protocol.

## Data Analysis and Interpretation

The narrative method has the ability to encompass complex factors such as time and communication during times of transition and this key feature is helping when dealing with complexity and human centeredness (Webster & Mertova, 2007). Meaning is created and validated through participants experience based on the moment in time in which they are reflecting on their experience and looking back at all that has come prior and how previous experience and relationships have helped to impact their current understanding. Using the three-step process for interviews, allowed me to help participants place their experience in context and help them elicit a breadth and depth to the experiences they shared. Together this data was analyzed, to identify recurring themes and codes to develop a "rich, developed account of findings" (Merriam, 2002).

**Transcribing.**  I transcribed data using an online automatic transcription service after each interview.  Interview recordings where uploaded and then automatically transcribed with timestamps, but with only about 90% accuracy, still required me to go through each transcription to correct grammar, spelling and context.  Transcribing the data after each interview kept the transcriptions manageable and allowed me to begin review for emerging themes that could then be confirmed or analyzed further in the third interview.

**Coding and Constructing Narratives.**  Once I have finished collecting and organizing the data sources from the survey, all three interviews, documents, and analytic memos, I analyzed the data in several stages. First, I started by asking analyzing the transcripts.  I analyzed the transcripts from each participant's oral history, which included researcher notes added during transcription, in three phases:  1) line-by-line, 2) thematically, and 3) holistically.  First, through the initial review using line-by-line analysis, I conducted simultaneous coding using Dramaturgical and Narrative Coding.

Dramaturgical Coding approaches interview narratives as "social drama" and perceives life experiences "performance," with "humans interacting as a cast of characters in conflict" (Saldaña, 2016).  Narrative Coding is also similar to dramaturgical coding and is also appropriate for exploring interpersonal and interpersonal participant experiences to understand human condition through story (Saldaña, 2016).  Interview transcripts were treated as dialogue in a script and dramaturgical codes were applied to terms and conventions used for characters in the way they would be used in a script for a play. The following are examples of the dramaturgical and narrative codes recommended by Saldaña (2016):

OBJ:　participant-actor objectives, motives in the form of action verbs
CON:　conflicts or obstacles confronted by the participant-actor which prevent him or her from achieving his or her objectives (See versus coding)
TAC:　participant-actor tactics or strategies to deal with conflicts

ATT: participant-actor attitudes toward the setting, others, and the conflict
EMO: emotions experienced by the participant-actor
SUB: subtexts, the participant-actor's unspoken thoughts or impression management, usually in the form of gerunds

In the second phase, I placed excerpts from the transcript under thematic codes that developed inductively through the analysis. For example, when one participated stated that she had not started looking for a job towards the end of her doctoral program, "so I buy a little more time by taking the postdoc position" under the dramaturgical code "Tactics" and then with other similar codes under the larger category of "Reasons for Taking the Postdoc."

Saldaña (2016) states that coding is not a precise science and it that it is primarily an interpretive act (pg. 5). So, through this second phase of data analysis I tried to seek patterns that were somewhat a stable indicator of my participants way of thinking and understanding of their experience. Some of their experiences had more than one code attributed to them. It was possible, as Saldaña (2016) said, that sometimes I was summarizing, distilling, condensing data; and other times, the codes produced more evocative meanings than I had not initially pursued. To help me manage in this process I used started by asking myself the following questions: what stories or narratives are participants sharing? Are there any common themes? What might these stories represent? What is this an example of? what kind of issues is this statement raising? what is the participant trying to convey? I wrote down the thoughts and answers to these questions, through the use of analytic memos.

The transcripts and memos were then read in their entirety, multiple times to get a sense as a whole before breaking it into individual participant narratives and identifying themes and codes for further analysis (Shkedi, 2005). For individual participants, I identified patterns related to their experiences, their relationship with their advisors, and life outside of their postdoc position. I also compare themes identified in the transcripts and documents and compared it to

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the information I found within the literature, utilizing utilize a balance between deductive and

inductive coding process. Examples of the coding process used in this study are provided in the

display, Table 4, below.

| Vignette | Dramaturgical & Narrative Codes | Possible Meaning |
|---|---|---|
| [109] I'm limited by the visa issue because as a foreigner, I don't have a green card right now. [110] So, I just don't know what to do. [111] I asked some of my friends and cohorts in the university. [112] They said, "Well, Jennifer, I don't think it's a bad point to just take the job." | [109] EMO: Feeling stuck [110] EMO: Feeling lost [111] TAC: Turn to network for advice [112] Resolution | Limited by choices, international students take the easiest path that will keep them in U.S. in their chosen discipline. |

**Table 4. Examples of Dramaturgical and Narrative codes**

**Evidence of Quality**

The validity and reliability of this research project rests on three criteria posed by Lincoln

and Guba (1985) credibility, dependability and confirmability and through the use: (1) member

checking, (3) positionality, and (4) through the use of an audit trail and data display.

**Member checking**

Member checking is the process of checking for accuracy in the data by participants

(Lincoln & Gruba, 1985, p. 316). I reviewed the transcripts of the first two interviews to identify

themes or categories that illuminated the messages postdocs where getting through their

experiences and how they helped to shape the decisions and paths participants aspired to take

after their training ended (dependability). I then took this information back to participants in the

third interview to ensure accuracy (confirmability). This is important because I want this study to

be rigorous and bring a "breadth complexity, richness, and depth" (Denzin, 2012, p. 82) to our

understanding into the lives of these individuals and how they are making decisions regarding

their career trajectory that would also be received as valid and credible.

**Positionality and Reflexivity**

As a second validity procedure, I utilized positionality and reflexivity statements for the study. I self-disclosed my own preconceived assumptions, beliefs, and biases inherent that I have realized as I conducted this research project (Creswell & Miller, 2010). Throughout this process I acknowledged to myself and my participants, my own role within the environment. My ontology is that of a relativist; I believe knowledge is a "social reality," therefore rather than make assumptions of my participants, I would ask questions of my participants, rather than make assumptions that I was interpreting their experiences correctly. For example, when a participant stated that her faculty member "stole her research," rather than simply accept the statement and state that she felt "violated" I asked her to tell me the story more fully and to help me understand why she used the word "stole" and how it felt. I believe this is an important step in narrative inquiry, because in reflecting on the event, the participant did confirm the use of the word "stole" but that the emotion she felt was not of "being violated" but of disheartenment because it made her "lose faith" in a person she thought had her best interest in mind. This nuanced understanding is critical to this research project and is therefore, helped by also being aware of my own positionality and reflexivity.

**Audit Trail – Data Display**

An audit trail and field notes in the form of analytic memos are used to establish dependability and can help demonstrate confirmability by others (Lincoln & Guba, 1985). The audit trail has six parts: raw data, data reduction and analysis products, data reconstruction and synthesis products. (p. 319). In this study, the raw data is in the form of the original transcripts, professional documents, and analytic memos (in the form of online notes in). Data reduction and analysis products summaries from transcripts and first-and-second cycle coding. Data

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reconstruction and synthesis products are the narratives, descriptions of cross narrative themes

and conclusions (examples of which are presented in the Findings section of this dissertation).

Appendix C provides examples from stories I heard from participants which I reflected on to find

meaning with my participants.

## The Researcher's Role

Prior to returning to school to pursue a PhD, I worked for almost 20 years managing

STEM programs aimed at getting more URM students, including women into S&E doctoral

programs. As a professionally trained academic and career advisor, I closely align myself with a

constructivist worldview and engage with students in helping them to become "members of their

[disciplinary] community, to think critically about their roles and responsibilities…and engage

[in societies] beyond world view, while acknowledging their individual characteristics, values,

and motivations as they enter, mover through, and exit the institution" (NACADA:  The Global

Community for Academic Advising [NACADA], 2006, Concept of academic advising, para. 4).

Outside of my professional life, I still operate within this framework in my relationships with

others and believe individuals develop subjective, varied and multiple meanings of their

experiences. Creswell (2014) calls this a constructionist worldview or social constructivism.  I

believe that "individuals seek understanding of the world in which they live and work and

develop subjective meanings of their experiences" (Creswell, 2014, p. 8).  I believe the

experiences collected from my postdoc participants represent their constructed and subjective

realities (Lather, 2006) and I have attempted, through this study, to discover and understand,

their past experiences through their point of view and contexts (Sipe & Constable, 1996).

My role as an advisor is an important insight into explaining my theoretical perspectives

in this study, interpretivism, which is often combined with constructivism (Creswell, 2014). In

the past when I advised a student as a professional academic advisor or career counselor, I always tried to listen to my advisee's story during the meeting and interpret what the significance is of the tale they are giving me in order to come to some sort of understanding of what their needs are. Gray (2014) calls this process part of the naturalistic inquiry paradigm, taking in the characteristics of the advisee: whatever, their cultural, historical, and ideological underpinnings that they may be sharing with me to determine some understanding that I can reflect back to them. I believe it's possible for two people from similar backgrounds, in similar positions, in the same location, to have completely different outcomes or experiences. As an advisor and researcher, I believe it is my job, not to predict outcomes, but rather to try to "develop some ideographic body of knowledge that describes individual [advisees] experience" (Gray, 2014, p. 26) and make help them make plausible inferences about the events in their lives and to help them find some meaning from them.

I believe my experience as a graduate student and an advisor to undergraduates, graduate students, and postdocs in S&E fields also makes me both an "insider" and "an outsider" (Unluer, 2012, p.1). Inside researchers are "those who choose to study a group to which they belong, while out-side researchers do not belong to the group under study" (Unluer, 2012, p.1). As a current doctoral student and seasoned professional who is advising doctoral students and postdocs at a large research university, I have the personal and professional experience to understand what it's like to feel the pressure of pursuing a faculty position, even though that is not necessarily my primary reason for being in my program and I have the support of my advisor to look at other careers. It also affords me the ability to connect and relate to participants in a way someone with less experience may not easily be able to do. In addition, my subjectivity is shaped through my personal and professional experience related to students pursuing advanced

training and education in scientific fields (Porter & Maddox, 2014). I have served in both student affairs and academic leadership roles at a predominately white institution where I've had to attend to the multiple identities of my program participants. Much of my professional experience involved being an advisor to URM students, providing them both personal and professional advice.

Due to my experience as an advisor and mentor, I tried engage with the participants in a manner that allowed me to conceptualize my participant's professional development through the individual's identity, and made sure not to try and define anyone by any one experience or my limited interactions with them, but tried to "incorporate the full context of [the individual's] experiences that have informed [their] perspectives on their self-concept…coupled with [their] additional identities" (Porter & Maddox, 2014, p. 30) to come to conclusions about their experiences as postdocs.

## Summary of Methods

I conducted a qualitative narrative inquiry study to gain a deeper understanding of how current postdocs, interpreted their educational and scientific experiences and how they impacted decisions related to their careers. For this study, I conducted open, semi-structured, in-person interviews with 4 purposefully selected postdocs in the biological sciences who were currently engaged in a postdoc position, had been in their positions for less than two years, and were currently in the process of looking for a full-time position. Participants were interviewed twice about their educational and postdoc training experiences and followed up with a third interview to identify *critical moments* in their lives. Individual narratives were then constructed to represent these moments as major common themes in their lives. This study attempted to ensure accuracy and trustworthiness by fulfilling the criteria of credibility, dependability and

confirmability through the use member checking, positionality, and the use of an audit trail and data display.

## Findings Overview

In this section, four postdoc narratives offer insight into their interpretation of educational and scientific experiences and how they interpreted messages from advisors, mentors, peers, friends and family about their scientific career path. First, each of the four participants provided their stories of how they became interested in their particular field of biology and described their relationship(s) with their advisors and mentors in graduate school. Second, participants then provided stories about how they transitioned from being doctoral students into their postdoc positions and how their previous relationships with their advisors and mentors compared vis-à-vis with the principal investigators who now oversee their postdoc experience. Participants also talked about the relationships and messages they received, primarily from their departments and disciplinary environments, and how different family and friends supported them throughout their education. Finally, participants talked about their desired career paths, the professional development resources they accessed (or not), and how the postdoctoral experience has helped them transition into their desired career path (or not). The text was created from responses from a screening survey, face-to-face interviews, professional documents (e.g. CVs, research statements, teaching portfolio, etc.), and reflective questions used during a follow-up interview to check for accuracy.

# CHAPTER 4 - THE TRAPPED SCIENTIST

For more than 20 years, Jane has been driven by her passion for science. Jane is originally from a Major Metropolitan City in China (MMCC) but came to the U.S. to do her doctoral education at American University in the Pacific (AUP). Jane did her first postdoc at a large university in an urban city center in the Midwest (UIUC) before landing her second, and current postdoc at MLU. As a graduate student and in her first postdoc, Jane states she received little advise or mentorship from her PIs. This resulted in her interpreting these experiences as very negative and states she received varying messages, both explicit and implicit from the faculty, but also her institutions and peers that academia was not a supportive place for international scholars. Some of those messages also included are that *students have to identify their career path early, without guidance, and under pressure*; *faculty don't care about trainees, only their own research;* and *academia is the only place that international scholars can work because industry doesn't want to deal with visa issues.*

Jane describes in-depth throughout the interviews, many *critical incidents* that occurred during her training in graduate school and in during both postdocs. Some of the tactics Jane used to get through these critical incidents included: *buying time*, *strategizing*, and *secrecy*. I believe validity of these experiences are evidenced in two ways: 1) by the emotions that Jane expressed throughout the in-person interviews including *feeling stuck*, *lost*, *helpless* and finally *losing trust*, and 2) by how passionately she spoke and her accent grew stronger as she told more personal stories, especially those involving conflict. The evidence of her emotions and her accent change suggests that Jane may have been telling her story as if she was experiencing it again in the moment (i.e. *lived experience*) and was reconstructing the full interpretive description of the experiences through the phenomenological process.

Jane shared a number of stories that provide insight into her experience and the messages she received, however, there are three critical incidents that I believe can help describe Jane's experience.  They are 1) *her decision to major in science and pursue a degree in the U.S*; 2) *her relationship with both her graduate advisor and the PI overseeing her research during her doctoral program*; and 3) *getting into her current (i.e. second) postdoc position.*  During our reflection interview, Jane ends the session with what I believe is an overall theme of both her experience and of this findings section: *a postdoc is not a career.*

**The Pressure to Choose a Career Path**

Jane grew up in MMCC where she completed her high school, undergraduate and master's degrees in English. Throughout her interviews, Jane provided vignettes describing the pressure she and other students like herself felt to be successful, including making decisions that would decide their future career without any real professional guidance or career advice.  During her high school period, Jane, like other students had to choose from one of two streams, either a liberal arts stream which includes history, education, and literature or a science stream which included biology, physics, math, or computer science.

> They let you choose what you want, but there is no career or professional development conversation in our school.  If you choose liberal art, you don't deal with math anymore. If you do science, you don't do anything more with literature. But it [her decision to pursue science] kind of fix your career path…the path to go to further education is limited [after high school]. You do two years of [the science or liberal arts curriculum] and on the 11th grade we take a public exam. The public exam will have about 100,000 students to take exactly the same test (which is like the SAT) but it's just one time. Everyone on the same day take either liberal arts or science test. Those scores will

determine if you can go to the 12th grade. Every year, only 30,000 are able to go to the 12th and 13th grade…From that moment you're on the liberal stream, you just have further advanced literature and history, but if you're in the science stream, you choose advanced chemistry, advanced physics or advanced math. Out of the 30,000 people, maybe about half of them would be qualified for the minimum of the college entrants…. In my generation it's about 12,000 people who go into college.

Under this system of academic pressure, with intense competition for higher education, little guidance, and having a difficult time understanding her alternatives, Jane chose to study biology, specifically biotechnology. More importantly, she reflected that at that time,

*I don't really know what I want to do with my life* because I was only 18 when I get into college…not like most of the kids are nowadays. They can know what the best career path. They know exactly what they need to do and so, they know which subjects or major to enroll in college.  When I applied for college, my first choice is pharmacy simply because it make a lot of money. The second is molecular biotechnology which I ended up be. It's 1999, that period of time, people start talking about DNA and the first cloned sheep Dolly, exists. I was fascinated by that…It's like a sci-fi movie.

Jane applied and then said she felt the molecular biotechnology program took her "*by faith.*" This implies that she had little trust in her abilities, knowledge or skills to be successful in this career path, but also foreshadows how she engages in this type of decision-making in the future.  As her education and career progresses, it is always at the end of her training, that she begins to realize she needs to start making decisions about whether getting a job in industry or continue on in academia.  For example, she states,

All the way in the first two years [of the master program], we never think about finding a job. You just try to finish all your class. *Only all of us start realizing, "Oh, I need to find a job" is on the third year*. No one tell us what we could do because it's a new department, new area. There's no DNA research in [MMCC]…just starting out…is 22 of us that year, it's a very small program. *I think at least 18 of us went to grad school because we don't know what to do*…That's why I enrolled in a master's degree of the same program. *I buy a little more time* …Try two year to *see if I like being a full-time scientist.*

Jane goes on to state that since her program was new, very few people left the program to go into industry because the biotechnology sector in China wasn't established at the time.  In addition, the curriculum required her to conduct a publishable master's thesis which added to her stress level.

*It's very stressful.* Every day, you don't know when you can graduate… you need to finish a project which is equivalent to one chapter in the Ph.D. degree…every time, every month, I got the results, I ask my myself, my advisor, "Is it enough to get into the dissertation?" *I end up actually having an ulcer on my last year of Master because it's too stressful. After that three years is painful, struggling but I do realize I do like science a lot just because it's fun to do it.*

Jane also added that while stressful, her master's degree education helped her *test out a career in science* and she realized she wanted to stay in academia.

*It is very stressful*, but my boss [advisor] is very supportive, so I'm glad that the lab I'm in has a very good atmosphere even though it's stressful but it's not that it's stressful in a nasty way… In total, I stay in the same school, same lab, seven and a half year.

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For Jane, the impetus to pursue science was out of a desire to continue doing something she enjoyed, but without guidance she felt a bit lost.

> When I look for the Ph.D., I do start having a little bit objective but not have a full career goal that. *I doesn't understand what the Ph.D. mean at that time. I just simply wanted to do science.* So, *I don't have a career plan at all, but I want a Ph.D. so that I can stay in the science*, able to continue what I like: hands on, doing experiments. Because if I go to work in [MMCC], I have to change my career path for sure because those work doesn't exist.

Not having a career goal and not understanding what it means to pursue a Ph.D. would eventually lead to a series of events that highlight the pressure and uncertainty that Jane would have to face early in her career, both explicitly and implicitly. Jane spent another year looking for a Ph.D. program abroad but found herself disenfranchised and frustrated. Therefore, Jane decided to apply for Ph.D. programs abroad, first close by in other Asian countries, then in the U.S.

> Most of the scholarship [in foreign countries] does not apply to you, because you're not a local citizen. I tried to go to Japan because it was closer to [MMCC] and they have one government funded scholarship. I applied one year, I got to the final list, but I didn't get the scholarship, so *I was pretty disappointed.* I'm trying to look for professor in U.S. but a lot of time, you send an email, you don't get feedback, or they just say, "Oh, I'm sorry. We don't have money right now." *I been going through a lot of frustration* during that application and looking for possibility. Finally, at one point, at that moment, I told myself I would let myself work for [more] two years as a research associate. I need to cut myself off after two years because *I cannot just keep looking for Ph.D. forever for my whole life.*

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If by two years in, I don't find any Ph.D. in foreign country, what I will do is I will do a

Ph.D. in [MMCC] but in medical science. *Luckily,* around one year-ish, my master's

degree boss knows that I'm looking for Ph.D. He has a friend, he needs a Ph.D. student,

so he told me, "Why don't you contact him?" It was in [AUP].

According to Jane, with no real career goals, the pressure of needing to move on from her

master's degree program, but limited options for staying in academia in her home country or

nearby, Jane made the decision to say "Yes" when her advisor's colleague at AUP offered her a

position in her doctoral program with funding to conduct research in plant science.

Basically, [it was] a personal connection. That's how I got into it…AUP is not a big

famous, fancy school but for me, at that time, it's just about science and I didn't even

think about how expensive to live there which is a mistake. I never asked what the

stipend is which is another big mistake, so I just went there…At that moment, I'm just too

naïve. "Oh, it's just about science."

**Mentoring & Advising:  Faculty Don't Care About Students**

Jane's narrative from AUP forward provides an insight into the many nuances of a

relationship between an advisor/PI and a student/postdoc not highlighted in previous research.

Upon reflection of her experience at AUP, Jane realized how connected faculty are, especially

those who work in the same discipline and come from the same culture.  The biggest problem

Jane identified was that her advisor didn't actually have the funding for her research at the

university. Funding came from an affiliated research institution an hour away from campus. The

PI on the grant expected Jane to work 20 hours a week on the project, while at the same time her

advisor expected her to work 20 hours a week on his. She found herself being told to work on

two research projects in addition to her doctoral studies. Jane realized a situation had been created for her, that she would need to figure out "how to survive."

It's impossible and I didn't realize that, and they never told me, which is a total mistake of course. They never explained the situation to me… I just focused 40 hours every week on Project B [at the research institute] and that make my boss on the Project A mad, of course. Then when I decide I have to do my proposal which is the second year of my Ph.D. …I propose all the things related to Project B because I got paid and it's just easier for my life… I also put the PI from Project B on my committee member…and then I put more people from the Project B to become my committee member to make myself survive. End up all the things related to Project B became my two chapters in my Ph.D. and I kind of abandoned Project A….

In addition to feeling taken advantage of by her advisor and PI, Jane also felt she was at a disadvantage in her career preparation.

Project B is actually in an independent research institute which is so far away from AUP. I can only go to the university to take class and then take an hour bus to go there. Because of that, all the career development and support, I cannot get it from our AUP. I couldn't view my network with the graduate student cohort on there. They have one class that is teaching grant writing. I was going to take it to help myself to develop my career. I couldn't because it's middle of the day, so if I do it, I can only stay at the university. I would lost a whole day to do my research and my boss in the Project B doesn't like it.

In reflecting back on the situation, Jane believes the onus for not getting career and professional development was due to her advisor. She believed her advisor's lack of career support, meant that her graduate advisor didn't support any career development at all.

It does hinder me a lot and one of the problem when I look back on my whole Ph.D. is

my advisor never have a plan of career development with me, never encouraged me to go

to conference, never asked me what I want to do or develop besides the research skills

and other miscellaneous things related to the research... my boss doesn't support any

career development at all. Then I went through the five years, got out of the Ph.D. Three

months before I graduate, one of the committee members of my Ph.D. program needs a

Postdoc. He offered me a job which is in [UIUC].

Graduation looming, Jane found herself in a position with no career direction and as an

international student with a visa that limited her ability to work in the U.S., decided to take a

postdoc at a large research-intensive university in the UIUC.  Jane's decision to take the position

is similar to how she made a decision to pursue a Ph.D., but it also highlights the relationship

faculty have amongst each other to influence and directly affect a student's trajectory.

But he [postdoc PI] knew me because he knew me for five years from my Ph.D., so he

knew I could work. That's why he took me, and also, he and the Project B leader, the lead

PI, are close friends. The leading PI of the Project B was his Ph.D., actually his Postdoc.

Her Ph.D. advisor was also a friend and colleague of her master's degree advisor. To

Jane, this interconnecting relationship between advisors and PIs reinforced her understanding

that researcher's in the same disciplines and sub-specialties from similar cultural backgrounds

(Chinese) know each other, have working history together and communicate on a regular basis.

This also meant, that career and survival in academia would be directly impacted by these

individuals, who could make it harder for her to succeed if she didn't do what they wanted.

In her first postdoctoral position at UIUC, Jane found herself once again dealing with a

complicated relationship with her PI.  "The reality is my PI, did a lot of unethical. He basically

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stole authorship from me." When asked to describe what she meant by "stealing from her" Jane responded,

> So, he literally stole my authorship by putting someone else that never do anything, a Chinese that he affiliates with in China and put it [affiliates name] right in front and took my authorship. It was an article for a journal with an impact factor of over ten… I actually argue with him. I say, "This is not fair to me at all." I raised my voice, because I have to fight for myself. In that moment, he just gave me a clear signal, this is how I'm gonna do. There's no bargaining. And I feel really upset in a way, because I work so many hours every week to do your project, to get everything done, and get a publication, which is gonna be a good one, and you stole it from me.

In addition to having her research "stolen," Jane goes on to describe her experience not seeming to be able to get any publications, especially self-authored papers past her PI. For Jane, this becomes a *critical moment* in her experience which helps her to change her perspective about her career and become self-empowered:

> So at that moment, that's the breaking point that I realized, I have too much hope on you [postdoc PI], that I might think you might care about me a little bit, but definitely when it comes to money and fame and reputation, you put someone else... My benefit is a very low priority to him. So that's breaking point actually I start realizing, "You know what? I'm going to take care of me, myself…And that's actually that's a learning lesson for me that sometimes I'm too naïve to say, you know, your boss you try to help them to develop in all the things. But at the same times, a lot of people do tell me you are... You need to think about your own benefit. That no one's is gonna put your benefit beyond their own… At that moment, you realize there's very few people that support you and you are

heartbroken that all the work that you do... Because my boss didn't do it just once. After that, he does it every time for all my paper.

When I do a lot of work actually, I know my boss is stealing idea from me so, I stop actually give him new idea on work. And even something I do; I cannot tell him what's the result because he will literally take that project away from me and give it someone in China and ask me to mentor the people in China to do it. I even raised this to the school, and the school did nothing. Just because it is what the system is.

When asked why Jane thinks her UIUC postdoc PI was unsupportive, she attributes it to a mix of cultural upbringing and academic training. She states,

He doesn't encourage it [career development] at all, he doesn't think about it because what I think is both my Ph.D., the research institute PI and my [graduate program] boss, they're Chinese. They never go through that, unlike in America that has a system to go through… when they went through their career and academic, [they were] never being told how to develop a career. You just work hard and you're able to get climbing up the ladder…Also for them, it's just they have a principal that you work really hard, you get more paper, you get the job...They never tried to help me to say, "I want you to be a substitute teacher for my class so you can do something on your CV" or, "I would recommend you to go to a conference every year for networking." I stay on that job four and a half years. In that four and a half year, my boss doesn't support any career development at all.

Jane believes the lack of direct verbal encouragement and her advisor's shared background in Chinese culture, which she says did not emphasize career development, is why her advisor was unsupportive and not a very good mentor. When followed up with the question

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"Do you think they acted like that because they were Chinese or because they were faculty?" Jane's response of "a little of both" makes the assumption that there may be aspects of both cultures (Chinese and academic training) that may preclude some current PIs from thinking of helping students with professional development. In addition, this experience helps to explain why Jane begins to think about moving on from her position secretly and without directly asking for her PI's support. She states, "I start looking for another job secretly."

Upon reflection in our third interview about why Jane decided to look for her next job secretly, Jane states *because faculty don't care*. Jane believes that limited advice and guidance she got from her doctoral advisor influences why *she believes faculty don't care about trainees*.

> As a science student, we're never told how to write a CV. We're never taught how to literally write a CV to make it look good. We're just being told, "Get a good GPA, you will find a job." That's the traditional, just like your mom told you, "Go to college. You will find a job." But as a kid, you never question those messages until you actually go to college and say, "yeah, that doesn't make sense. Go to college, you will get a job. How?" So it's really depends on each PI personality and how they value. Some they just use the postdoc as a tools to get more paper. But the tools you don't have to care about if they're gonna get a next job or not.

Because PIs aren't providing guidance and treating postdocs as "tools," Jane believes faculty don't care about them. Jane goes even further to say, that since faculty don't care, by extension, the university as a whole doesn't care about postdocs.

> They [administration] just ignore what's the mentoring ability of the faculty. You could be a jerk, but you get like five million grant, you get hired. You can hire, torture, separate your students, do as many things as you do, and there's nothing the school do.

Because it's one of the things they'd never actually care in a way that, at least in the

science, throughout the whole system, as long as you show them you have student

graduate from the program, how many number of them, how many PhD, how many

Master's student you have, how many undergrad you have with a diversity panel,

especially people with color, then your tenure package looks good.  But it doesn't matter

like how successful those students are or how much your student hates you, just as long

as they graduate.

One of the interesting aspects of Janes views on the relationship between Postdocs and PIs is

whether a PI who mentors and provides career and professional development support is either "a

bonus" or the exception.

It would be good if the PI help. But I think he [commonly accepted attitude by postdocs]

is the PI doesn't help is a normal situation.  But I want, I hope, one day that the PI help

you is a normal situation. So right now, the PI help you is a bonus instead of normal.  I

think that's the thing I'm debating [about internally] is this a normal or it's a bonus….

Jane eventually did find a second postdoc position, the current position she is in at MLU.

When asked if this postdoc position was helping her get the kind of advice and mentorship she

was wanting, Jane goes on further to state that while she is having a good experience, she does

not feel like she is doing anything to develop her career.  She states,

I'm just waiting, just like you know how like a video game, you try to go to build like

your own house and things, but you skip accumulate gold, money, resources, you know?

So then but at the same time, if you don't accumulate during this postdoc year, when you

find that that's a piece of house that you can buy, you don't have money and you don't

qualify. So at this couple year, I do see like it's just hard because you keep accumulating

that these things and you never know when you can actually use them. But at the same

times, if you don't accumulate, you definitely don't have the chance to use it.

When asked if she is getting better mentorship and career guidance from her current PI that could

help her be successful, Jane says "not really." She goes further on to say,

He got this position when he was 27. So for him, I don't think he know how to mentor a

postdoc just because he never really go through a official postdoc like I do. So I don't

blame him on that, and unfortunately, I was trying to teach him on that, but it's also

gonna be really difficult that you teach your boss how to mentor a postdoc or mentor a

grad student, so it has to go through his life, honestly.

I believe this is the result of Janes past experience with her 1ˢᵗ postdoc PI and how its affect has

lingered into her second postdoc. While she states her relationship with her second postdoc PI is

positive and going strong, she states,

When you're an assistant professor, of course you start having a lot of things you need to

consider in your life. So, you know, *he still cares about me in a way, but then at the same*

*times, at some point, he will just have to sacrifice my benefit. It happens to everyone.*

When things come in front of you, then that's gonna happen. And I don't want that

happen to break our relationships. So, it's just better that I find a better job. But right

now, I don't see myself qualify for a faculty job. I am very confident, 80-90% confidence,

I will NOT [emphasis] get a job in a Tier One school because I don't have any teaching

experience in US….

Since she is not getting what she wants from her second postdoc, I posed the question,

what's keeping you from leaving? This led Jane to reflect on her challenges as an international

scholar and trying to leave academia.

**Trying to Leave the Academic Sector**

Jane states that her status as an international scholar limited her options when trying to get out of her first postdoc position due to visa issues. When asked how she incorporated the visa process into her career planning, she states, "It's not a career path plan. It's my life plan." Jane goes on to provide an example of how being an international scholar and dealing with visa issues has affected her. She states,

I actually wanted to leave [1st postdoc position] earlier than four and a half year, but eventually took me four and a half year to find another job because visa issues, it's a big, critical part…but I still need to stay in there [academia]." Because as an international, the other thing you will see, is the visa you choose, literally limit where we can go, limit what we can do, because every time you're signed by a H-1B, it's three years. So, at that three years, you want to stay in the same job, because if you want to move, it will take couple months to transfer for your H-1B visa. And then in recent year in U.S. they start having a... At least in the sciences we are, there are certain jobs that start requiring that you have to get your PhD within the last four years. If you're more than four year, they cannot hire you, because I think when they wrote the grant or something, the funding has a limitation that you need to use to hire a new PhD graduate…So that become another boundary that if you're reaching that goal, they are unlikely gonna hire you. Because let's say you're on the third year, okay, I hire you, oh, you can only work for me for one year. That's not even enough for postdoc research to start. So that become really difficult.

One of the major themes woven through this particular narrative is that *being an international scholar makes the career management process difficult. Jane's visa status limits*

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*the number and types of jobs she can take* and the current process for applying for citizenship is both cumbersome and lengthy.

> Without a green card, without being a permanent resident, a lot of companies do not hire you because they don't sponsor H-1B visa or they don't want to deal with any visa issue. When I screen for the job, a lot of them, they won't even allow you to apply. About 2014 or 2015, I actually applied for an industry job. I got into the interview twice, they almost offered me the job, asked me when I can start.  When I told them about my visa, it's like, "Oh, I'm sorry but we don't sponsor."  That's how I literally lost a real job opportunity. From that, I was kind of scared in some way, just, "What's the point of private industry?" *Wasting my time and effort and hope.* That is also a personal experience just getting me a little bit scared…Then after that point, *I just stopped looking for industry, because it's literally shut the door to myself at that moment,* so I just keep looking for academic.

> *As an international scholar, this very difficult that besides your career path or development, you have to think about the legal or visa or citizenship problems.* That's also I think, I didn't think about that early enough. *That's also hinder my career path because if I thought about that when I first joined my first Postdoc, I might start doing my green card earlier and if I had, I would already be a citizen.*  And I might not even end up at this job.  I might have chose to try different things in my career path.

What Jane's experience highlights is an issue international scholar faces when trying to navigate both their current workplace and trying move into a position that is more supportive.  In addition, since Jane's postdoc position, and specifically her visa, was contingent on staying in UIUC, she could not conduct a job search in the open, for fear of getting fired before landing a

new position. One resource Jane turned to for helping deal with the visa challenges of finding a job, was *by building a secret network of support among fellow international postdocs*.

> So, most of the times, that's why like even I doing the job searching, *it's like it's definitely do it secretly*. But then like are you hang out with other postdoc of your department that become close friend that you can talk, you know…So that become like a hidden channel that you will talk to those people. But of course, *we cannot go to the PD*A [Postdoc Association] and tell everyone that, "Hey, I'm looking the job." *Because you don't have the trust from them that it won't be brought back to your boss* [that you're looking for a job]. So, you end up having to find your own postdoc group of people.

During her first postdoc position and when looking to get out of her position, Jane talks a lot about this secret network made up of postdocs who conducted plant science in the same department but different labs.  Jane shared that within this informal group, they talk about many issues related to being international scholars.

> The first thing you'll see is like talking about visa issues…. we have been talking, because after Trump, also the H-1B that everyone's goal, first problem, it becomes a big concern in the last two years that people start talking about more. Before, then we talk about it, it's more like, "Oh what you gonna do for your postdoc job?"  So, for example, some people start saying, "Oh, yeah, I'm applying for academic assistant professor." Then we'll start talking about, "Oh, which school you apply? Oh, how's the interview?" So you get more like hands on the real life experience. Oh, this is how they do interview. Oh, you have to... Like flow in the application like this. So it's more helpful in some ways because it's literally someone doing that in front of you.

And also some people will say, "Oh, I'm thinking of like, USDA job or like government job," and then some people will say, "Oh, I heard the friend, she go for government, and then but like it's difficult to go in, you have to..." You know, like all the hidden secrets that you never see on the job ad. And then like how to go into industry. Also, some people it's like, "Oh, I have a friend in industry. Let me ask like what's the situation there. Are they hiring or they are slow recently because of this reason and this reason."

So it's more like a lot of hidden news, but most of ours, like we'll talk about a little bit work, we'll talk about our boss, like, of course, right? Just like the all the rest students hang out together talk about the boss, you know. It's the same. So we talk about it a bit. But more we talk about is our life. Like our how do we either stay in U.S. or a plan to go back home. That's always become our topic recently. Or just let each other like a support to let ourselves like venting and whining. And wine. Drink wine.

For Jane, connecting with other postdocs and talking with them about these issues particularly around their career, is what helped lead her to the conclusion that even with places that have a postdoc association or professional development resources, they may not be accessible or relevant to international postdocs.

[UIUC] have a very strong Postdoc council, they literally send out emails every week updating you what happened, there's a lot of workshop this and this and this, with the amount of work I had, it's almost impossible for you to go because it's always in the middle of the day.

I went one time. They really actually have workshops to teach foreigner what's the chance you can or how you can write a grant as a foreigner in US because that's

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literally the problem at that moment I was facing.  I have a project that I develop the idea myself and I look at all the NIH, NSF grant. I know you need to be a citizen…but I don't know channel I can have as a postdoc, a foreigner to write a grant.  I was hoping to try to go to that workshop and see if I can get some hint.  It didn't end up very helpful…

I do learn a few things:  what is actually important when writing a grant, what is not; but a lot of the foreigners in the talk, they all ask same thing:  "I'm not a US citizen. What can I do?"  They give a little bit of information, but I don't feel that's helpful because it's not applicable to my case.  That's the only workshop in the four and half years I went to…

I actually signed up for one, but then later, I have to call myself out, because it was at night seven to nine…. Two days before that I was like, "I'm very tired." I've been working so long hours. I don't think I can spend two hours just to listen to that talk. So, I actually wrote to them. I said, "I'm apologize, but I want let you know two days before so you can open the slot to other people." So, I end up just like, you know what? I'm just so tired from my work, I couldn't attend any workshops…when it comes to the time, you're just like, "Uh, never mind. I still have a list of work to do. Let's just give it up" … Sometimes I will put the work in front of my career development.

Jane stated numerous times, she enjoys "doing science." However, part of what she believes, has been missing from her education and training, is advice on how to develop a career plan.

## Learning from the Postdoc Experience

Jane believes many international postdocs end up staying in their postdoc positions too long because of the visa issues they face.  Some, like Jane, also take consecutive postdoc

positions over many years, hoping that they will eventually land an assistant professor position. In reflecting on her experience in our third interview, Jane says she's that "a postdoc is not a career," and that it's taken this long to realize that a postdoc is not a viable long-term work option.  Jane also states that the postdoc has allowed her to reflect on what it means to be a faculty member because she' been able to *buy time* by *observing the life of an assistant professor.* In addition, the postdoc has allowed her to learn the skills she'll need to be a successful tenure-track faculty member and it allows her to *strategize her next career move*.

> At least I get those little experience to understand what's a real life of an assistant professor, not the full life of it but get a glimpse of it…My current boss here will say, "Oh, could you mind read through [this grant application] and see what kinds of comment you have?" That's the learning process that right now I get to experience in real life…. I was able to help him on the grant writing, how to budget the finance for the grant, for when we get a student…

When asked if she thinks she will continue looking for a tenure track position or go try again to into industry, Jane replies,

> I was 50/50 before I moved to MLU. Now, it's still 50/50, it's just now I'm getting to see the real life of assistant professor. It is not encouraging…I've been in this position only two and a half year. That also make it feel difficult knowing if want to be an assistant professor or not…I'm still a little bit slow on determining my career direction.  But right now, this year, I'm 38. I set a [deadline] for myself that by 40 years old I need to choose a [career path]

> While she has suggested several times, that she would like to go into industry, she still

needs to deal with the issue of work visas.  In response, Jane is currently applying for a

citizenship which she hopes will enable her to move in that direction.  During our final interview, when reflecting on her narrative together with her, I asked Jane what she believed she has learned about herself through her educational career, and in particular her postdoc experience.

I was in a really bad situation before so that strengthened my stress tolerance and learned how to go through all the difficulty.  So for me, it's like now when I look back, I take it as a lesson that there's nothing I can change, or I don't even think what can be better because it's not going to change me. But for me, it's like when I teach my student right now, I will teach them how you should expect, what you should expect. No, no one ever told you what is a successful teacher, what is a successful mentor? And even like a PI, they just never give a class how to be a mentor.

Janes experiences have directly impacted the way she mentors and works with her own students and her thoughts on mentorship in general.

I think I learned actually from my daily life rather than from workshop or career development plan because I was never encouraged to do that.  I'm learning from my undergrad and grad student what they would tell me, what they would do in situations and I'm just like, "Wow, that's a good point." I actually should encourage it when later I mentor other students.  I do know that they have other [career development resources] through the school, so when I mentor my undergraduate and grad student, I will actually encourage them to go… even I never attend it but I can refer my student to go to look for that and I feel better in that I know that some resources exist.  I might not know exactly what it is, but at least I can give a hint. I think that's important and actually useful.  I mean, one of the things is for me is like it's the ideal scenario if you think about on the angle of a student, of a PhD, or a postdoc. Like your boss actually need to force you to

have a plan. And like, for example, I don't know for PhD student here, but most of boss

doesn't do it. Theoretically you should have every semester evaluation, and say, oh,

what's the expectation: "I want you to finish in this three month." And then by the end,

they will evaluate is that being done.

Jane learned from her experience to encourage her students directly to think about their

career and to participate in professional development activities and uses her own narrative as

examples of why it's important to think about your career early.

You could be a very good scientist, but you could have no job.  Like being just a good

scientist might not be sufficient nowadays. When is everything become competitive.

Maybe in old days, that's all you have because there's so little scientists in the world.

Now there's so many scientists. You need to have more than that.

Jane encourages her students to develop career and professional development plans and

encourages them to attend workshops and events. However, she notes that there are challenges

within the current system of doctoral education that make it difficult to mentor students around

these issues, especially since many look towards the faculty advisor/PI for guidance.

But that's the thing, because the PI would never go to attend those workshops. And if

they never did it during their postdoc, they would just like, "You know what? I don't

know." And you ask for it, "Okay, I will think about it." But that's not like an initiator

that is from the PI.

My current PI is supportive, so I can ask for almost everything. But at a certain

point, my work is so busy, that it's just not gonna able to do some of the things. But if you

get a not so good PI, then you don't feel like to raise those requests…every time when

you request something, even though you do have the right to request, but a lot of people

doesn't feel like so, especially as a non-American. It's just a little bit awkward, like, okay, I want to take a course on this, I want to learn this, but that's mean I'm going to spend ten, like five hours take away from myself. That's mean you have to work overtime for five hours in order to compensate the hours. Instead of like, you think, "Oh, no, but that should be part of your postdoc. That's why you should compensate that five hours." It never work in that way.

What is very interesting about Jane's experience is after hearing her story and asking her "should faculty do more around career and professional development for their trainees" she talks about her relationship with her current PI. Jane states he is very supportive of her, but that she has to ask for resources and opportunities,

So, but then if I don't ask for it, unlikely I will be given it. And I think it's all the same for every single PI in science area. I do hear there's a few PI actually who occasionally give some opportunity to their postdoc or to their grad student. But I don't see that's a common phenomenon. It's more like I would say maybe 20 percent of the PI might do it. Eighty percent will just wait until you ask them. Or some of them even you ask them, they don't give it to you because they will worry that, oh, you don't spend time on your work now. And are you trying to find a job that leave my lab. Even though they accept the fact that you're gonna leave one day. But there's still that keeping... oh, god, you're gonna leave. Who's gonna finish the project. So I think that also having like I see the problem like every postdoc, you know, we have to do our own things to get yourself out for the next job.

I would say now it's getting a little bit better; more that saying, "Oh, we do encourage you." But is it the PI need to doing the one that being initiate, "Hey, Jane, I see

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this higher education forum in California? Maybe you should consider, see if you can put an abstract."

Jane further elaborates, that one of the tactics she uses with her mentees and that she thinks is a sign of good mentorship, is faculty who are proactive rather than reactive and actively encourage their students to engage in professional development.

> Because if your PI is the one who tells you to do that, you feel, "Wow. I'm being care. I'm in your mind." Right? And you do care and saying, "Oh, okay. I do need to think about myself that actually my PI encourage me." And that encouragement make me feel like I can do something and tell him and say, "Hey, can I do this, too."

Reflecting back on her educational career, Jane believes she learned a lot about herself.

> It's not uncommon. What my boss did honestly, there's just another professor like that. Also famous at {UIUC]. So, I would say, it's not super common, but it's not uncommon. It's not like when you hear this kind of news like oh my god, I never hear that. And you kind of like, Oh yeah, it's like that Professor B, he does like this too. So, there's a lot of hidden story, but people usually don't talk about the bad things. So, there's a lot of things hidden until like, you actually go and talk to the people who experience it. Just like what I experienced it my old job, unethical and all those things. But then sometimes you just forget there's something more than that.

> After a while, you start realize what you don't…Not don't like it's just like your past it already. Like you start something and suddenly realize, until the opportunity turn into truth. Then you realize, I don't like this job…I'm leaning toward I want to try industry.  But when I told some other people or student about that, I feel like I'm not competitive enough because I never know what the industry setting because I got into

college in 1999, so this year is after 20 year and I've never left school.  Yeah, I've never left university. For us, the industry people see us as naïve…. Also, I feel like my work is more academic, basic science based. It's really hard to do application even though I have the skillset.

I'm just very scared to get out of the comfort zone just because it's so easy to deal with academic [culture]. I know how to do this, I know how to do that but when you go out of that, that's difficult.

Janes biggest pieces of advice she's gained, and hopes postdocs get from her narrative are that postdocs need to be self-motivated to determine what they need to be successful in their careers and find the resources and workshops that will help them do that.  And for international scholars who are uncomfortable reaching out or looking for resources, Jane simply states, "you have to leave your comfort zone.

# CHAPTER 5 - THE HUMANITARIAN

At the age of 27, Sunetra states she had already committed almost 12 years of her life in pursuit of infectious diseases and with a passion to work on global health issues. At the time of this study, and the first interview, Sunetra was three months into her six-month postdoc in microbiology and molecular genetics. The position is with her doctoral program advisor/PI in the same department she got her Ph.D. in at MLU. Sunetra is using the time in her current postdoc to finish up her research from her doctoral program, work on a couple of papers she wants to publish. As an international scholar, she also feels she needs the time in her current postdoc to deal with visa issues and wait till she can get into a job in global public health.

As a graduate student and now a postdoc, Sunetra believes her experience has been contrary to what other students and postdocs have experienced. Sunetra states the overarching experience that influenced her career was the *"amazing experience" with her PI*, who Sunetra also states *is "the perfect example of a combination mentor, advisor, and friend*." She identified the relationship with her PI as the major overarching factor that has influenced her career to date. Some of the tactics that Sunetra used to get her through her doctoral and postdoctoral experience include *planning, networking*, and *staying true to her commitment to helping others through public health.*

During the first two interviews, Sunetra shared a number of stories that provided insight into her experience with her PI and shared several critical incidents that *reflect on her idea about what an engaged advisor/PI looks like and the role this individual can have on a trainee's experience and career*. In addition, Sunetra shares several other critical incidents *signifying her commitment to a career in international public health by dealing with a complex and stressful visa process and pushing back against family influence to go into other more financially*

*lucrative jobs.* However, it is not until we reflected on her experiences during the third interview, including asking her about her acknowledgements page of her dissertation, that Sunetra realizes that *being a woman in science and having a role model and the support of other women in science, is what has really helped make her experience "amazing."*

**Having to Choose a Career Path Early**

Sunetra's experience, like Jane's, was also that of an international scholar who was tasked with having to choose a career path early, in order to help her decide what to study.

> Yeah, it is pretty intense. So, we have kindergarten all the way up to class 12. And so, it's very similar to, so you know how you have Harry Potter, they have like OWLs and NEWTs? So, we also have those exams. So, in class 10 we have to take boards, and then class 12 you have to take boards. And depending on our class 10 results, it's really sad, but we have to choose which stream: the students who get a higher percentage, they go straight into science. And so, the students who don't get a higher percentage, they have to go into humanities or like, commerce, those kinds of streams. I got into the science stream…And then, usually what you're expected to do is either go into a medical career, or you go into engineering. That's what students usually do. And so, we don't go into undergrad not knowing what we want to do. We have a clear idea about where we're supposed to be going by class 12.

Sunetra decided that she wanted to be in a science stream, however, unlike most of her fellow students, did not choose a medical career or engineering, instead she states,

> I'd come across a chapter in my class 12 biology book about microbiology. So, I was like, "This is pretty cool! I want to do this!" It was on how microbes cause diseases, what

sort of diseases they cause, the fact that they are so geographically varied. I was very interested in that. So, I was like, yeah!

For Sunetra, the decision to pursue microbiology, was more than just choosing a major. For her, it was the beginning of what she says, was her commitment to science.

> I went into microbiology undergrad… you don't have any flexibility on what courses you want to take. You have to take all the courses… You have to *commit* three years. And so based on those courses, I got interested in the more medical microbiology, clinical microbiology, and epidemiology, even though we never took an epidemiology course… so, and then after that, at that point of time, I didn't know exactly what sort of path I wanted to take, like which *subject* of microbiology. I was interested in virology, immunology, medical microbiology. I knew then I wanted to apply for a PhD.

Coming from a family of "engineers, mathematicians and doctors" trained in the U.S. system of higher education, Sunetra also knew she would pursue her Ph.D. in the U.S.

> I applied to a lot of colleges. I applied to, I think, 20 colleges, and a lot of them were based on what my parents thought would be good colleges, because they studied here. They're like, "Oh yeah, these are some good places." But then, I filtered them out based on like, what professors I wanted to work with… So, I added certain schools, because of the faculty and research that did like, epi analysis research and like, global health kind of research. But there's not a lot of professors who do that.

Sunetra was adamant that she would choose a program based on criteria she determined for herself. So, when she found MLU had both the faculty she wanted to work with, but also the funding to support her students, she accepted. While not their first choice, to her surprise, her family was fairly supportive of her decision to pursue a degree at a non-ivy league school.

And none of my family members have any clue about microbiology. They're mostly

engineers, mathematicians, doctors. And so, they're like, "Okay, we don't know anything

about this, but sure." They trusted my gut into going into microbiology.

Often, while in school, Sunetra's family would offer suggestions about studying

industrial microbiology or other majors where "where the money is" but Sunetra would silently

refuse.  Sunetra stated this "annoying pushback" came particularly from the men in her family,

due to their desire for her to be able to earn "a real salary" and "make money" in the future.

However, at the beginning of her doctoral education, Sunetra said, she wasn't thinking about

actually jobs "just yet," and was *more committed to studying* infectious diseases. Rather than

engage them "right now" in the conversation, she just ignored them, since they were being

"fairly supportive" of pursuing a Ph.D. in general.

**The Ph.D. Experience and the Relationship with a PI**

Sunetra did her Ph.D. and postdoc position at MLU with the same person and really

believes that her experience reflects the positive relationship and role a PI can have on doctoral

students and postdocs.  Immediately at the beginning of the interview Sunetra, when asked, "Do

you call Dr. Montana, your PI, your advisor, or your mentor," she replies with "She's a mix of

all three, but I mostly call her my PI."  When asked why she believes her PI is good example of a

good mentor, advisor, and PI, she said it was due to past experience with faculty.  She had done

two previous rotations before working in her current PIs' lab,

So, the first person I rotated with, I had emailed him saying, "Hey, can I rotate?" Didn't

hear back. I never heard back. So, I went to his office, and I really wanted to work with

him, so that's why I was like, "Hey, can I rotate?" And he was like, "Yeah." And he is

really nice. I like him a lot.  But I think that he was never there when I was rotating, and I

don't think he was as investing in the kind of research that I was doing. And so, at the end, I always thought that I would have to present my research, but there was nothing like that. So, I don't think he was like very interested in taking a student at that point of time.

The second one, I wanted to join his lab because he was completely epidemiology. And so, the thing with him was that he was also never there. He was never around. And also, he was a new PI, so he didn't have anyone in his lab, like no post docs, no grad students. And so, it was hard trying to figure out stuff on your own when you've never done it before. And so, I think, and I was not also getting the right guidance on how to do like, this was more like bioinformatics stuff, which I don't have the background in. And so, I needed a little push…but he's a great teacher! He went on to be in my committee.

When asked, "did you have to convince your PI to take you" like the others, Sunetra responded the decision to work in her lab was mutual.

It's actually both. So, at that point of time, [my PI] had six people rotating in her lab and she was only going to take two, so in my year. And then, she'd already taken one person. The thing with [my PI] also is that she also wants to be the first choice, right? And she was my first choice, and I did let her know that, that you're my first choice...And so, she was like, "Yeah, I'll let you know like once I figure out the funding if I have a spot, and I'll just talk to the other lab members and see how ..."

And yeah, that's also one thing that they do in the lab. [My PI] takes the other lab members into consideration when making a decision. She does talk to them, like saying "how does she work", or "was there any problems while they were rotating". So, she does take all of that into consideration.

Sunetra believes, this taking into consideration what prospective doctoral students are looking for, with feedback from current doctoral students and postdocs is evidence that her PI cares about developing a good experience and environment for everyone that works in her lab. In reflecting back on her lab experience with her colleagues, Sunetra says,

> We were a pretty big lab. When I first joined, there were six grad students. There were, I think, three post docs. And then, she had four undergrads, and then two lab managers… So, all the grad students, we have like one large office which can seat like six people. And so, just like being around them, like you know, we became friends…. we've gone on trips together, not like conference trips, like actual vacations… I think like even with the hierarchy with postdocs and grad students, it was never there… it's [Susan]. She's also friends with us. She also comes in on the jokes, and she brings chocolates and candies for us, so that we can eat. And it's just, like even the lab meetings, it's just so fun, because she's a fun personality. And so, she keeps it light. Even though like, when we have to get work done, she will ask us to get work done. But, yeah.

> I think my PhD experience was really great! The first three years I was like, this is great, I'm doing well…. I was getting good research. I got published pretty early in a really good journal, in a high impact journal. And then, I was getting awards from the department, and also, I joined a great lab. She's amazing [her PI], the people are amazing. And just, I think I lucked out with joining in her lab.

When asked to clarify and expand on what makes her experience with her current PI "amazing" Sunetra responds with "she's a really great mentor!" Sunetra then gave an example of what she thought her advisor did that made her a "good mentor,"

So, when I first wanted to rotate with her, I think what I liked about her was that she's

very hands off. So, she lets you do your own thing, she doesn't nag, and I needed that. I

don't like people nagging. And also, when we met, she's like, "Okay, this is a rotation

project. You choose whatever you want to do. We have a lot of resources; we have a lot

of money. Go ahead and decide your own project." And I was not allowed to do that in

the other two labs that I rotated in. Like, we had set projects.  And so, in this lab, I really

got to work on something that I was interested in and wanted to work on. And so, I think

that was what stood out about her. And she's also very kind, very warm. Like, she's

understanding. I think that's what makes her such a great mentor!

Sunetra goes on to talk about how her PI was not only a *good mentor* but also a *good advocate*

because her PI went out of her way to make sure Sunetra had funding and the opportunities to

pursue her interest.

Yeah, so, the first two years, she had grants that paid us. Then she did run out of those

grants, but she would always apply for like, departmental fellowships. And so, for most

of my time here, I was on like a fellowship or an award that gave me money. Like, she

even applied for [a fellowship] for me…She takes out the time to nominate us for

fellowships. Like, we don't have to ask her to do that, she does it on her own…She also

knew that teaching is not something that I want to pursue as a career, so she never

pushed me to do it.

Sunetra believes these examples highlight the way her PI, and others, can positively support and

encourage doctoral students and postdocs.  When asked if she knew of other doctoral students

who were not having the same experience as she was, she replied,

So, one of my friends who's in my lab. He told me yesterday that a professor told him

that if you're not in the lab 24/7 doing research, putting all your stuff in, you're not doing

grad school right. And that is not how we in [my PI's] lab. We've been taught how to do

grad school. And so, I think it's in the mentality of a lot of people that this is what you're

supposed to do. If you're not doing it this way you not doing it, right.

When asked what her PI says about work-life balance and "doing grad school right", Sunetra

shared,

She's always told us, if you don't have that work life balance, you won't be able to do well

at work. And so, she's always encouraging us to go on trips and stuff, like when we go for

conferences. So, we went to San Diego one time, and she was like, oh make sure you go

to the San Diego Zoo during the conference time! She's like telling us to go explore and

do other fun stuff. I don't think a lot of PIs would say that. I think it's just like how she

has made the environment that makes it so good.

While Sunetra describes her as being supportive and nurturing and helping to make sure

she was "checking the boxes and hitting the milestones," she never talked with her PI about her

actual long-term career plans.

Because I never, I should've done this with her too. I never discussed my career

aspirations. I don't know why I didn't. I think I'm just not a person who likes asking for

help, but I think I should've started that way earlier.

When asked why she didn't start thinking about her career sooner, Sunetra states,

I think when I first joined, I was like, "I have four more years to figure this out, so I have

a lot of time." And then, I was busy with classes, busy with research. And then, I think a

lot of it was that I'm going to get a terminal degree, I'm going to be a PhD, it's not going

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to be hard to get a job. That's what I was thinking, you know?  And so, but it's not the case. I'm struggling, and I've seen a lot of other people also struggle with jobs.

I started planning for fellowships and stuff to do after my PhD, six months before I was supposed to defend. And I think I also had that added pressure, that if I'm unemployed, then I'll have to go back to India…[My PI] was really nice to say that, "Yeah, for six months, you can just like, stay here, finish up writing papers. It'll be a short postdoc, and then you'll be set to go and work there."

Sunetra adds that, what she didn't realize at the time, was the visa process was going to complicate the process of looking for a job after the Ph.D. and would foreshadow a lot of what she would be spending the next 6 months dealing with while in the Postdoc.

**Issues with Being an International Scholar**

During the second interview, Sunetra shares that she specifically took the postdoc position as a way to "buy time" to figure out her visa process, which she went into great detail before actually talking about her actual experience.  Sunetra explained that in her experience "you have to be a U.S. citizen for a lot of the jobs in public health" which makes it hard for international students to apply for those positions.  In addition, she talked about a process called STEM OPT, which is a visa application process that allows non-U.S. citizens to work some jobs but requires those employers to sponsor the person.  Sunetra believes many employers don't want to use this process because it's both a costly and lengthy process, therefore, Sunetra talked a lot about *making plans and timelines for finding jobs* that always seemed to be complicated by visa issues.  She states,

I've been struggling with this, not being able to be considered for jobs, like fellowships, that I think I would have a good shot of applying for, because I'm not a US citizen. In

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fact, I did email the person who's in charge of this one fellowship. This fellowship is completely what I've done in my grad school: antibiotic resistance, and then looking at public health samples. Completely similar to what I've done. I emailed this person saying, "Hey, I have this OPT for a year. You don't have to sponsor me. CDC doesn't have to do anything. Can I still apply?" And they said, "No, because you're not a US citizen. You can't apply." So, it is frustrating.

Some of these fellowships are... I think a lot of them are government fellowships, also. With the citizen stuff, it does cause a bit of a problem. I think I was frustrated with it the past year. I think right now I'm more it is what it is. I have to work around it. And it depends on the job I get. With the policy fellowship that I had the interview with on Monday, they said that a lot of it depends on my visa because. If I do get selected for that, I probably have to go back to India and get a new visa. It takes approximately two months to get a new visa, so if I leave here end of April, two months after that. Probably July I'll have to start there. I did tell them that and they did say that it's a limiting factor to their decision.

For the other fellowship, the Mayo clinic one, that starts in 2020, in July. So that's next year. If I get that one, I was thinking of working here with [my PI] until July, getting everything done. And then if I don't find a job here, which I think it's going to be highly unlikely, then I'll go back to India, maybe do an internship there, get my visa situation sorted, and then come back for this one. I've been talking with this company which is the global health company. If they want me to start in May, I'll be able to start in May. Yeah, because I have that STEM OPT. So, they don't need to sponsor me, for the time being at least. The other ones I'll have to change. The STEM OPT, it's kind of annoying. They

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want an employer/employee relationship. With these fellowships, I won't be getting that employee/employer relationship. That's why.  Yeah, it's pretty frustrating!

These are all examples of what Sunetra believes are the challenge of being an international scholar.  *Visa issues directly affect her ability to start her career and she feels like it's keeping her from moving forward.*  She says it gives her a feeling of *resignation* - "It's like I have to accept this is the way it is."  Therefore, Sunetra believes, she needs to apply for U.S. citizenship and why many other international scholars do the same.  Sunetra believes gaining U.S. citizenship is another way of improving not only her job prospects but also would help her be more effective working in the realm of global public health.  She notes that she could go back to India, where she could be with her family but,

First, with my Indian passport, I'm going to have to get a visa to enter the country that I want to work in. Being a US citizen has a lot of perks, not only getting jobs here but also if you want to work in global public health, you don't have to deal with the whole visa situation. You can go to countries without getting a visa first… It's on stamp approval. Or some countries you don't even need to, you can just enter the country.  I think it's hard to get things done in India. So, I think coming here, it's just so much smoother. Like, I love public health and I want to be able to work in global health field, trying to help with infrastructure development for microbiology labs. But I think that it's going to be easier to do if I'm affiliated with an organization that's either in the US, or like the WHO [World Health Organization], rather than like, work in a government in India, because things don't get done… *I've come to the realization that I think I'm going to be able to do a better job if I'm affiliated with an organization here, and then be able to go to not only India, like different countries, and then work with them to improve their infrastructure.*

After reflecting on the challenges of dealing with visas issues, Sunetra states this experience has helped her realize her commitment to pursuing a career in global public health, shows her *tenacity*, *commitment to career goals,* and *perseverance*.  She believes these tactics are especially important because it is increasingly *frustrating* dealing with visa issues.  Sunetra also states, this is why she thinks some postdocs wind up staying in their positions long term, simply because they didn't plan early enough for how to handle them.  Sunetra goes on to say wishes she had done the same – thinking about her career pathway earlier in her career.  She states,

> I think I knew that it is easier to be a US citizen [and find a job]. My brother is a US citizen. He lived in India, obviously, but he didn't have to go through the whole visa process before he went for college over here. I knew that I'm going to have a tougher time than he did. I think, at that point in time, I wasn't really concerned about the global health and how that would affect that process. I think I was also so young: I was 22 when I started, so I wasn't thinking of... I was like, "I have four years to figure this out." I think at that point in time I didn't think. I should have. Yeah. At that point in time I didn't think. I was like, "Yeah, I have time to figure this out. I'm sure I'm going to get a job here" …. When I first came here, I didn't realize it would be this hard.

> I think what I should've done when I started out [the doctoral degree] was start thinking about what my next steps are, because I think the last year, I've just been like, I haven't really planned for anything.  Especially it's hard, because I'm an international student…I think definitely it is a limiting factor, and definitely with jobs, too. I think a lot of companies don't want to go through the hassle of sponsoring people.

Sunetra talked a lot about how the transition period from defending her doctoral education into the postdoc, was also a very frustrating time for Sunetra because she was dealing with visa issues at the same time.

I was defending in 2018 December and I was going to go back home in May, and then come back by June, and then keep working on my project. And so, I heard back from the consulate in India and they're like, "We don't have any dates for May." And I'd already booked my flights, everything. So, I kind of had like a mini breakdown, and I emailed my PI. I was like, "I can't come in today because I need to sort all of this out." And she was really kind. She was like, "I've never seen a decline in your productivity, and you've always been so great. Take time off, figure it out, and then come back." So, before I left for India, I had a committee meeting, and they approved my timeline of defending. And so, when I went to India, I thought I would be back by end of June. And so, I booked my tickets, everything, didn't hear back from them in June, from the consulate. And so, I had to keep switching my flights. And so, that was also like a lot of money going, which is also like, stressful.

I got back in July, and so then I realized I was going to have July, August, September, October…Yeah, so I would have like four months, four months of preparation before defending my dissertation! So that was one thing that freaked me out. Second thing was, I was stressed out about the USCIS not approving my OPT application, because I've heard horror stories about that. This happens sometimes. So, I was stressed out about that as well. Inside I'm just like, "Arrrrgggghhhh!!"

The issues with her visa and the complications it added to her timeline, are why Sunetra chose to continue into a postdoc, especially after her PI offered it to her. Sunetra believes this "act of kindness and understanding" also showed support of her career goals by her PI and made her transition from doctoral candidate to postdoc more manageable, *provided her with time to address her visa issues*, and time to *network and think about the direction of her career.*

**The Importance of Finding Inspiration & Role Models for A Career**

During our second interview, Sunetra spoke about the challenge she had connecting to prospective employers outside of academy. Sunetra also added her frustrations was somewhat compounded by her family who keep trying to influence her away from public health into industry. Her solution was to seek help outside her department through the use of social media, and draw inspiration from those around her, like her PI and other women in science, though she didn't realize it at the time.

Sunetra spoke at length about the challenges she had finding inspirations for a career path outside of academia. In one example, she states,

> In the microbiology department, most of them are not interested in global health. It's a very basic science, research-focused department most of the time. My lab was the only one in our department, along with another one, which had done EPI research with the public health perspective. I've really not had a lot of people in this department that I can talk to about wanting to pursue global health…That's been a little tough. That's something I mentioned in my pre-screening interview is that I didn't think this through then. It's so important to go to a school that has connections with companies that work for global health. That's something I haven't found in the department.

When asked why she thinks her department doesn't have a lot of connections to sectors outside of academia, even though it is one of the top programs in the nation, she states,

> I think a lot of people [in the lab] right now, they look down on people who don't go into academia. And so, they're like, "oh you are choosing an alternate career path," which is not an alternative path, it's just a different career path. I've seen that happen to a few people but haven't seen it happen to me because I've always been pretty clear that I don't want to be a PI.
>
> I think of lot of them in this department, they want to pursue an academic career. I definitely think that a lot of the people, or friends who I've spoken to, they have different goals. They want to go into teaching in colleges. They are a little different. The thing is, a lot of them don't know how to pursue global health [or jobs outside of academia] so they can't really help me with that. That's why I've been trying to find people in other places to help guide me into that direction.

When ask who are the "people in other places" she's been looking to guidance, Sunetra at first mentions family.

> I'm kind of talking more about it with my cousin. She's also in the same process of applying for jobs and looking for jobs, and she also has a bit of a public health background, so she can give me ideas about that. So mostly I'm talking to her about it. I think it's also because a lot of people... like, the rest of family don't know exactly what I want to end up doing.

Like with her undergraduate studies, Sunetra finds that the men in her family do have ideas about what she should do,

Yeah, they wanted like, even my uncle, so he works, he's in the pharmaceutical industry, and so he's like, "Go there. That's where the money is." And definitely I think that my brother also has his opinions in what I should be doing. Like, "Oh, you have a PhD. You'll get a job easily in industry and something, so go for that."… He thinks I'm a little stubborn for not listening. He told my mom that.

When asked how the women in her family have responded to her career choices, she notes,

I think definitely the women in the family kind of understand that I need to figure it out for myself, so they don't really push me. My mom doesn't push me. She's like, "Yeah, I trust you. Make your decisions." And my cousin is very... I mean, she does voice her opinion sometimes about, "Maybe you should do microbiome research." But I was like, that's not something I'm interested in. But they're not as forceful; I think a lot of them have backed down right now, after December.

For Sunetra, *these incidents with family turn into a critical moment* for her because she says, she begins to realize that she is determined to stay true to her goals,

I was like thinking to myself, I was like, "that's not I want to do, though. Like, it's [industry] not interesting." I have a clear idea about what I want to do, it's just trying to figure out how to go about it…I think that, at the end of the day, it [industry] is not fun for me to do that.

Sunetra also adds that as a woman of Indian descent, her culture does tend to have some very prescript roles for women. She says she doesn't feel that pressure is directly though because it's usually not about her job interest, but pressure regarding her personal life, specifically getting married and starting a family.

I think my mom was always like, "Do you want to start looking [for a husband]?" I was

like, "Leave me alone. When I want, I'll do it myself." And she's backed off since then.

For me, I still feel like I'm very young. I'm 26, I'm going to be 27. It's actually

really funny. For a lot of my high school friends, they're getting married and having

families. I still think that I want to first get into a place in my career where I'm

comfortable, and then think about that. I think I'm still not there yet. It's just so much

uncertainty. This kind of feels selfish, but I want to be able to do my own thing first, and

make sure that I'm doing my own thing and am happy with that before I take someone

else into consideration. Little selfish, but yeah.

Again, this mindset and thinking, going against what she believes other people around her are

doing, shows Sunetra's commitment to her career goals.  Sunetra attributes this attitude around

not wanting to start a family and being "selfish" as part of shift due to a different generation of

women going into science,

I think it's a change from their [mother's] generation. I think its way different. But it's

also interesting that maybe a lot of my opinions come from this bubble that I'm living in,

where a lot of my friends currently are still doing their career, they're still trying to figure

out their life and they're the same age. It's interesting that I was talking with someone

else... he's from the US... and he was like, "Oh yeah, the average age for marrying right

now is 24, 25." I was like, "I don't know what you're talking about. This is not true." He

was like, "Yeah it is." We are living in a bubble right now, especially since I'm

surrounded with people still doing their PhDs. A lot of them are married, but a lot of

them aren't. I think I am thinking from this bubble.

When asked about what else about being a woman in science is different from before, especially working in discipline that is still predominately white and male she adds,

> Personally, I don't think that I'm at a disadvantage, but I have seen people who have been at a disadvantage. That's why I've tried to be involved with Graduate Women in Science, trying to make sure that young girls are getting inspired to pursue science as a career, just making sure that they know that they can also be engineers, because if you look at the stats of people in physics it's like 10 percent women and then most of them are men. I have not personally felt, but if I was in a different department maybe, then I would have felt that way. In my department there's a really good balance. Still, there's a lot of professors in our department who are male. There's a lot that can be done, but I've never felt that I was at a disadvantage.

After hearing this, I asked if Sunetra ever thought of her PI as a role model for herself or possibly other women. She responded, "Yes! I think [my PI] is a great example. She's done a lot in a male-dominated environment." Upon further discussion and reflection about her PI and things she had accomplished in her career, I asked Sunetra if she thought there were any similarities between the two that made them so tenacious in pursuit of their goals. Sunetra responded with,

> A lot of it has to do with my personality, I think. I think I'm just someone who *does things without thinking of external factors sometimes*. Like, oh, this place is mostly full of men, but that doesn't stop me from doing it. It's a mix of both and having the right role models. Yeah!

Upon reflection in the third interview and going back and reflecting on some of her responses from the previous two interviews, Sunetra said she was beginning to understand more and more the role that women, especially her advisor, had in helping her along the way.

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I noticed that, especially [My PI] and people who wrote me letters of rec from here, they have been women. And I didn't consciously look for that, you know.  I think it just happened. I mean I did rotate with other male PIs and I don't think I took the gender into consideration at that point of time. But now that like you mentioned it, I've noticed that a lot of them have been women and I think it's because maybe we just, you know, we you might say vibe on the same level. I don't know. But yeah, I've noticed that too.

When I told Susan, I didn't get Mayo she told me her story where she wanted to be a genetic counselor. She got rejected then she applied for the PhD in microbiology and now she's a PI. So, she is like you never know what'll happen. So, she tried to help me out that way.

This personal experience that her PI provided, was for Sunetra, another good example of what she thinks a great mentor does for her students, role modeling.

**The Importance of Networking**

After asking more about where she found inspiration and connection to women scientist, Sunetra talked about her use of Twitter, and how social media has helped to connect her to other women in science.

Twitter is like a huge thing with scientist. I don't know if you know that.  All the scientists are tweeting about their lab, research and like Global Health stuff. And so, like people who I've looked up to in the field of global Health now follow me on Twitter, which is pretty cool! So, I was like, this is amazing! And so, knowing that you have that common interest, I'm building connections through that to.  I follow them and I would retweet their tweets, I would like their tweets, because it was interesting. And then one day she just followed me back. So I was like, "oh my God", and then I DM'ed her. But I

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was like, "I'm a follower of your work and stuff" and she was like, she was very nice. It was pretty cool you know, especially since it's like people you look up to and you want to be able to do something that they're doing now in their career. So just having that like if you I ever want to ask them a question about their career, I can always message them on Twitter and ask like just questions about their career path and stuff.

Throughout her interviews, Sunetra gave multiple examples on networking, especially being uncomfortable doing so and not knowing how to follow up with contacts that were made.

So, the first few years, I did not think about networking. I think I finally realized the importance of networking like in the past two years, and I did start. One mistake that I made was I didn't follow-up with them [people she has met at conferences]. So, I think I should've done that. And like, you know how they say that, as soon as you get their card, just say, "Hey, it was nice to meet you." I didn't do any of that, because I was like, oh, this is going to be awkward. Like, do they even want me to email then?

Sunetra talked a lot about feeling awkward and unsure of herself when starting to learn how to network. She also talked about making mistakes at the beginning of the process at conferences,

The first time I networked at a conference was last year when I started speaking to a lot of the people who would have booths at the conferences. Some of them were like in ending pandemics, stuff that I'm interested in. So, I would be like, "Hey, are you guys looking for people? What sort of jobs do you do?" They would give me their card. I think the only mistake I made there was not follow-up at that one time. That's something that I've learned that I need to do. It's a lot of troubleshooting and figuring out if I should be following up.

Sunetra talked about how not knowing how to network "held her back," but now she's become more "brazen" about connecting with people on Twitter and LinkedIn and trying to learn about people's careers.  She also provides, what she believes, is an important rationale for needing to network in the current job environment.

> Before I started it, I hated it. I'm going for conferences and stuff. I didn't honestly realize the importance of networking before I joined Cheeky Scientist [a career networking organization for scientist]. They said that this is how it'll work. Nowadays, it's not about uploading resumes and you'll get an answer, which I've actually seen now is happening, is that the places that I've uploaded resumes I'm not getting an answer. But it's where I'm networking, I'm getting the HR managers to call me and stuff. I think it was out of necessity: I was like, okay, I have to do this, might as well get comfortable. I actually don't mind it now. I've done it. I felt weird emailing people randomly saying, "Hey, I'm interested in this. Do you want to talk and stuff?" But a lot of them also realize that nowadays it is about networking, so they're also pretty comfortable talking to me over the phone or via email. I don't mind it now.

Sunetra believes networking is especially important for individuals who are moving from academia trying to go work in industry or other public sectors, because companies aren't looking for people with an "academic background."

> I thought that with my technical background, I thought they [the companies in industry] would want someone with that technical background on their team, and that's what I was going with. What I didn't realize is that they do require a lot of like, they prefer people who have a lot of field work experience, which is fair, I understand that… So, I applied

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for one job, and they were like, "Yeah, we're not exactly looking for a person with an

academic background."

I applied [for another job] in Jan, I think end of Jan, and then I heard back from

them like a week later. Because I was trying to network, and so, I tried to contact people

in that organization. And so, they forwarded my CV or someone in HR, and they were

like, "Yeah, this is ..." It's essentially what I did in my PhD. - a lot of food pathogens.

And they were looking for an associate who works in the safe food project with the same

bacteria that I was working on.  And so, they were like, "Yeah, we're not exactly looking

for a person with an academic background." And I was like, I've studied these pathogens

that you're studying.  So, I was just like, that's so frustrating.

Sunetra believes networking has helped her connect to more prospective employers and

since she is still struggling, decided not to focus solely on industrial jobs to her public health

work.  Instead, she says she is choosing to use her experience and network with individuals in

other sectors such as NGOs, to show the skills and knowledge she would bring to those types of

positions.

**Learning from the Postdoc Experience**

In the end, Sunetra does believe she is on the right path to her career, thanks to the

support of her PI and many other women in science who make up a part of her network.  She

says one of things she learned from the postdoc is the importance of developing a network of

support.

Because it's so competitive, the [research] environment. I don't I mean I can't handle it. I

think it's more important that people know that you're all on the same side, right, like

you're all trying to solve a disease.  You're all trying to find a cure for something. And so,

I think I thrive in that kind of environment. I've actually heard from some of my friends and other colleagues that their lab is very competitive, they're always trying to put each other down. And so, I think we did get very lucky and I think a lot of it has to do with [My PI]'s mentoring style. She like, chooses people who wouldn't have that kind of mindset, like to put other people down. Which is I think if I was in a different lab, I don't think I would have I mean, I guess I would have done my own thing. But I think it just helps that you have other people there to advise you and provide you support. Yeah.

Sunetra goes on to say she's also realized the important role an advisor or PI can play in not only helping a postdoc find a job but also creating a supportive environment. However, she states,

I don't think a lot of them do. I think the first lab that I did rotate in, he had a lot of students, he had a lot of grad students and staff, but he did not, I never even spoke to those grad students and the grad students never spoke to me. They were just like, oh she's a rotation student, let her do her own thing. But in Susan's lab when I was rotating, the postdocs and the other grad students who were senior to me, helped me out by explaining stuff. And I think that's how she ends up seeing how people interact with each other and see if they can help each other out. But I have seen that a lot of people, a lot of PIs when they're looking for student, it's just their research ability.

I've seen a lot of professors who are not supportive of their students who try and do something else because not all of them want to go into academia. But not all of them want to do research and I don't think a lot of professors understand that there's more to career development than just getting papers out.

Sunetra also believes she learned a lot about herself, especially how much her passion and her personality have helped her weather her time in her doctoral program and the postdoc.

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Lately, I think it's been a lot of ups and downs. At the end of the day, you just have to keep applying [to jobs]. I think I've realized that mentality. You'll get rejections. I'm not afraid of rejections; I mean, it happens. No one likes it, I don't like it, but I can move on pretty quickly. It's just how I've been programmed, I guess.

I think looking back I might have made a few different decisions about what sort of courses or degrees I would have done if I had known that this is what I would end up doing. So instead of my master's in microbiology I might have done like an MPH or something.

In the end, however, Sunetra credits her experience with her PI, Susan, as helping to influence her to move forward in her career.

I think I learned a lot of like, if I ever have to mentor someone, I've learned a lot of mentoring styles from her. I mean she's very hands-off, she doesn't nag, and she wants to support you not only just in science but also in other professional developments. Like, she's allowed me to do so many other professional development stuff like serve on leadership panels, which is obviously taking up some of my time where I could be doing research, but she's always been supportive of that.

It is at the end of this reflection that Sunetra has another critical moment that I believe summarizes her narrative well, "It takes a village to raise a scientist."

**CHAPTER 6 - THE STEEL TOWN SCIENTIST**

Bridget graduated in 2018 with a Ph.D. in Plant Biology and at the time of this project, is six months into her postdoc in Biomedical Physics at MLU. Originally from a small suburb outside of Pittsburgh, Pennsylvania, Bridget was the first person in her family to pursue a Ph.D., though her mother does have a nursing degree and her father and older brother have bachelor's degrees. Bridget's career goal is to eventually find a non-academic position as researcher or research manager position in government, non-profit or industry. Throughout the interviews, Bridget *interpreted her educational training and experiences* in graduate school and the postdoc position through the lens of *needing to build resilience to "bad things" early in life* and *her upbringing as a daughter of a steelworker, which she defines as being "blue-collar*." Similar to the two previous postdocs in this study, *Bridget's experiences with faculty, especially "new faculty" solidified her decision not to pursue an academic career path* and as well as provided her insights into *how NOT to be a mentor to students and postdocs.*

Key themes in Bridget's narrative include *wanting a career that provides good work-life balance* and a job that keeps her humble and grounded. Bridget believes a tenure-track faculty career is not conducive to either a good work-life balance or keeping a person humble, therefore, is part of the reason she is choosing to pursue a career outside of academia. Some key experiences and individuals who Bridget believes have helped shape her experience as both a student and a postdoc, include *her undergraduate research advisor*, *dealing with several personal traumatic experiences in undergrad*, and *support from her husband.*

Bridget also shared that during her doctoral program, *she was able to participate in programs that provided her with opportunities to look at other types of careers* that allowed her to *find the right postdoc position.* Bridget took the postdoc position at MLU partly because she

defended her dissertation "early" due to her doctoral advisor leaving for another job in the
Pacific Northwest and partly because she wasn't ready to go on the job market due to timing and
lack of what she felt was a publication record.

**Building "Blue-Collar" Resilience**

At the beginning of our interviews, Bridget talked about how her family expected her to
go to college, because they knew the value of a higher education. She states,

> I mean my parents made it pretty obvious that college was not optional. They wanted me
> to do something better than what they had done…It was just an expectation from the get-
> go. My dad, he did college in criminal justice but now he's a steelworker, so he clearly
> doesn't use it. My mom, she has her bachelor's in nursing, but I think it was always very
> clear to them that there's not good job opportunities for people without a college degree.

However, in the blue-collar neighborhood where she grew up, Bridget said there were few role
models for her. She states,

> I met one person with a Ph.D. before I went to college, and that was because my dad,
> inexplicably one of his best friends is a professor in nuclear physics or something like
> that... We have a couple success stories from [our neighborhood], but most people stay in
> [our neighborhood].

Bridget states this meant finding good role models for building a career was going to a challenge.
In addition, although she knew she was interested in science, she wasn't clear on a what career
path to take, so rather than just give up and not go to college, she persevered and was able to earn
scholarships to a small liberal arts college close to home. However, as Bridget recounts, life
before college didn't plan on making it easy for her. She states,

I kind of had a rough period before college. Right before I started college, I was working

two jobs to make ends meet, my mom had cancer again, my dad had a really rough

family situation…my grandfather killed himself. It was just kind of a really bad time.

These critical incidents gave Bridget the insight that "bad things will happen" but that somehow

you have to learn to keep going.

And then I went to college and just drunk my sorrows away for the whole first semester

and got in trouble a couple times. One time I drank so much, I stopped breathing for a

while. They sent me to the counseling center to get that figured out.  I had a really good

counselor and they helped me, I don't know, like learn to be sad and then learn to get on

with life and somehow that has just let me compartmentalize...no, I don't want to say

compartmentalize cause it's not like I squish it away and everything about it. But like bad

things will happen, and then you still have to keep going. I could wallow in sorrow and

do nothing with my life, or I could distract myself and be really busy all the time. So, I

went with that option.

Talking with her counselor about these issues in undergrad is what Bridget attributes to

one of the biggest critical moments in her when she realized she would need to build

"resiliency."  She talked about how "after that summer there are very few things in this world

that can happen that could be worse" and coming back from these traumatic experiences is how

she found the strength to continue to persevere through college.

Bridget started undergrad at a small liberal arts college near her home.  At the time, she

had no idea she would eventually pursue a Ph.D., let alone in science, until she participated in

undergraduate research and "the wheels started turning."

I had no idea what I would do after [undergrad]. I was like, "All right, I'm going to get this biochemistry degree, and then we'll figure it out as we go." Then before my senior year, my advisor was like, "So, you should think about whether you want to apply to grad school, because I think that would be something that you could excel at." Before that I was just like, "Get to graduation and we'll figure it out after that." That's when I decided to apply for grad schools.

It was through her undergraduate research experience that Bridget realized, "people will pay you to do research." It was at this time that Bridget says *she found a role model and support mechanism in her undergraduate advisor* because *she encouraged her to pursue graduate education and role modeled for her what a scientist could be look like.*

Yeah, I think my undergrad advisor was definitely in that role to a certain extent because she was German and she came here, I think, just for Grad school onwards. So, her upbringing was very different. But she also had a family like mine ... like her family were shopkeepers, they had a family business…And I could talk to her about a lot. I had some personal things that happened in college with deaths in the family and things like that.

She saw me both at my lowest and when I was on top of the world in undergrad. And I've cried to her even after, while I was in grad school and I was in a horrible situation... She's very driven. She's very not aloof but there is certainly a barrier there and I wouldn't, I don't know discuss my sex life or things like that with her. But I can talk to her about, you know, like "oh like this is a problem I was having with John when we were long distance" or things like that. And just...the way she was always... she like encouraged me a lot. But she was also... I've had some professors, like some teachers, who were just like, they think they're the "shit" and like, the best thing since sliced bread

and she was never like that. She was always pushing me, but not like, to the point where it was miserable. She's just always expected the best out of me, and I would always joke like in college...I said this in my valedictorian address, that "when I grow up, I want to be just like, Dr. C." And not, like obviously, I don't want to be a professor, but just the way she is, and the way she's happy with her life and she's happy with her science and she does really great things with the resources that she has.

Bridget provided this short narrative about her undergrad advisor to show how that advisor was being supportive of her. However, from a research perspective, what is also interesting about this narrative, is it is also indicative of how much *Bridget downplays critical events in her life* (e.g. "I had some personal things that happened in college with deaths") and *remains "humble.*" An example of Bridget "*being grounded,*" is despite Bridget's rough start in undergrad, she did well enough during her studies to earn a university distinguished fellowship when she applied for her doctoral program at MLU. She states,

> See everyone seems to think that that's a really big deal and it never seem like that big of a deal. I got that. I don't mean to brag but, I got offered the equivalent of that almost everywhere I got into grad school. So, like it wasn't that big a deal for me. It was just like, "oh they gave me a fellowship and apparently it's a big deal here."

I believe this vignette highlights what Bridget means, when she says she's "*grounded.*" While others find this achievement impressive, she knows that others might not, so she doesn't let herself think she is better than others.

> I didn't even have it on my CV, until someone was like you should really put it on there…I mean it doesn't change what I did in undergrad and I have always had this feeling where like, I'm the cream of the crop but I'm a big fish in a small pond, but once I

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get into like the big ocean and then I am no longer...I'm not competitive enough on a

national level.

While the comment "not being competitive enough" seems like it would be unrelated, it is

actually indicative of the personality trait that Bridget believes is necessary to become a faculty

member and why, when she entered graduate school, she knew from the beginning, she didn't

want to become faculty.

**Graduate School Realness – Dealing with Difficult PI and Relying on Family Support**

Bridget knew going into graduate school that she did not want to pursue a faculty

position when she finished, so she made sure that when she went on interviews, she told people

"I don't want to be a professor."  She did this because, she said she needed an advisor who

would be "okay with that" and who, even if they didn't have the resources to help her get a non-

faculty position, they would still be supportive of her career trajectory.  When asked if she

received any pushback, Bridget states,

I didn't really have that many people who, at least to my face, said that would be a

problem. There was one, one of the labs I rotated in here, he talked the talk about

supporting people who didn't want to be a professor, but his grad students were like, "No,

he wants you, he will push you, into being a professor because that's what he thinks is the

right path."

Bridget believes a lot of these contradictory messages exists in academia, especially from

faculty, most of the time unspoken.  She says while some faculty are supportive of non-faculty

careers, many who say they do, are just paying "lip service" to the notion.  She says,

When I was applying for grad schools, everyone was at least *paying lip service* to the

idea of supporting people in doing whatever it was that they wanted to do after grad

school, but there weren't really many concrete ways in which they could do that. And I

think there is much more of that now. So, I think it really, at this point, it really depends

on your advisor as to what, because there are still people who will think, "Yeah. You

should be a professor."

So then there's kind of, I don't know what you want to call them, *reality checks*?

But people will try to be honest with you saying like, "If you want to work on this

project, but you don't want to become a professor after grad school, then you should

really think about whether grad school is for you," which is maybe not the exact same

thing. But I think that's really helpful because I have some friends who did their PhDs in

a very ecology focused field and they're like, "What do I do now?" One of them is

working at a science museum, which is not ... nothing wrong with that, but you don't need

a PhD in ecology to do that. So, she could have skipped five years of misery and started

working up the salary ladder sooner.

With that knowledge, Bridget made sure she chose a lab with a PI who could both advise her

through the doctoral research process, but also provide her with opportunities that would open up

other career paths besides faculty positions.  Therefore, Bridget wound up doing four rotations

before finding her eventual Ph.D. advisor.  However, Bridget doesn't call her, her "advisor", or

"mentor", simply her "PI." When asked why, Bridget simply states, because she didn't do either

of those things.

Bridget stated her relationship with her advisor from the beginning was "kind of weird,"

in that she was both supportive of her career choice, but also distant and hard to work for.  For

example, Bridget relates the story of when she started her PhD program,

It was my first rotation. I had just gotten here. That day I moved in she emailed me and is like, "When are you coming to lab?" I drove from Pennsylvania and moved all of my earthly belongings into a house [by MLU]. She didn't provide me any guidance. She works with switch grass and mountain grasses, essentially. Never worked with those plants before, never done large-scale greenhouse experiments. She gave me really, really vague instructions to set up a really big experiment. I messed some stuff up, which is to be expected. I also distinctly remember one day she was not yelling at me but raised voice, really telling me off for 35 minutes. I was like, "I'm really sorry. Please, I need to use the bathroom, I'll be right..." She followed me into the bathroom to continue yelling at me while I was crying in the bathroom stall. Just things like that.

Bridget stated this was *one of the most important critical events in her life*, because it made her want to quit her graduate program. However, with the emotional help and support her mom and boyfriend, she pushed through it, because they were able to convince her to stay. They told her "you will be angrier at yourself for just giving up that easily." From a outsider's perspective, I believe this was just another example highlighting her resiliency and ability to deal with tough situations.

Bridget also stated that while working in this lab was a negative experience and knew she probably shouldn't have taken the position to with her doctoral PI, the PI was the only one who seemed the most supportive of her of all the rotations she did.

She pursued me to rotate in her lab… but she's never graduated a grad! No one told me this! She's never graduated a grad student. The grad student who was in the lab when I rotated with her, she was there for seven years and left with a course-based master's because she did not have enough data to even get a thesis-based masters! I shouldn't

have gone into her lab.  But when I told her I wanted to go into industry, she was all

about it, but she was very like, "That sounds great. I will help you as much as I can, but I

have no information and no contacts in that field, so you'll have to figure it out on your

own."

While this did not sound very supportive to me, when I asked Bridget why would did you stay,

she did state she was initially hesitant to join the lab for her doctoral research but ultimately was

convinced to stay because the PI only required her to teach the minimum number of courses

required for her program.  In addition, the PI said she was committed to covering her funding if

and when it would run out.  To Bridget, *being allowed to pursue her own career, without*

*guidance, but with funding, seemed an acceptable trade-off.*

As Bridget went on to describe, her experience with her PI, she provided more stories

filled with contradictions and that required her to negotiate her relationship with the PI

constantly.  For example, when it came to conducting research, Bridget states,

There were no clear expectations. She was always micromanaging. Simultaneously

giving you instructions, but setting you up for failure with those instructions that were

really unclear, and then micromanaging every aspect of what you had to do. One time I

called my now husband and I was like, "I really don't know if I can do this. I'm clearly an

idiot. I don't know what I'm doing at all. This woman thinks that I am so dumb."

In contrast, when it came to helping Bridget with her career, Bridget states her PI acted vastly

different and was very supportive of Bridget wanting to experience other careers and training.

In one example, she says,

I went and spent one and a half months in Australia. I found the travel, the application,

and then I was like, "Do you know anyone in any of these countries?" She said, "Well no,

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but I heard a talk at a conference by these people from the Center for Rhizobium Studies in Australia. It seems like it's something that's up your alley, I can contact them and connect you… I got to help them out with their field work where we were. I traveled the whole up and down west Australia to put in field trials of this novel legume crop that they were trying to develop. That was like, if I could do that for my career, that is exactly what I would want to do!

She also encouraged me a lot when I wanted to do BEST [Broadening Experiences in Scientific Training], and then there's also Plant Biotechnology for Health and Sustainability (PBHS). It's a NIH thing, another training program. She was supportive of me doing that. Just in general, every time there was an opportunity to go to a conference, I traveled a ton because I think she thinks everyone should travel a ton.

When asked if she tried to get any outside help with her relationship with her PI, she stated,

Yeah, yeah. I did get to the point of during the... I think the very beginning of the semester I went and talked to the grad advisor in my department about what are the options for leaving before I finish my Ph.D. Then I didn't act on any of that. Allegedly, she's been talked to by the department and has a mentor for how to be better with grad students. But…

Bridget added that she believed her PI had such a hard time working with her because her PI was a new professor and Bridget was her first grad student, which I believe was also why *this relationship was a critical experience that has helped shape her career decision not to pursue academia*.

Finally, Bridget stated, the *critical moment* it became clear to her that a tenure-track faculty position in academia was not the career for her, was when her PI made the decision to go work at another institution.

> She left [MLU] in 2017, but I stayed here to finish because I was not packing up and moving across the country for one year. I think I would have been in grad school a little bit longer if she hadn't moved, but I had fellowship funding that was ending. It wasn't worth it. It didn't make sense to drag it out just to get a few more papers or something like that.
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> My parents took [my PI leaving] very personally. They thought that was a huge insult and that she is the worst human being in the world. They're like, "Why would someone do that to their student?" I mean it sucked me and for a lot for the people in her lab, but it is kind of an expected part of academia. Then it was like, "Okay, hurry," because she told us in April that she was leaving in August of 2017. Then it was like, "hurry up and graduate, hurry up and find a Postdoc." I knew then I did not want to be a professor…

I believe this experience with her PI and her PIs decision to "just leave" was what help Bridget realize that making "those kinds of decisions" with regard to others was something that she believes faculty do often. Bridget states she "wouldn't want to do that to someone" and therefore, thinks a faculty position is not for her.

**Professional Development in Graduate School**

Despite the lack of career advice, her PI allowed Bridget to participate in *two other programs that she believes were also critical in helping her find direction for her career:* the Broadening Experiences for Scientific Training Program (BEST) and the Plant Biotechnology

for Health and Sustainability Graduate Training Program (PBHS).  BEST is funded by the NIH at multiple campuses across the U.S. and is a professional development program for post docs and Ph.D. students in biomedical science and engineering fields (BEST, 2019). The goal of this national program is to provide trainees with skills and experiences needed to be competitive in seeking jobs outside of the academy, such as in regulatory affairs, government agencies, private industry, and entrepreneurial ventures.  The programs offered by campuses vary; the program that Bridget participated in, included one year of professional development workshops, seminars, and panel discussions around careers and also required participants to engage in two short-term internship experiences.

> With BEST, I did enjoy some of the more focused workshops where it was much more about how to make yourself [pauses]… instead of just meeting people who are in industry, how to make yourself a more attractive candidate for industry.

The two short-term internships Bridget participated in as a part of the BEST program included working with an organization that helped new start-up enterprises get going and the other was a project with a company that was making gamified online learning modules.  While Bridget says she didn't think at the end she needed to do both internships, she did say "I guess they were different enough, so it was helpful to have those two really different experiences."

> When asked to describe what she got out of her participation in the PBHS, Bridget states, PBHS was pretty different because in that, a main focus of it was we have this symposium that happens every year in the fall. A lot of that program was focused on planning the symposium, preparing for it… Then we'd bring in speakers, some from academia, but some from government and industry to talk about plant biotechnology. It was very much more narrowly focused. There was definitely, it's like a career prep

program, but we never had any classes about working on your communication skills. It was kind of a different... It was nice, getting to plan the symposium. Then we had a lot of one-on-one time with the speakers. That has been great for me because I managed to stay connected with people from Monsanto, which is someplace where I want to work, so that was nice to make those connections.

Bridget stated that these two different experiences, especially the short-term internships, helped her identify the tech transfer field as a career path of interest.

**The Postdoc – Checking All the Boxes**

At the beginning of our interview, Bridget had stated that she took the postdoc position in order to get additional training while looking for a non-academic research or manager position outside academia. However, after hearing her story about her relationship with her graduate school PI, it turned out there was a more important reason – it was easier to do than look for a job. She states,

She left [MLU] in 2017, but I stayed here to finish because I was not packing up and moving across the country for one year… Then it was like, "Okay, hurry," because she told us in April that she was leaving in August of 2017. Then it was like, "hurry up and graduate, hurry up and find a Postdoc"…I think that's part of why I ended up here [in the postdoc], because just with everything going on, I was applying to Postdocs because that seemed like a kind of almost simpler interview process. I knew by then I did not want to be a professor. I want to go into industry after my postdoc. Then the hiring timelines for industry jobs, I didn't want to wait until a month or two before I was graduating to start applying for jobs, but do not necessarily get an industry job interview, interview six

months beforehand and have the job wait for you. That was part of it. Then this position opened up and it checked all of the boxes that I was looking for.

Bridget added that she went into the postdoc with the additional goals of publishing at least two more papers since "I only had one lonely paper as first author" and also wanting to wanted to learn "some of the new sexy techniques to be able to say I can do transcriptomics or proteomics or any of those 'omics.'"

To pursue her interest in developing new skills and new techniques, Bridget specifically sought postdoc positions that would allow her to work on different kinds of research than what she had already worked on.

I actively chose not to apply to postdocs that would have been more legume, rhizobium, eco-evolution kind of stuff. Then I picked this one partially because it was convenient to not have to move. Especially my husband, I still wish he had a different career, but I would say he has a career here now and not just a job. Since he only got here a couple years ago, it was nice not to have to uproot him and make him look for a job somewhere else and then do that again in two or three years.

Brigit wound up applying for a postdoc at MLU where she did her Ph.D. because, "it checks literally every box that I had with the subject matter, the techniques that I'll be using, and the connections to getting into industry." Interestingly, Bridget says her advisor warned her about taking a postdoc at the same place she did her Ph.D. because "apparently it looks bad on your CV." Given that, her doctoral PI was having trouble recruiting people to go out to work with her at her new institution. Brigit stated,

I felt like at that point I was not getting unbiased input from her. I talked to the people on my committee. They were really helpful at thinking through what are the pros and cons of

staying here. I was not going to find another position that had all of those things already

lined up. That's how I decided.

This decision to apply for a position at her current institution as opposed to moving to a new

institution with her PI was important to note in Brigit's narrative because it begins to show her

more of her individuality and taking more ownership of her career. Brigit also stated that her

experience with the PBHS program and her use of social media influenced her to apply to her

current postdoc. Bridgit explains what influenced her to apply,

> I first saw her speak at one of the symposiums that we hosted with the plant
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> biotechnology for health and sustainability [PBHS]. Then I was following her on Twitter,
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> and I saw her tweet about this job opening. I had ignored it for a while because it was
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> like, "No, not applying to a Postdoc at [MLU]." Then it popped back up on my Twitter.
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> Someone else retweeted it and I was like, "Hmm, maybe I should." Then I interviewed
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> with her and it was just like, yeah, it just felt right, you know?
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> Brigit said her current postdoc PI is aware of her interest in pursuing jobs in industry.

The position has funding for 5 years, but her PI has already advised Brigit that she should aim

for being in the postdoc for two years and then her PI would help her start applying to jobs.

Brigit shared how this was arrangement was "perfect" for her postdoc PI as well because,

> [My PI's] lab is entirely microbiology, and this is the first time she's done anything with
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> plants. It was part of why I was also a really good fit for what she was looking for. She
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> needed someone who could do the plant work, and they did not have that expertise in
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> their lab… For me, the thing really is the skill development, being able to say that I can
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> do these things and actually feel comfortable with them. Learning how to work with
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> soybean and we might even get some patents, depending on how the strains go. We can

try to patent some of the strains that we've been working on. That would also be really

cool.

Brigit goes on to say that her PI also has many connections to industry, especially start-up

companies, in both industrial microbiology and agriculture.  Bridget believes being able to help

her PI start-up her project, conduct this type of research with minimal supervision and help her

PI publish results, is a good trade-off for the connections this position could give her in the

future.

When asked who else she talks to for career advice, Bridget immediately answers by stating,

I would say, for any career, specifically career related things, like what should I put on

my CV or that sort of thing, I would talk to [my PI] or one of my committee members.

Because I feel like even if [my PI] couldn't relate to me as a person per se, she could still

tell me what to do as a scientist. And I think you can separate those pretty easily. And

then I think for more like philosophical questions about what to do, at least in terms of

people in grad school, I've always felt like I was kind of on my own front deciding that.

Especially with [my PI] not knowing really anything about non-academic careers. She ...

we could hash things out in a hypothetical manner, but she couldn't really help me decide,

like, "I think you would be happier doing this or I think this would be less stressful or

something." Because she has just no basis to talk about that sort of thing.

While Bridget didn't look to her former or current PIs for advice about careers.  Bridget

does say she learned a lot from observing them.  She states that she's been able to observe "new

faculty" a lot while in graduate school and the postdoc and those experiences have helped shape

her path away from academia because, as she states, these faculty have "no work-life balance"

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**Learning from "New Faculty" About Work-Life Balance**

Bridget speaks at length about not looking to faculty for advice about her career, especially because she believes she has observed enough "new faculty" to know they wouldn't be able to advise her on a non-faculty career, let alone how to find a career with good work-life balance. She describes what she has learned from observing new assistant faculty as being an important part of her career decision not to follow in their footsteps because,

> You have to be willing to work just about around the clock and put everything behind science and have it *be the thing that you want more than anything else*. I was actually just reading someone else's, a different professor's, lab expectations page and they had the first bullet point in their expectations for people who joined the lab who said that like, "If you look at this as a 40 hour a week job with paid time off, that's not the right attitude to be successful." And I want a 40 hour a week job with paid time off and benefits. That's what I want.

In terms of a career and working in academia, Bridget states she likes being intellectually stimulated and learning new things, but she also states that it comes with a high cost,

> I don't know any faculty who really have the level of work life balance that I would want. And even if it's ... I feel like there's less of the stereotypical ones where they're in their office before you get there in the morning and they're still there when you leave in the evening. But everyone is working late at night, on the plane, after they put their kids to ... everything, all the time. So, and that's just not what I want. I want a job where I can go in the morning, I will work really hard for you for eight or nine or I probably max out at nine hours per day. And then I go home and then I'm done. I don't want to always have to have this like looming thing over my head that there's something else that you should be

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doing. And professors, they're always ... you have to write 20 grants to get one funded. You expect lots of things to fail. And I can handle that, but I just don't want it. It's like nose to the grindstone your whole life and then you retire, and you have no life. You're one of those people who never wants to leave their office. And science is cool to me, but science ... I think I would also be fine if I wasn't a scientist.

Bridget goes on further to talk about her current Ph.D. advisor, who often comes in on the weekends to work, had to make rules for herself to keep from coming in every single weekend, otherwise she would have been in the lab seven days a week. "Nope, nope, not… that's not at all how I feel about *anything!*" Bridget added. Bridget compared that observation to what the important experiences she learned through her internships that have also to help shape her career. She explained that the only scientists or academics she's met that appear to have a work-life balance that appeals to her, are those she's met who work in industry, not academia.

There's been some people that I met with these plant biotech symposiums that we've had here. Some people who work for Monsanto who seem to have a lot of stuff in their jobs that I would really enjoy. They get to do a lot of travel and they bring teams together. I think their specific job was coordinating research at universities that Monsanto is sponsoring and their industrial research team. So, he got to travel internationally a lot. But he still had a really active family life and was very involved in his children. So, something like that. But of course, I mean, I met him for a couple of days, so I don't ... clearly don't have the whole picture, but something like that would be really interesting to me. And just the fact that he very clearly knew what his kids look like and saw them on a regular basis. I don't want to have kids, but just having a life outside of the lab.

These experiences and observations caused Bridget to think very critically about whether it is possible to be a scientist and have a work-life balance.

> So, I have been thinking about this a lot lately because I was talking with one of my friends who is also ... he's really close to his defense and he's ready to pack it all up and be a bartender. But, so far up until now, there's always been that clear, clear goal. You get through college, you get through grad school, you get the postdoc after grad school and now [after the postdoc] there's not that prescribed lockstep path. And I've been thinking a lot about what I want to do with my life, and what I do not want to be ...
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> There was a time where I was like, "Oh, it'd be really cool to win a Nobel prize" or whatever*, but I don't want that*. I think probably because *I've been in the labs of two really new faculty members*, I've seen what it takes to be a really successful scientist, at least in academia. But I mean, a lot of the times the intellectual approach is quite similar and the level of dedication that you have to have to your job and all of that.  But I would rank going home at the end of the day ...
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> I was talking to my dad actually and he was saying, "Oh, you have so much flexibility in your job" because he was a steelworker, so you clock in, clock out like that. No flexibility there. And he was quite jealous of my flexibility because it was like I can't just up and leave without telling anyone, but if I need to leave early on Friday afternoon to go home or whatever, I can do it and it's not really a big deal. I just let my advisor know and that's wonderful. But then that also means they expect you to work all the time. On the weekends, in the evenings, you get emails at 8:00 PM and ... I mean, I wouldn't have minded, it's not like my advisor now would say, "Write this paper before

tomorrow," but you're expected to answer. She emailed me December 26th to send her a figure for a grant that she needed that day. And it's like I sent it to her…

The focus on *spending so much time on research at the expense of everything else* is why Bridget is stating she is not pursuing a faculty career.  Rather, Bridget says she is focusing on deriving satisfaction from within.

So I am personally working on deriving my self-worth from being a human being and not being a successful scientist, but that also means that I've been really thinking about what it means to be successful because by looking from the outside, things are going really great for me right now. I got my PhD, I'm at a Postdoc, I have papers published, but ... and there are many people who are much more successful or much less successful, but they're all ... what's the word for it? There are some really successful people who are very unhappy and some very unsuccessful people who are very happy, and I think I'd rather be happy then one of those people who works 90 hours a week and never ... has no life outside of that. So, yeah. So, then I don't want to be someone whose job is the end all, be all. I want a job that gets me far enough to have the lifestyle that I want but not something that is my whole existence… I don't want to be the kind of person who only derives happiness from success at work. *And this is something that I actually talked a lot about with my undergrad advisor*, is that if you are a good student, it is really easy to derive all of your worth from being successful in your classes. And that is not great if you're a student, but if you do well, you can survive that way…It is really dangerous to have your self-worth tied to your success as a scientist because there is so much failure that is inherent to science and so much of it is luck based and also to be really, really successful, you have to put in more hours than I'm willing to do.

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**Having a Husband and Friends Helps in Trying Times**

Bridget credits her husband, her undergraduate advisor, and friends and family for helping to support her throughout her educational experience and in her career. Bridget met her husband in college in undergrad and while Bridget does take her husband's career into account when thinking about her own future, she states that other than talking about locations, he doesn't provide much input into the type of work she does. "That's not something that he can really comment on. He doesn't have that kind of knowledge," she states. Bridget does say that he is the one that supports them at home though and is a counter to the narratives she has heard other women in science talk about. "I've not met any women, especially mothers in science who have stay at home partners. But I have met men who I knew have a stay at home partner."

Bridget identifies several different ways her husband has supported her throughout her education and her career,

> Well, the most obvious thing is that he always mans the home front when I go for conferences. I actually calculated; I was out of town for six months of my last two years of grad school. So that was a lot of time for him to be taking care of our dog, which is ... I mean, it's not like we have children. That would be much.

She also talks about how during the dissertating phase of her doctoral program, he knew how best to support her progress in writing,

> …he developed a really good skill if he could tell how things were going based on my facial expression. So, he knew when to bring me a drink or bring me a coffee or give me a massage or just back out of the room without saying anything. He can read that really well. And he ... it's not like he would ever be ... he didn't read my dissertation or anything, but he's read cover letters for me when I write blog posts that are specifically

designed for non-scientists. He'll read them to make sure that things make sense or if I can't figure out the word that I'm trying to use here, he'll help me with that. And he actually, he's helped me make parts of my posters before because he knew how to use LATEX. He came to my dissertation defense and he bought me cigars and a fancy bourbon to celebrate after. And even just, he always tells me how proud of me he is…

The type of emotional support Bridget's husband provides goes beyond showing he is proud of her, but also allowing her the space and opportunity to decompress and help her manage her anxiety, even though he may not understand exactly what she is working on because he is not a scientist.

We talk about our days and he'll tell me like, "Oh yeah, we had some like really crappy customers," or, "My boss is dumb," or whatever. And then, but I can tell him like, "Wow, my experiment failed and that really sucked, and I don't know what to do next." And he'll help me. I'm a very panicky kind of person, so he's like, "Hey, just take a breath. It'll be all right. You can figure out what to do next." Yeah. He just listens every time I'm like, "Oh, this coauthor is saying this absurd thing in this paper and it's so dumb," and yeah.

In addition to her husband, Bridget also talks about friends being part of her support network,

I have friends who are also in grad school and of course, that's a pretty good source of support. Especially one of my ... she was my lab mate before [my PhD PI] moved universities and now she's in the lab of one of my committee members. So, she was actually my bridesmaid, we're really close. We complain about our old advisor all the time and she has also been really good because *we both came from very blue-collar families* so she can understand the whole like, "I don't fit in culturally here." And like,

"These academic people are really weird," and like, "What does that word mean?" So, like that's been really nice to have.

Once again, the connection to "blue-collar" comes up for Bridget, and having friends, and a spouse, who can she can relate to, especially in trying times, has helped Bridget navigate her education and training, but also as she tried to determine what she wants to do next in her career.

**Don't tie your self-worth to your success as a scientist**

In our third interview, when we reflected on Bridget's experience, like the previous two stories, her experience with her PI shaped how she views her career moving forward, especially with regards to academia.

I feel like I understand it [academia]. I don't belong and I don't think I will ever belong, because I'm not a sophisticated individual… You see, you meet these people who are in academia whose parents were professors or engineers or lawyers or whatever and they just know people and they know how to order expensive food or just the topics of conversation that you bring up, the way you dress, the food you eat. None of that. I will never be ... I can eat kale and drink fancy cocktails and all of that stuff. But that is not what I would ever choose. And I know a lot of that's like the kind of exterior trappings, but it's like ... Actually, I read Hillbilly Elegy and this is probably a very stereotype or cliché or something, but I think I remember reading in there a line about how you move into this new society and everything about your old life is at best unhealthy and at worst horrifying or something like that. And that's kind of where it is. I go home and it's I'm around a bunch of racists and ketchup is a strong spice and we never want to leave our little bubble. And I know I don't belong there anymore, but I also don't belong here...

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She believes her experiences with PIs has impacted how she will act, especially as supervisor, since she believes the only things, she's learned from them are how to be a "bad mentor" and "bad communicator." She says,

> I don't want to do what they did to me to other people. And I don't like, I don't think I would necessarily ever want to be in a super managerial role. I know it is kind of unavoidable. I have an undergrad who I mentor, who really just does what I tell her to do in the lab, but they call it mentorship. But I'm not a people person and ... Absolutely not! I put on a good show, but I'm a very introverted human being. I guess I'm good with people that I'm comfortable with… I've even noticed that when I've had multiple undergrads, I had one that I didn't personally like. Like our personalities... for example, the one who I don't think is going to survive in grad school because she's so delicate, I don't deal well with that. I am not good at supporting people. I would much rather have someone who, not that we would shout at each other, but we could argue and then move past it. I'm not good at adjusting to be the best mentor that different people might need, so I don't think that I would be well suited to a position where I am the primary mentor for a lot of people. But there are certain things I will never do, like follow someone into a bathroom to yell at them. Hahaha! And, I have been on the receiving end of people who are really bad at communication, I realized how important it is to be really clear about what it is that you want. So, things like that like I will make sure I do.

Bridget emphasizes that *communicating what you want is extremely important*, whether you are talking to your supervisor, mentees and especially friends and family. Bridget also says, that *learning what you want to do and what you need* are also just as important if you want to

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communicate effectively.  Bridget states that knowing what she wants has helped her choose a path because,

> When [my Ph.D. PI] left I did a lot of soul-searching about what am I doing? How am I going to keep going? And like, I don't know, I guess *I'd always known that I don't want to be a professor*, so that crosses off one whole big angsty path for me and a lot of people to worry about. So that was helpful from the start.  And then, *coming from a blue-collar background,* you know being a postdoc.  Some people are like "oh, being a postdoc their whole life, that sounds terrible to me!" It doesn't sound that bad to me. Maybe I'd like to make a little bit more money, but we're not doing badly. Well, we have student loans. But it would be nicer, or we would be golden if we didn't [have] student loans. We could exist at this level happily, indefinitely. So then, it kind of feels like, if this [the postdoc] was a big step up from grad school, hopefully wherever I go next will be a big step up from here.

In the end, Bridget describes that her doctoral education and the postdoc helped to reinforce her decision to go for a non-academic career.  *Knowing that she did not want an academic career also helped her realize what to kinds of professional development resources to look for*,

> I feel like *I did an absurd amount of professional development* stuff in grad school.  So, I feel like that has left me pretty... even if I don't have a particular job in mind nailed down, I have a pretty good idea of the things that I'm interested in pursuing. And so really, it'll just be like *building my professional network outside of academia*. I feel I have all the resources that I need, and I have to say, to toot my own horn…
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> I've always done, very basic research and I've always wished I could do more applied research…Farmers are not society as a whole, but like society as a whole is so

predicated on agriculture that I think I would like to try improving AG will be really

important for improving society. I think it would also be really interesting to work on

solutions for people in developing countries because when you have a lot of subsistence

farmers and you could have a direct impact on a lot of people. But there's even less

money for that...maybe I could get a job at a non-profit or NGO or something to work on

that but, that is unlikely. And it would probably not pay what I would want to make to be

comfortable. And *I'm not willing to sacrifice*. I am not going to go work for some evil

pharmaceutical company. Like for example, whichever one came out that they made all

the opioids and now they have an opioid addiction drug. I wouldn't work for a company

like that. But I'm also not going to be the person who makes 25 Grand a year to follow

their idealistic dream. I can't do that.

In reflecting on her entire experience, Bridget also mentions that she wants to make sure

that *I, the researcher*, understood that she is not against graduate education, or doesn't think

people from "blue-collar backgrounds" should not get a Ph.D. Rather, she says that prospective

students going into doctoral programs from backgrounds like her, need to know that *it's really*

*dangerous to have your self-worth tied to your success as a scientist* because there is so much

failure and luck inherent in conducting science. "You have to put in more hours than I'm willing

to [do to]be really, really successful." She goes on to state,

> I mean, even just in terms of the product, because when you start grad school, you pick a
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> lab, you might be able to have your pick of projects or you might not, you might be told
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> this is what you're going to do. And sometimes a project that seemed like something
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> really simple to do and easy to wrap up and should make a paper in six months,
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> something will go wrong. You'll figure out your hypothesis, the hypothesis you were

working on, was wrong or something like that. And then maybe it'll take two years to get really boring results or it'll take two years and you'll get a [small] paper out of it. And there's really no way of knowing that. And then there's also just ...

I had some issues with some really promising research that I did when I was in Australia, I had to stop working on it because the only person who could ship me the seeds and bacteria to keep working on, nearly died of malaria and retired. So that just, that can happen. Your freezer dies, someone kills your plants on accident. There's so much. You can work really, really hard and be infinitely less successful than someone who happened into a project that got these crazy and shocking results. And you can definitely set yourself up to be more likely to hit one of those two paths. But there's ... it's so unknowable, there's nothing that will guarantee. Hard work does not guarantee success in any way.

"Hard work does not guarantee success" seemed like a tough statement to end her interviews on so I asked Bridget if she considered herself a success now. She responded with,

Excellent question. I don't ... To someone like my parents, yes, they would definitely say so ... I have job, I have health, and I even have dental insurance…So yes, by that standard, for sure.

To my, someone like my Ph.D. advisor, I honestly don't know. Because I graduated my PhD with zero published papers, well, zero first authorships, I had a couple of co-authorships, but those aren't that important for your personal CV. I finally got one first authorship published now. A lot of people would aim for three public, three first authors from your PhD. So I'm not ... I wouldn't say that I'm not really bothering to apply for Postdoc fellowships right now because I know I'm not competitive enough by those

standards to be a huge success. I don't ... it's weird. I'm also ... I wouldn't call myself unsuccessful even by those metrics. I got out of grad school, I have a paper, so yeah, I'm not an abject failure or anything, but I'm just definitely not the cream of the crop. So yeah, I think that's where ...

I would call myself a scientist. But I think you can be a scientist and be unsuccessful in academia…About the making it thing, I don't know if I'm ever going to be totally sold on me having made it, because I will always wonder if I got squished out of my PhD early just because of my advisor moving…My Postdoc advisor seems to think that I am highly competent, which is a good sign. It's always refreshing to know that they think that you're competent. So, I don't know if it is contradictory to classify myself as *successful, but not made it*. But that's kind of where I feel like I'm at.

## CHAPTER 7 - A SCIENTIST, A TEACHER, AND A MOTHER…

Maya is 31-year-old married white female, originally born and raised in Western Michigan.  Maya went to undergrad at a small liberal arts institution where she met her now husband, before going on to pursue her doctoral degree in cellular microbiology at a large research-intensive university.  Maya graduated in 2016 after having two children and then proceeded into her first postdoc at Midwest Land-grant University (MLU).

Maya believes she's had a "great experience" in undergrad, graduate school and in her postdoc position. She believes she's gotten all the right support and mentorship necessary from advisors, mentors, PIs, and her family, that enabled her to pursue a career that is exactly what she wants and is supportive of her having a family.  That's why, when asked "why she wanted to participate in this study", she stated that she felt it was important for people to understand the research mentor/advisor relationship and also added "it's really important that people have access to thinking about ways to improve this process for everybody and how it actually works" especially at the postdoc level.  She took the MLU postdoc position in order to "get a little more research and teaching experience" while she looks for a job at a small liberal arts college.  She believes *the mentoring she received throughout her education, including the postdoc*, *her desire to have a family and choosing to make that a priority, being confident* and *direct about her career choices,* and *engaging in and accessing professional development opportunities and resources* on campus, have ultimately made her feel successful in her career so far and will continue to into the future.

### "I've Been Really Lucky with Mentors, in General…"

Maya believes the mentoring she's gotten over the years, especially in undergrad, have been integral in helping her get through not only her doctoral education, but also in finding her career

path and feeling confident she will find a job as a tenure-track faculty member. Maya states mentoring has made a big difference for her and feels like she's been "really lucky with mentors in general." When talking about her undergrad research advisor, she says,

> It was a small school, like between 2,000 and 2,500 probably undergrads and so, I knew all the science faculty really well. I took like three or four classes with her [undergrad research advisor]. It was like every class she taught, basically I had with her…so in addition to doing the research for a summer with her, you know, I saw her a lot too…So she was like my first research experience and I just felt like she was so nice and patient. I'm sure now having mentored a lot of undergrads on my own, especially like the first time, I was mentoring an undergrad I was thinking about that experience with her and thinking like I must have been such a pain to her. I like asked so many questions, like "am I doing this right?" and "Can you watch me do this to make sure it's okay?" But I remember feeling it was really helpful and she never made me feel like I was annoying her.

Maya also mentioned a research internship she did in industry, and she talked about how she felt those mentors were also "really good." She states,

> We didn't have maybe as much of a personal relationship because it was a more professional setting and they were more like colleagues that were helping me. So like a little bit different dynamic, but they were also very friendly and very willing to answer questions and helped introduced me to other people and things like that.

In her eyes, a lot of what the industry mentors did was introduce her to other people and helped her to expand her network, which she thought was really important. In addition, she mentions

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that they helped her to understand research outside the academy.  Maya then goes on to talk about her mentorship experience in grad school.

Maya prefaces her experience talking about her graduate school mentor by stating that she understands mentors have their own style and sometimes what works for one person may not work for another.

> I'm like a really self-motivated person and I'm really good at identifying if I need help. So like I'm trying to do something. I realize I don't have all the information I need, or I'm confused about something and I'll just go ask either him [graduate school mentor] or I would go find somebody else basically who I felt like I could address the question. And he [graduate school mentor] wouldn't really ask me about that.  He wouldn't necessarily be like, "hey are you doing okay with this?" I would just go do it. For some people who kind of are not confident asking questions or maybe not as good at self-evaluating in a realistic way, in terms of like "hey, this isn't going well, I need help," if people are not as good at doing that, the more hands-off mentoring approach can be a problem because they can just like beat their head against the wall for way longer than necessary and waste much time or get super frustrated and just not get help.   I've definitely observed that with some of my colleagues like my fellow grad students and other people in the lab in general!

Maya adds, that "you can't make people go do things" like ask for help, so she says she feels "lucky" that *she's been able to recognize what kind of mentoring she needed* and *consciously looked for mentors who could work with her style* and who she felt would fit what she wanted.

> [My graduate school mentor] has also been really supportive, in terms of both letting me try to branch out a little bit, so like kind of test my wings. But also being really

accessible, if I needed help and also try to help me meet people who could help me out, or let me practice different skills that they felt like would be important such as like writing papers, reviewing papers, applying for grants, teaching his class. So, all kinds of things that he basically really listened to what I told him I felt like I wanted to do, and then really tried to connect me with those chances to practice.

Maya also mentioned that one of the best things her graduate school mentor did was not only let her practice different skills necessary to be successful as a faculty member, but also provided positive reinforcement. She said, he would give her some positive critiques and feedback on her writing, teaching and presentations skills. Maya believes this positive reinforcement has helped her build the confidence needed to deal with the stressors and rejection that come with working in such a highly competitive field. She also says that this has helped influence her own mentoring style,

So I tried to like think about those things when I'm mentoring undergrads myself to make sure that they feel comfortable and like they CAN [emphasis] ask questions and that they don't feel like they're being annoying and are like afraid to like figure out how to do it right.

When asked about her mentorship experience as a postdoc, Maya states that the position at MLU has been a great opportunity, because her PI has allowed her to develop her own research agenda and come up with ideas about developing her own research lab and direction, independently.

I did have more chances to do that [develop research ideas] in grad school than I think a lot of people do just because of my advisor. But here I like really developed my own research mini-program sort of underneath the umbrella of my mentor. That really gave

me the confidence that I could do that because I feel like for me, I don't really know that I can do something until I'm already doing it, right and it seems kind of scary.

So like initially when I was thinking about looking at like a job, a job ad would pop up and I'd be like "hmm, this is a professor job, but you have to like have an undergrad research program" and the thought of developing that initially it was like, "oh my gosh, what does that even mean?" Like that seems really hard but then realizing that I was developing my own program, and then you know, getting handed some undergrads and being like, "Okay. What do you want them to do for you throughout the semester or the year," or something like that? And I just started to think out loud about what I've been doing already with undergrads and then I kind of realized that I was already doing that. And so that definitely has given me a lot of confidence that I can actually do that kind of job [being a professor] because I have been and it's been working but I think it takes actually being able to do it sometimes to feel like you can. At least for me.

Maya also stated that during the postdoc, her PI also allowed her to expand her experience teaching.

I had had a lot of practice TAing and doing some guest lecturing [during her doctoral program] but then when my PI, Shannon asked if I wanted to teach a course by myself over the summer this past summer, I said yes. Having that experience of developing a syllabus and planning ALL [emphasized] of the lectures and writing ALL [emphasized] of the assessments and planning ALL [emphasized] the activities made me feel like again, oh okay, I can actually do this! And it was nice to have a little bit of a soft, first beginning, I guess, with just having one class that I was doing and that it was not being my full-time job for like the year.

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Maya said the experience of organizing and teaching the summer course, definitely made her feel like a faculty position was something she could not only do, but "actually enjoy doing for an extended period of time." Maya went on to state that the postdoc experience *validated* her goals and ideas about what she can do and also what she wanted to do. This means the experience also provided her with *self-awareness* that she could be good at being a tenure-track faculty member because *she felt she was already doing the job*. In addition, the postdoc also allowed her to *realize she could have the kind of work-life balance she hoped for in the future*, because she was already balancing family, research, and teaching in the position.

Circling back to her undergrad research advisor, Maya states that she felt like her advisor did an exceptionally good job of being encouraging and directly shaped her style of mentoring. Moreover, she states, it was that same advisor who reached out to her and said "Hey, by the way, there's this opening at your old undergrad and we would love it if you would apply. We can't promise anything. We'd love to seriously consider you." To Maya, there was no better evidence that she learned what she needed from her mentor to follow in her footsteps.

**Choosing to Have a Family and Finding Support in Academia**

When someone asks Maya the question "what do you do," she says she identifies as "a scientist, a teacher, a mom, a wife, a daughter and a sister." She believes that in addition to *defining yourself by what you do*, that it is also *important to understand what other aspects of your identity influencing your life are important to you* as you move through your career.

> I mean family for me always has to be first. Because at the end of the day, that's just what's the most important to me. Fortunately, the kind of job that I've picked, works well to allow me to be the kind of mom and wife and family member generally that I want to be also. That's definitely been a big part of how I've selected what kind of job that I

wanted to do because I didn't want it to be at the expense of these other things that are also really important for me; to just feel like I'm being the kind of person that I want to be and having the balance in my life that I want to have.

Maya states that she always knew she wanted to have a family and that choosing a career where she could balance work and home was important to her. Maya says she enjoys doing science research "at the bench" and enjoys teaching a lot, so having a career where she could do that and have family, made academia a likely career path over something like medicine.

One of my sister's is a cardiothoracic PA, and so she does surgery and she's on call and seeing like how hard she works. She's like nine years older than me, so enough of a gap where I could kind of watch how this plays out, and just seeing how hard it is to be a mom and do like a high-pressure job where it's like people's lives actually depend on the decisions you make, made me not want to go into medicine partly…Academia definitely has challenges with like the tenure system, and you have to like be on the ball to be competitive with other people, but it is a more flexible job in a lot of ways too. So, you can kind of work different hours, you don't necessarily have to be at work all the time to do your work. You can do some things at home. It tends to be a little bit more family-friendly…

Maya adds that her doctoral institution was very family-friendly, where lots of faculty had children and the faculty seemed to have a good work-life balance. She states,

Like you'd see them, you'd hear and see things that definitely indicated like it's okay to go take care of your sick kid, and no one's going to give you a hard time about it. You see people work more like a normal workday; more of like a nine-to-five and they tell you "okay, like I'm gonna be here during this time. If you need me after hours, like you

can email me and I'll get back to you, but I'm going to go do my thing with my family in

the evening," basically. And they would say that and that was not criticized by other

people, mostly at least in my department.  But my department was like very balanced. I'd

say it was more like 50/50 men and women.

Maya strongly believes that getting her doctoral degree in a department that was half men and

half women, was definitely out of the norm from what she heard her colleagues talk about.  She

talked about colleagues in other departments,

I would hear people complain a lot more, in departments that had a lot more men,

especially a lot more older men. So, like engineering.  Not so good, from what I hear, for

women. Because there's just not a lot of them [women] and so a lot of the older men

especially just didn't get that these women professors had some other priorities and they

would give them a hard time apparently about not being there until 7:00 or 8:00 at night

or something, which is a bummer.

Maya believes this kind of treatment discourages women like her from wanting to stay in some

of those fields because they feel like they're going to just get a hard time all the time for not

devoting every hour to research.  Maya believes few people want to work in that kind of "toxic

environment," so she says she's been "lucky" to work in biology which tends to be more gender-

balanced and hence, a more family-friendly environment.

Maya does also add, that she has been "fortunate" to have a spouse who is supportive and

has a job that is flexible enough that he can also leave work to deal with problems at home as

well. She states,

He has been super supportive and so that has definitely made it possible for me to be able

to do what I want to do. So, he's a patent agent. He got his degree in chemistry and

decided to do this because he didn't want to work in the lab anymore. And so, his job actually is pretty flexible too…if he wants to work at home some or whatever else he can. And the firm that he decided to work for, a lot of those people have kids also. A lot of them are guys who happen to have stay-at-home wives, so that's different. Some of them, have partners who work but outside the home because IT IS A JOB [emphasis] being a stay at home parent.  Certainly, but they don't necessarily always get that. He is more supportive than they are…we really make an effort to be kind of equal partners in terms of like caring for our kid and this one too [points to her pregnant belly], as much as we can….So he has that job, which also means, if he's [her son] sick in the middle of the day, he's the one who brings him home. I may come meet him and trade off or whatever but for like logistics of family dynamics and stuff, he's been like super helpful with that. So, I definitely don't feel like some of those things are just on me to like figure out.

And then just in general he really cares that I'm doing something that I want to be doing and has always been really good about supporting me. You know, we have these conversations and he's like, "okay, well, yeah, if you want to do that, it seems feasible like it'll work with what we're trying to do, and you should go do it."

Maya states, that this kind of support from her husband has made a big difference in helping her feel confident about pursuing her career, but also in not making her feel guilty for doing so either.  She adds,

I don't know if you've heard of Mom guilt, but it's a real thing. I don't know, there's something about, I want to work and part of me feels like a little bad about it that I would rather go to work than take care of my kids all day. Which you know, there's something that seems bad about that to some extent like emotionally or something. But I just feel

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like I really need the mental stimulation of doing something.  Additionally, using science helps you do that for sure, and I love spending time with our son, but I also really like the rewarding aspects of doing the work too and I think in some ways it actually makes me more patient and like better with him because I feel like the time I do spend with him it's a treat.  I haven't been like annoyed or frustrated all day and dealing with some of like the little things, so I really feel like the time we have together is more like quality. It definitely was hard at first like especially when he was really little to drop him off and be like, I'm not taking care of you today.  He's always done great with it really, but yeah, it's hard.  I think it's harder for women than men.

Maya adds that having mentors who support her decision to have a family and make them a priority, was also helpful for her and important to her success.

When I talked to my graduate advisor and let him know that I was expecting, he was really supportive, and I let him know with like lots of notice so that we could plan.  I asked, "do you think I can finish by this time?"  We talked and we said, "we think I can defend, and I talked to my committee and they were all really supportive; and it also happened that they all have kids too. And so, they understood how that was going to be. My advisor himself doesn't have kids and isn't married, but he was always really nice about being understanding despite not like having those experiences himself.

My postdoc mentor, she herself has a bunch of kids, four. I knew that she had had kids in grad school and during her postdoc. And so, I didn't like talk to her about it beforehand. But I kind of knew that she'd be fine with it because she did that and it's pretty unlikely for someone to criticize you for doing the same thing that they did in something like that. And there were some other people in her lab who also had kids and

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so it was kind of like, I was able to look for signs that it was going to be not a hostile environment for a person with kids because that exists certainly.

Maya added that she was well aware that the academic science field, especially for tenure-track faculty, could be hostile towards women who want to have children.  She personally knows postdocs who ended up taking projects in different labs because their advisor said, "I wouldn't have hired you if I knew you were going to have two kids when you're a postdoc." While Maya acknowledges that she knows it illegal to discriminate against pregnant women, it happens.  In addition, she writes that even if prospective faculty don't discriminate outright, "no one wants to feel like they're in that kind of environment where they will be discriminated against for wanting family." Which is why she says on entering the job market, she's tried to lookout for unsupportive environments and advises other women to do the same.

**Confidence and Being Direct About Her Goals in the Job Search**

Maya states, that as she goes forward with her career and looking for tenure-track positions, that when it comes to networking and going on interviews, she plans on *being open, honest and straightforward* with her identity as a scientist, a mother, a wife, etc. and what she is looking for in terms of work-life balance in a new work environment.  She states,

So definitely things that I have asked and would recommend asking – "honesty," I think, being more transparent. I feel like some women are afraid to show their cards almost on how important like family life-balance is to them. But I think that that's actually a bad idea because legally people are not supposed to discriminate against you for them, first of all for that. But secondly, I think it's a terrible idea to not know what you're getting yourself into because you wouldn't want to, I wouldn't want to, end up in a situation where I felt like I was having all of this pressure, and no support for the other side of my

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life. So, things that I've asked are basically asking about, family-leave kind of policies; directly asking, "is it okay if I have some kind of situation where I've got a sick kid"; you know, asking if it is going to be acceptable for me, to within reason, be able to leave and deal with things that might be happening with family…I will also ask about things like is there a place for moms who are nursing?

And also, probably, I will mostly just be like straightforward with conversations like: "Okay, like I just want you to know, if I get this job, that I have two kids, okay. Or like "can I teach classes, during like this set of hours. Is that possible?" Also asking, "What do you expect of me, like nights and weekends?" And just making sure that, I have a really clear understanding of what expectations would be so that I can talk to my husband about it and we can decide if that seems like it's going to work for our family or not. And also making sure that the place that I would go work understands what my preferences would be. Because sometimes people are willing to accommodate you, but they just they don't if they don't know but that's what you want. And so, I'm a pretty transparent person generally

Maya also adds that during job interviews, when she is doing on-site interviews, she tries to figure out what kind of environment and community exists among potential colleagues. She says she does this by,

I find that by offering some more information about myself, usually other people will kind of tell you what you want to know anyways. And I also try to get a feel for just like what the climate is there. So, I might ask things like, you know, do co-workers get together outside of work at all or during work to do some kind of like group bonding sorts of things? Like, whether you know, eating lunch together once in a while or getting

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together for some kind of gathering socially because I think that really can help to tell

you how they're interacting with each other and if it's like a happy place to be or not?

She does this because as she is looking for a new position, she wants to know if her new

environment will be supportive of her and her family and how they think about work-life

balance, in the hopes she might get a sense of how they might treat her.

Maya is very confident in her skills and abilities and while moving forward with her job search

plans intends on being open and honest about having family and wanting a supportive

environment.  She acknowledges there are a lot of women in science who choose to not be as

direct as she is for legitimate fear of being discriminated.  When asked, how she became so

confident and direct, she states,

> I don't know if it's partly being part of a big family that if you don't speak up you don't
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> get what you want. So, there may be some of that, but I don't think I was always really
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> confident because I think I remember elementary teachers saying, "Maya's good at these
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> things, but she lacks confidence." I remember this happening, you know as a kid and just
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> kind of as I got older, just figuring it out and just getting more confident with being able
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> to just say what I wanted to say. I don't really know how that happened, exactly. But
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> yeah, definitely by the time I got to high school and college I think I somehow learned
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> how to be pretty assertive and straightforward and I just felt like that has worked.

Maya also states, being assertive and straightforward has occasionally "gotten her into trouble,"

because she says she is not as tactful or diplomatic as a situation may require, especially in the

lab setting.  She talks about how she believes she has hurt lab colleague's feelings because, "they

are more sensitive than I am because I'm not very sensitive." Maya states,

That's definitely one thing has been frustrating to me in my current situation [being a postdoc]. So, in my grad lab for a long time, I was the only girl in the lab, and it was great because the other guys were just super mellow, and you could not offend them. You could just say whatever you wanted to say, and they were fine, but I mean not to be like sexist. I feel like just a lot more women tend to be more sensitive, in my experience anyway. Not all of them certainly, but in my current lab, there's a lot more women and hardly any men. And the only man, actually, who's full-time, is gay and he is more sensitive also! So, like, oh my gosh, I actually got to be, well he's not like overly sensitive or anything but it makes me feel like I have to think about what I'm going to say. I have to like strategize... There's always a way that people want things to be done or following like the safety protocols. It's like "I want things to be organized in this way." Like, our lab manager is really particular about how she wants things and also is like sensitive. If I don't do something how she wants it's like a thing or like if other people in the lab don't do things how she wants, it's a problem. And she won't say anything, or she will but she's more like passive aggressive. And I don't want to do that. I just want to be like, okay, well, what do you want and I'll do it. Unless I have a very good reason not to. And so I prefer...I'm not like confrontational... but I just want to have a conversation in a straightforward way.

I believe this is Maya's way of saying that she prefers being "direct" with people; she is fine with confronting individuals with conflict and is fine engaging in "confrontations." She says it's frustrating to work in a lab with people, including management who don't want to say anything negative that may be construed as conflict, especially if it's a safety concern. On the other hand, Maya also talks about how being direct is frustrating, it has also helped her navigate her career,

Like I think for the most part it has served me pretty well because a lot of people do

appreciate it because if you have to guess constantly what someone else is thinking or

what they want, it can be really annoying and kind of slow progress, I think. When, if you

can just talk to someone and say like "hey, this is what I want," or "these are my needs,"

or "this is what I think is really important in this situation," and even in teaching being

able to tell a student "this is what I want you to be able to do," "this is what you should be

able to do to be successful," then there's no guesswork. And so, I think it can be more

satisfying for them to, both in the workplace setting and then also the teaching and

mentoring. I think it's worked pretty well, for me, at least. I also try not to be abrasive.

But yeah, okay. I tried to strike a good balance. I really do; sometimes it's hard.

Maya also talks about defining what "success looks like for her" – good work-life balance - has

been helpful in her job search and has allowed her to take that idea directly to prospective

employers and make it very clear to them what she is looking for.

…and so I would say, be honest with yourself about what success actually means to you

and think about how you can balance maybe family goals with career goals and things

like that and then be realistic when you're looking, and thinking about, "is this track

going to actually get me where I want to go." Am I going to learn the skills I need?  Am I

going to meet the people that I need to meet to help provide me with the training or the

network or the support system that I need to be successful?"  So like, really first creating

this kind of vision of what success actually is and then at each step along the way

evaluating if you're on the right track to get there.

Maya acknowledges that this internal reflective work is not straightforward or easy.  But

in her conversations with advisors and mentors and other people she's talked to who she thinks

are successful, they all say the same thing – "You can't just check your boxes and think you're going to get where you want to go.  Opportunities don't really work that way."  Maya believes people need to determine what success means to themselves, connect with other individuals who model what you are looking for, be direct about what you want, and with luck, people will connect you to others or opportunities that will help you along the way to your career.

**Accessing Professional Development Resources on Campus**

As a doctoral student, Maya says she participated in programs at her previous campus that helped her plan and think about her career and being a woman.  One organization, called the Association of Women in Science (AWS), helped Maya recognize the importance of mentorship, and how the higher up you go in an organization, regardless of sector, there are less women getting promoted and less women who are in management.  Maya says this organization helped her realize that being a woman and having a family should not limit her ability to move up in an organization or find a job.  It was through AWS that she also learned from guest speakers how to deal with issues on the job search, especially for women.  Maya states,

> AWS would bring internal professors and outside speakers to talk about their experiences. For example, parents with kids and sometimes we would bring in both spouses, which was really fun for them to talk about their experiences and how they've been able to manage family life…For example, at [my previous institution], in one of these career panels, they had spouses come in who got hired at the same time. Apparently, they offered the husband more startup money or something than they did his wife. And of course, they [the couple] know what the other ones getting offered and she's like, "Well, what's the deal?"  She said they replied with "Well, overall the package that the two of you got offered here is as competitive together as your package from this other

offer that we know that you got from the other institution." She's like, "well, yeah, I'm sure my husband will be very happy to have more money. But I want as much as you're giving him."

Maya said she originally joined AWS because "I know I'm a terrible negotiator," she goes on to say she believes women are notoriously poor negotiators and poor at negotiating other work issues like service work. Through AWS she said she was able to explore and understand her own identity as a woman in science, and how she learned women frequently end up doing a lot more service roles and get "roped into doing more things than their male counterparts." Maya also says she and her husband learned a lot from AWS workshops, especially the examples given by couples where the husbands talked about what they do to support their wives. Maya goes on to give an example an example of what her husband said to her after attending one AWS' presentations on negotiating,

My husband is actually going through some interview processes right now that I'm eventually going to be in. He's like, okay, if you get an offer, you talk to me before they give you a number because we really want to make sure that you're not selling yourself short. He's a lot better at that kind of thing than I am; it just does not come naturally to me like him…

Maya is aware of the other professional development, career resources and workshops available to her at MLU as a postdoc, such as the grant writing workshops, CV and resume building, and the resources to help postdocs learn to teach better. She does believe MLU does a good job at providing those resources, but also says she wished she would have engaged in those workshops as a doctoral student. When asked why she didn't participate in them more, she responded,

Oh, usually just like, experiments or some other commitment that got in the way of it. It definitely wasn't that I didn't want to go. You know something, they can only offer these kinds of things at specific times and sometimes it works and sometimes it doesn't… one of the hardest things for me now is when things are only offered like after five [p.m.], because as a parent that's like really hard… people who do have family, like their kids are at child care…Grad students, a lot of grad students don't have kids yet and I think it works for a lot of them to have stuff after five [p.m.] so they can get their stuff done in the lab during the day. But for people like me or for grad students who do have kids, it's pretty hard. That's been a big limitation for some stuff that I've actually wanted to go to here, but just felt like I couldn't swing it….That's probably affected me the most actually but a lot of great things are offered that I'm like, oh, I wish I could go to that and sometimes I do, if I can make it happen.

Having to balance work-life issues was a concern for Maya during her doctoral program, and in some ways still affects her. Therefore, she also offered some solutions and insights that she learned from her own experience. For example,

Online stuff is great! That was actually something really nice for the certification in college teaching program I've been doing. You have to take at least one course about STEM education research, and I was able to take an online one. That was great for me, because I could do it when it worked out best for me, which was usually at night after my kid went to bed. So, that was perfect. So yeah anything like that, or when maybe if the workshop is offered later making like a video of it or slides like available and sending that out or something like that would be really helpful to, so people could just check it out on their own later.

Maya also stated a problem specifically related to postdocs was getting information about professional development resources in general.  She says,

> We have no idea what's going on a lot of the time.  I noticed that when I was a grad student, it was a lot more clear what resources were available. And even when you're just getting started you have kind of a class or orientation kinds of things that tell you what's up.  That didn't happen when I got hired here.  So, I don't know if it varies like depending on what time of year maybe you join because postdocs kind of show up any time of year. That's definitely harder because grad students are pretty much all showing up the same time and undergrads are pretty much all showing up at the same time.  And so, it's easier to plan like some kind of group thing, but maybe if there was like just a list of resources that postdocs just got when they came. Like here are all the kinds of things offered for professional development, or these are the contact people for these different kinds of things. Because even getting on email lists took a while for me…I'm sure a lot of people who it's not on their radar that something like that even exist anywhere, especially probably people coming from abroad would have like no idea about a lot of resources.

When asked if her PI had given her any information about resources, she replied,

> NO!  And you know it's not like she doesn't care. She probably just has no idea about what resources are out there. So, I just like kind of asked other postdocs that I sort of randomly met or asked grad students if they knew postdocs who knew about things like this. So, it was all like word of mouth, which as you can imagine, it's probably not super effective.

When asked if Maya thought the role of a mentor was to help prepare postdocs to become research scientists or how to prepare them for various career pathways, she stated,

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Yeah, um, I think that they should happen together, but I think that most postdoc mentors primarily look at their role as getting you in [their lab] to do research. Okay, and that your job for them when you're a postdoc is to just do research primarily. I think that there are some mentors, like mine, who are very supportive and realize that their postdocs and their grad students maybe, need some other time to do different things to support their professional development and that's not just doing research. But those people I feel, are more like the exception than the rule. That being said I don't necessarily think it is a postdoc advisers' job to prepare you, but I think that they should be willing to support you to do some of those other things. Meaning they should allow you to make time in your schedule to go to workshops that you might need or make it possible for you to do some kind of professional development internship or something like that because especially for people who don't want to be RO1 PIs you have to, because there's no other way to get those skills.

Personally, Maya believes that a postdoc or doctoral student should "do what you have to do to find the resources." She doesn't think that it's anyone else's job to get you a job, but does think that some postdocs and especially graduate students "wish that they had more hand-holding" in the job search process, but Maya believes that it's more the role of the institution through its career services office, postdoc office, or some other department to help students and postdocs get connected to those resources and then you, the student or postdoc, have to decide to go use and access those resources. Maya also states, "That's kind of how I look at it. Anyway, so lots of people probably wouldn't like that it's all on them. Yeah, but I think that realistically that's just you know what it is."

**Feeling Confident About the Future**

Maya feels positive in terms of the direction her career is going and that she will be able to find a tenure-track faculty position, even though she knows there is a shortage of positions and a lot of competition for those that are open.

> Yeah, so I'm not too worried. I think it helps that I'm a little bit flexible…If I don't get this job that I'm currently interviewing for my world will not be like falling apart or something because I feel confident that I'll get a job doing something else that I like. For example, I'm going to be applying for some positions here [MLU] doing teaching work. And I feel like I could be really happy doing that. If I don't get any of those jobs that I'm currently applying for then I'll look into doing some kind of combination teaching and research position where maybe I would be doing some kind of instructing one semester but doing research other semesters still like under the umbrella of someone else. So, I think it helps for me that I am not so set on one single dream that I feel really anxious about it. It also helps that my spouse has a stable job, right? I'm not worried about like just paying the bills. Which obviously is what is a real concern for some people when they're looking for jobs; they have to find a job that's going to work financially in that way.

Maya also reiterates that because of her postdoc experience, she now feels confident enough in her own skills and abilities at this point that she is going to be able to find a job that she likes doing and that is meaningful to her. Maya believes it's more than possible to find a job that will "fit" and allow her to use the skills she's developed. With regards to her future career, Maya says, "I feel mostly at peace with it, but at the same time, like of course, I have to do my part to like make it happen."

Maya believes having a supportive spouse has been one of the biggest factors in her current success.  In addition, Maya states having mentors, throughout undergrad, grad school and the postdoc has been helpful.  And finally, having an environment and support of family has been helpful in keeping her interest in her field and academia.  Maya closes our final interview with,

> I really feel like it starts at the beginning. Like if you're lucky enough that you've got two supportive parents that are like not only, you know supporting you as a person but just encouraging your goals, that makes a huge difference in your own confidence. I think from the very beginning but yeah being able to then also find those mentors along the way. I feel like I've been really fortunate in a lot of ways to find people who have been supportive.  And kind of lucky, you know. Just not everyone finds other people and so I feel really lucky that I have. Because if you don't sometimes it's hard to build that confidence in yourself. And so that makes a big difference.

# CHAPTER 8 - SUMMARY AND DISCUSSION

This final chapter describes current postdoc's insights into their educational and scientific experiences in relation to their careers by summarizing the study findings and comparing these findings to the current literature. Table 5 provides participant information, including demographic information and background information about why they chose to participate in a postdoc position. Following the table, this discussion addresses each of the two research questions highlighting the common themes found from across the participants' experiences. Theoretical and practical implications of this study are presented, with recommendations for follow-up based on insights from this study, suggestions for future research, and a final summary.

| Alias | Age | Nationality | Degree | Year Conferred | Time in Postdoc (Status) | Career Goal | Why Postdoc |
|---|---|---|---|---|---|---|---|
| The Trapped Scientist (Jane) | 38 | China | Plant Genetics & Genomics | 2011 | 1st Postdoc, 4 years, <br><br> 2nd Postdoc, 2.5 years | Open to any position | 1st postdoc – forced to take while waiting for desired position; no other option; <br><br> 2nd Postdoc - Additional training |
| The Humanitarian (Sunetra) | 27 | India | Microbiology | 2018 | 1st Postdoc, 3 months | Global Public Health | Forced to take postdoc while waiting for desired position; completing research in same lab; no other option |
| The Steel Town Scientist (Bridget) | 28 | U. S. | Plant Biology | 2018 | 1st Postdoc, 6 months | Non-academic research or manager position in government, industry or non-profit | Additional training |
| A Scientist, a Teacher, and a Mother (Maya) | 31 | U. S. | Cellular Microbiology | 2016 | 1st Postdoc, 2 years | Tenure-track faculty position | Expected in aspired career path |

**Table 5. Participant Information**

## Research Question 1

The first research question I examined was "What is the experience like to transition into and out of postdoctoral training? Participants described their reasons for transitioning into their respective postdoc positions and also their experience trying to transition out of those positions into their preferred jobs.

### Transitioning into the Postdoc

In this study, three themes did emerge across the participant narratives regarding their experience transitioning into the postdoc: 1) participants transitioned into postdoctoral training to acquire research experience, access about faculty positions, and test whether being a faculty member is right for them; 2) participants took postdoc positions immediately after graduation as a holding bay because no other job or work was available to them in their chosen career path; 3) international scholars had challenges due to visa issues therefore transitioned into postdoc positions in order to buy more time to deal with immigration issues.

Jane was the only participant who transitioned into two postdoctoral positions. She transitioned into the first postdoc, even though she wanted to leave academia after completing her doctoral studies. Jane stated she was unable to move into a different position due to lack of career direction and her status as an international scholar because her visa limited her ability to work in industry. Jane stayed in this first postdoc position for four and half years, and although she applied to industry jobs, she stated visa issues limited her mobility out of the academy again. Therefore, Jane took a second postdoc position at a land-grant university in the Midwest (MLU) to buy time while applying for U.S. citizenship and to test out whether she indeed wants to leave academia.

Sunetra transitioned into the postdoc position at MLU with the same PI and in the same department she did her doctoral education. She planned on being in the position for six months while she deals with visa issues and finds a job doing global public health work. Bridget took the postdoc position at MLU partly because she said she defended her dissertation early and because she wasn't ready to go on the job market due to timing and lack of what she felt was a publication record. Maya took the MLU postdoc position in order to "get a little more research and teaching experience" while she looks for a job at a small liberal arts college.

**Using postdoctoral training to acquire more research experience and assess life as faculty member.** Two of the four participants went into the postdoc to develop new skills. Bridget, in particular, wanted to go into industry, and her experience helps support research that suggests doctoral recipients go into postdoc positions to specifically development new research techniques (Sauermann & Roach, 2016). She stated in her interview, "I wanted to learn some of the new sexy techniques to be able to say I can do transcriptomics or proteomics or any of those 'omics.'"

Jane and Maya transitioned into postdoc positions in order to test "being a faculty member." Jane specifically took the second postdoc position at MLU to help her determine if she wanted to pursue "the life of an assistant professor" or go into industry. Maya knew she wanted to be a tenure-track faculty member from the start of her doctoral education. She took the postdoc position in order to "get a little more research and teaching experience." Maya described how the postdoc at MLU allowed her to validate her goals and ideas about being a faculty member by giving her a chance to prove to herself, she could fulfill the necessary tasks required of a junior faculty member. These two participant experiences confirm previous research from Huang, Cantwell, and Taylor (2016), Sauermann and Roach (2016), and Scaffidi

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and Berman (2011) and van der Weijden, et. al. (2016) that postdoctoral training can help doctoral recipients acquire research experience, access information and mentorship about faculty positions, and test whether being a faculty member is right for them.

**Using the postdoc as a holding bay until a "real job" becomes available.** Jane, Bridget, and Sunetra went immediately into postdoc positions after completing their doctoral degrees because no other work was available, and they believed they were not ready to enter into their desired career paths post-graduation. All three stated, in various terms, that taking a postdoc position was the easiest thing to do, rather than try and look for a job. Previous research by Cantwell and Taylor (2015), Chen, McAlpine and Amundsen (2015), Scaffidi and Berman (2011) and Zumeta (1985) supports the finding that recent doctoral recipients take postdoc positions immediately after graduation because no other work is available for them.

**International scholars need to buy time to deal with immigration issues.** As international scholars, visa issues impacted Sunetra's and Jane's ability to leave academia. Jane also specifically stated visa issues impacted her ability to leave academia after completing the Ph.D., which was also the main reason she transitioned into a second postdoc. Research from Nerad and Cerny (1999) and Yang and Webber (2015) has shown that some international doctoral recipients wind up transitioning out of their doctoral programs and into postdoc positions as a holding bay until their visa issues are resolved. Both Jane and Sunetra's experiences being on temporary visas provide examples to support this phenomenon.

In addition, Jane's experience also supports research from Mishagnia (2009) showing the lack of job opportunities hinder postdocs ability to find permanent positions resulting in some postdocs taking a second postdoc and ultimately were more likely to leave science. Jane's experience also provides insight into research showing the average length of time spent in

postdocs seems to be increasing, however, the data is not definitive (National Academies, 2014, p.1).

**Transitioning Out of the Postdoc**

Before summarizing the findings on how the postdocs in this study attempted to transition out of the postdoc and compare these experiences to current research, I believe it's important to highlight the status of the study participants at MLU at the conclusion of our interviews. As of May 2019, Jane was still in her second postdoc position at MLU since her U.S. citizenship application was still pending. Jane is still not sure if she wanted to become a faculty member or go into industry but because of her application status, feels her only option is to continue looking for a tenure-track faculty position in academia. Sunetra, also a non-U.S. citizen, was transitioning from the postdoc position into a fellowship position in global public health at an academic institution, while also applying for U.S. Citizenship. Bridget was still in her first postdoc position but was looking to transition into a job in industry in the Midwest closer to her family. Maya was offered a position at her undergraduate alma mater, a small liberal arts institution in the Midwest, where she planned on starting in the fall as a tenure-track faculty member in a biological sciences department.

Three themes emerged across the participant narratives regarding their experience transitioning out of their respective postdoc positions: 1) visa issues *still limit* international postdocs ability to transition out of the postdoc; 2) postdocs wanting to transition into careers *outside the academy* (e.g. into the public or private sectors) had a harder time transitioning due to lack of resources and; 3) postdocs who transitioned out of the postdoc asserted their agency and utilized an identity-trajectory framework to achieve their goals.

**Visa issues continue to limit international postdocs ability to transition out of the postdoc.** This study highlights the additional difficulties for international scholars transitioning out of the postdoc. Both Jane and Sunetra's narratives provide firsthand experiences of the added challenge of having to think about visa and citizenship issues in addition to planning their defense and graduating in order to transition out of their postdocs. Previous research by Cantwell (2009, 2011b) and Cantwell and Lee (2010) highlights the limited mobility international scholars encounter when transitioning out of the postdoc in the U.S. This study adds to their research by providing a closer and more nuanced view of how current postdocs navigate challenges in that process and assert their agency in trying to manage the challenges they encounter.

Cantwell (2009) found that postdoc advancement in their careers is constrained by visa issues which resulted in individuals in the life sciences having to stay in their postdocs for extended periods of time in the hope of securing U.S. citizenship. Jane's experience highlights how, even when trying to use their agency to move, postdocs are met with constant challenges that result in them ultimately giving up and staying in academia. Sunetra's experience highlights the additional hurdles in transitioning out of the postdoc because the work she wants to do requires, her to be a U.S. citizen in order to be effective. In addition, Jane and Sunetra spoke about the fear of losing their visa throughout their doctoral education and in the postdoc, which would require them to be deported back to their home country. This was another finding from this study supported by previous research by Cantwell & Lee (2010).

**Postdocs wanting a career outside the academy had a harder time transitioning due to lack of resources.** Findings from this study suggest that postdocs who want to work outside the academy had a harder time transitioning out of the postdoc due to lack of career options, lack

of networks, and lack of planning.  Both Sunetra and Bridget talked at length about the difficulty they encountered finding individuals they could talk to about careers outside of academia.  This led Bridget to participate in programs like the Broadening Experiences in Scientific Training (BEST) Program, which she said helped her prepare for industry.  Even with that experience, Bridget still talked about the lack of individual connections in her department to help her build a network to find opportunities that might lead to jobs and a career in industry.  Much of the support she (and Sunetra) received to aid them in their career search and planning was from organizations outside the department.  Findings from this study support reports and research by the Council of Graduate Schools (Denecke, Feaster, & Stone, 2017; CGS, 2012) voicing concerns for the academy's need to develop more appropriate and comprehensive programs to better prepare students and postdocs for careers both inside and outside academia.  This study in particular adds to the growing body of literature on postdocs by asserting the need to support postdocs in pursuing careers *outside of the academy*, as well as encouraging them to continue into tenure-track positions.

Sunetra and Bridget are examples of the need for support for postdocs who are pursuing careers in industry.  Sunetra spoke at length about her challenges finding inspiration for a career path outside of academia and Bridget also transitioned into the postdoc knowing she was going to pursue a career in industry.  Much of the prior literature on postdocs focuses on the need to support and keep under-represented minorities, including women, in the academy, and specifically tenure-track positions (Dean & Koster, 2014; Gibbs, Basson, Xierali, & Broniatowkski, 2016; Griffin, Gibbs, Bennett, & Robinson, 2015; Huang, 2015; Martinez, et al., 2007); very little of this research focuses on supporting under-represented minorities (i.e. women

in science) going into industry.  This is especially critical since *long-term, more than half* (57%) *of all doctoral recipients wind up employed outside of higher education* (see figure 1).

      **Postdocs who transitioned out of the postdoc asserted their agency and utilized an identity-trajectory framework to achieve their goals.**  In previous research on postdocs, agency referred to "individuals' motivations, intentions and efforts 'to plan, to construct a way forward given constraints (whether expected or unexpected)' (McAlpine, Amundsen, Turner, 2014, p. 958) while recognizing the influence of structural/systematic factors beyond their control" (Chen, McAlpine & Amundsen, 2015, p. 1085).   Agency was a finding in this study that was an especially important realization made by all the participants with regards to getting career and professional development.

      In this study, agency has two meanings.  The first meaning refers to the planning and goal setting a postdoc engages in for the purpose of career planning and also includes the behaviors and actions they take to achieve those goals (McAlpine &Turner, 2012). Participants in this study evaluated what their job interest was within their given discipline structures (e.g. tenure-track faculty vs. job in industry) and what future actions they would need to engage in to realize those choices given their individual and personal contexts (i.e. what job they were interested in attaining, and how their work or personal life would be impacted by making that decision).

      The second meaning refers to participants efforts to advocate for themselves with their mentors, advisors, or PIs and asking for assistance with their professional development and career preparation needs, regardless if those individuals ultimately were able to help.  For instance, Sunetra and Maya both indicated to their respective graduate advisors and postdoc PIs their respective career pathways (non-academic for Sunetra, tenure-track at a teaching college for Maya).  Both participants were agentive in managing their time, seeking out help from their

faculty on research and/or teaching assignments, asking for time to deal with personal/family issues as they arose, asking for time to go to workshops and programs outside of lab time, etc. They both made their intentions clear to their faculty from the start of their training that they knew they could not get "everything" from their advisor/lab setting so made sure to have conversations with their faculty early in their training to make sure their career and professional needs would be met.

Both Maya and Sunetra's experiences in asserting their agency, also highlight the role that advisors, mentors, and PIs can play in helping individuals who have a clear idea about their career aspirations to transition out of the postdoc position by creating supportive environments and opportunities to show what they have learned. Previous research has found that faculty influence has a positive role in helping to socialize female postdocs into the academy and promote their retention (Griffin, Gibbs, Bennett & Robinson, 2015). Research by Giffin et. al. (2015) found that female and URM scholars' interest in faculty careers, especially in the biomedical sciences, seemed to decrease as their training progressed (Gibbs, Basson, Xierali, & Broniatowkski, 2016) as in the case of Jane and Bridget.

All the participants also talked about the importance of "knowing what you want" and "making sure you ask for what you need." I believe participants were speaking to what researchers call having an "identity-trajectory" reasoning. This reasoning merged inductively in this study, after reviewing findings from each participants' narratives and returning to previous research on the postdoctoral experience (Chen, McAlpine, & Amundsen, 2015, p. 1084).

Previous research has used the identity-trajectory framework in studies that have situated early career scientists experience within their broader lived experience (Billett, 2009; Chen, McAlpine,& Amundsen, 2015; McAlpine, 2012; McAlpine & Amundsen, 2011; McAlpine,

Amundsen, & Turner, 2014; McAlpine, & Emmioğlu, 2014; McAlpine, & Turner, 2012).

McAlpine's research in particular (2013) has helped to show how the personal aspects of

scientists' lives play a role in their academic experiences and decisions regarding careers and

shows a relationship and interdependence between an individual's personal life (e.g. children,

financial situations) and its impact on working life (Chen, McAlpine, & Amundsen, 2015).  For

example, research from McAlpine (2014) found that the emotional support that an early career

researcher received from their family facilitated their pursuit of academic careers, whereas a

family members illness or personal financial difficulties constrained their progress.  Both Maya

and Bridget talked about having the support of their spouses as crucial in helping them make

decisions about what direction to go in their career.  Maya in particular, also spoke about

wanting to have a career where she could balance work and family life, and also made sure to

actively engage with prospective mentors and employers in conversations about family to discern

if they would be supportive of her decision to focus on both her family and career.

Identity-trajectory is defined by three broad strands of work activity: *intellectual*,

*networking*, and *institutional* (Chen, McAlpine, & Amundsen, 2015).  In past research, the

*intellectual* strand has referred to "past and continuing contributions to one's disciplinary

specialism" such as writing, publishing, and conducting research in the lab (Chen, McAlpine, &

Amundsen, 2015, p. 1084).   In this study, the intellectual strand also includes developing

teaching skills through professional development programs and putting that knowledge into

practice by teaching courses, developing new research techniques that could be used in any type

of lab setting, and expanding one's knowledge of future areas of research.  Similar to previous

studies, it also leaves a trail of artifacts, which in this study was in the form of CVs, research

statements, teaching statements, and dissertations.  The *networking* strand primarily refers to

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relationships that individual's develop through research collaboration and membership in disciplinary organizations (Chen, McAlpine, & Amundsen, 2015, p. 1084). In this study *networking* also includes inter-personal relationships built between participants and individuals they connected with during internships they participated in (Bridgit), scholars they connected with on social media (Sunetra) and past advisors and mentors that participants stayed in contact with over the years (Maya). The *institutional* strand is the context within which the *intellectual* and *networking activities* occur in and influences how postdocs engage in those activities (Chen, McAlpine, & Amundsen, 2015; Horta, 2009; Micoli, 2005; Su, 2013). The institutional environment includes the ability to access resources, such as funding opportunities needed in order to fulfill those intellectual and networking activities to advance in a career. For example, the lack of funding for conference attendance has been shown to hinder the development of networks for postdocs in the past research (Micoli, 2005; Su, 2013).

Sunetra and Maya were the two postdocs from this study who were able to transition out of the postdoc. Both participants, talked about knowing exactly what types of careers they wanted to pursue and how their respective PI and mentor were able to help them accomplish their goals. Sunetra knew she wasn't going into a tenure track faculty position when starting graduate school and when looking for a doctoral program, made sure to communicate that preference to prospective PIs and labs she interviewed in. Maya knew she might want to teach in the academy or possibly work in industry. She made sure to participate in internships that would help her gauge her interest in those two areas and when she decided to pursue a tenure-track career, talked with her doctoral advisor and postdoc mentor about her desire to pursue more teaching opportunities and develop instructional skills. Both women asserted their agency in order to pursue an identity-trajectory.

**Summary of Findings Related to Question 1**

The first research question I examined with this study was "what is the experience like to transition into and out of postdoctoral training?" Participants described their reasons for transitioning into their respective postdoc positions and also their experience trying to transition out of those experiences and into their preferred jobs. Findings from this study help to identify what it is like to transition into and out of a postdoc position for a small subset of international scholars and women in the biological sciences. This study found that participants transitioned into postdoctoral training to 1) acquire research experience, access about faculty positions, and test whether being a faculty member is right for them; 2)took postdoc positions immediately after completing their doctoral degrees as a holding bay because no other job or work was available to them in their chosen career path; 3) international scholars had challenges due to visa issues therefore transitioned into postdoc positions in order to buy more time to deal with immigration issues.

This study also found that 1) for international postdocs transitioning out of the postdoc, visa issues still limited their ability to find jobs, 2) postdocs wanting to transition to careers outside the academy had a harder time transitioning due to lack of resources and, 3) postdocs who transitioned out of the postdoc asserted their agency and utilized an identity-trajectory framework to achieve their goals.

**Research Question 2**

The second research question I examined was "How do postdocs interpret their education and training experiences, and the decisions they made about their career during that training?" All participants described their relationship with their advisors, mentors, and PIs during their doctoral education and postdoctoral training. Each participant also talked about how the

relationship with various individuals influenced how they thought about their career trajectory. In addition, two participants also provided their experience with undergraduate advisors. Based on participant's interviews, three themes emerged that illustrate how participants interpreted those experiences: 1) faculty can only provide career advice on faculty careers; 2) faculty are role-models for work-life balance, especially those with families; 3) postdocs must look outside their department for career support, especially those looking for careers outside academia.

**Faculty can only provide career advice on faculty careers.** Previous research and various reports have identified issues and concerns dealing with the career and professional development of postdocs including concerns with inadequate mentoring and advising (Denecke, Feaster, & Stone, 2017; CGS, 2012; Scaffidi & Berman, 2011; ), inadequate training for a variety of careers (Allum, Kent, McCarthy, 2014; CGS 2012; Gibbs, & Griffin, 2013; NAS-NAE-IOM, 2014) and issues transitioning from academic into non-academic jobs (Lin & Chiu, 2016). In addition, some research has suggested that faculty have limited information and experience on how to mentor or advise individuals for multiple careers and some even lack buy-in and support for postdocs to participate in professional development (Denecke, Feaster & Stone, 2017; Scaffidi & Berman, 2011).

This study's findings are in line with previous research and adds to the body of literature that states faculty are not able to provide career and professional development advice outside of tenure-track careers, nor should they be expected to. For example, Jane specifically states that there are challenges within the current system of doctoral education that make it difficult to mentor students around these issues and Bridget's experience provides additional insight and adds to the narrative that faculty can't mentor or advise postdocs on careers outside of the academy. Findings from previous research (Fenker, 1977) has shown that incentives for faculty

are focused around research and grant-making and that it's hard to incentivize faculty to help

postdocs transition into other careers that they don't have any knowledge or experience in

(Hund, 2018).  While findings from this study are not suggesting faculty shouldn't try to help

give postdocs career advice, it does make the case that it is a difficult process to help manage.

Even the two participants, Sunetra and Maya, who talked about feeling supported by their PI,

related that they both still looked outside their departments for additional support and mentoring

on their career.  Maya, in particular, believed it was not the role of a PI with regards to

postdoctoral training, to focus on career and professional development, but it was within their

scope of influence *to provide postdocs with space and time to explore other careers and options*.

**Faculty are role-models for work-life balance, especially those with families.**

Women constitute approximately 45% of the postdoctoral fellows in the biomedical sciences

(NSF, 2018), yet they are still more likely than men to quit at the postdoctoral stage and less

likely to transition into a PI position (National Academies, 2007).  Previous research (Huang,

2015) has found that there are three main challenges facing postdoctoral women:  1) career-life

balance, 2) lack of mentoring and support by other female scientist, and 3) lack of childcare

and/or conflicts between work and family obligations.  All three of those challenges were present

in this study and faced by at least one or more of the participants.  However, findings from this

study can be used to identify how some postdoctoral women have learned to deal with these

issues and adds to the body of literature by providing a more nuanced view of how some

postdocs interpret an academic life through the experience with their advisors, mentors and PIs.

For example, Bridget stated she learned from observing her postdoc PI that she did not

want to follow in her footsteps to become a faculty member.  While her PI was a successful

woman in science, she saw that it was due to making family sacrifices (e.g. spending less time

with them) and being in the lab all the time.  These were sacrifices Bridget was not willing to make for herself, so although, her PI was supportive and a good role model, Bridget still decided not to follow in her footsteps.  This desire to for a work-life balance is also present in Maya's story.

Maya said she was aware that the academic science field, especially for tenure-track faculty, could be hostile towards women with children.  She believed having mentors who supported her decision to have a family and make them a priority, was also helpful for her and important to her success. But Maya's experience also highlights how faculty can be supportive of postdocs even when they may share different identities.  Both Maya's postdoc PI and her graduate advisor highlight the various ways faculty can support postdocs in positive ways, even when they don't share the same experiences.  Jane and Sunetra also talked about starting to think about work-life balance as they progressed through their experiences, but while not as central as Maya and Bridget's, it still helps to highlight the findings from this study and add to the research underscoring the importance of work-life balance for women.

**Postdocs must look outside of their department for support.**   Research by Williams-Tolliver (2010) has found that perceived competition between success as a graduate student and family responsibilities, the impact of graduate study on emotional/physical health in female students, and the existence of an inverse relationship between perceived stress and lack of marital/social support combine with the resilience and a desire to complete their studies, significantly impacts the experience of women in science.  Findings from this study highlight each of these aspects of the women's experience in-depth.

Jane and Bridget both talked about the perceived competition in their departments and to find support both went outside their department:  Jane talked with other international postdoc

friends to find support and Bridget participated in professional development programs. Jane and Sunetra both talked about the impact their doctoral experiences caused in terms of stress and negative emotional health. Bridget and Maya also added how having supportive spouses supported them in completing their studies and during times of duress. In some form or fashion all the participants talked about the need for both "resilience" and the need for postdocs and students to think early about what type of career they want and become self-directed in a way that will allow them to assert themselves and advocate for the resources they need to be successful. All four participants also acknowledged that postdocs, in general, need to go outside the department to both network and get professional development help, especially if they are choosing a career outside of the traditional academic arena. Further research is needed on a broader scale that highlight some of the ways that postdocs have been able to transition out of academia and which programs and practices have been shown to be successful in helping them.

## Summary of Findings Related to Question 2

The second research question I examined was "How do postdocs interpret their education and training experiences, and the decisions they made about their career during that training?" All the participants described how the type of advising and mentoring they received during their doctoral and postdoctoral training impacted their experiences. Three themes emerged that illustrated how participants described the type of career support they got as postdocs: 1) faculty could only provide career advice on faculty careers; 2) faculty were viewed as role-models for work-life balance and; 3) postdocs must look outside their department for career support, especially those looking for careers outside academia.

In this study, faculty were not seen as the best or only source of career support. However, participants did state that faculty can provide space and time for postdocs to explore

other careers outside of the academy, especially for those who do not want to pursue a tenure-track faculty position. However, that might mean re-defining the role of a postdoc position and is beyond the scope of this project.

## Implications

This study with only four participants cannot be generalized to the larger postdoc population, this study can provide valuable insights into how current postdocs are accessing career and professional development resources in order to transition into the next step in their career. Since there are no other studies that specifically focus on postdoc transitions outside the academy, this study has the potential to have practical and theoretical importance for faculty (i.e. advisors, mentors, and PIs), institutions, and postdocs themselves.

### Implications for Faculty

Faculty are role models and important to the training of new scientists and developing the scientific workforce. Women constitute approximately 45% of the postdoctoral fellows in the biomedical sciences (NSF, 2018), yet they are still more likely than men to quit at the postdoc to principal investigator transition (National Academies, 2007). The inability to establish satisfaction between work and life, especially those with family (or the desire to start a family) have been cited as to why women leave (Huang, 2015; Mallinckrodt & Leong, 1992; Martinez, et. al., 2007; Monosson, 2008; Williams-Tolliver, S. D., 2010).

Findings from this study can provide examples for faculty on how to better support postdocs as they transition into and out of their labs by: 1) being supportive with postdocs (and prospective doctoral students) upfront about supporting careers outside of academia; 2) providing postdocs (and graduate students) with time and space to focus on professional development and expand their networks; 3) by role modeling good work-life balance for

participants, especially if faculty have families and/or children of their own, and 4) being honest with postdocs and graduate students about what type of advice or resources faculty can and can't provide them, but also encourage postdocs and graduate students to think about their career before their training ends and to participate in professional development programs early.

**Implications for institutions**

This study, as well as previous research, has helped to highlight the inadequate training and preparation postdocs get preparing for a variety of careers outside the academy (Allum, Kent, McCarthy, 2014; CGS 2012; Gibbs, & Griffin, 2013; NAS-NAE-IOM, 2014), and the issues postdocs have transitioning from academic into non-academic jobs (Lin & Chiu, 2016). Institutions have started to address some of these issues through programs such as the Broadening Experiences in Scientific Training (BEST) and the Plant Biotechnology for Health and Sustainability Graduate Training Program (PBHS), but programs are limited to primarily graduate students and to a small number of institutions. Faculty advisors, mentors and PIs cannot be the sole provider of career and professional development for postdocs; therefore, institutions should find ways of implementing these programs on their campus and providing them to postdocs. In addition, findings from this study suggest that the focus of some of these programs should also be on helping postdocs (and graduate students) translate skills they develop in the lab and in graduate education into skills that can be utilized in other sectors such as industry and public health. In the career and professional development space, these are called transferable skills and along with helping postdocs learn how to network, would make programs such as BEST and PBHS much more effective at helping individuals transition out of postdoctoral training.

**Implications for Postdocs**

One of the underlying themes of this study was the role of *passion* for science, and specifically *a career in science*. Participants talked frequently about how much they enjoyed the research they did and how it helped to influence them along their respective trajectories. I believe this is especially true for those who have been affected by adverse events out of anyone's real direct control, such as Jane and Sunetra, who had to deal with visa issues, and Bridget who dealt with personal crises but still managed to successfully complete her undergraduate studies with honors. Researchers have defined passion in a number of ways including:

- an enduring, positive, internalized state of contentment resulting from favorable cognitive and affective work appraisals (Zigarmi, Houson, Diehl, and Witt's (2010),

- work passion in terms of time and energy investments focusing on activities that are enjoyed and considered important (Vallerand et al., 2003)

- vigorous immersion in rewarding activities that build self-efficacy (Maslach & Leiter, 2008)

- an individual's emotional and persistent state of desire on the basis of cognitive and affective work appraisals, which results in consistent work intentions and behaviors. These consistent intentions and behaviors include everything from being persistent on completing work tasks to demonstrating organizational citizenship behaviors, and even taking initiative to solve problems at work. (Perrewé, Hochwarter, Ferris, McAllister, & Harris, 2014)

I believe any of these definitions could be used to describe participants in this study and their respective journeys. One implication to the broader postdoc population, is that postdocs should be warry of developing tunnel vision (O'Keefe, Dweck, & Walton, 2018) or listening to advice from advisors and mentors that say to just focus on research. Postdocs can learn from participants in this study who followed their interest in science, without thinking long term about a career, and saw how they found themselves struggling and still searching, even well into postdoctoral training. Postdocs should learn that just setting their sights on just doing the

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research (i.e. following their passion), may find their careers lagging when difficulties arise or when the end of training comes.

Postdocs, and graduate students in general, should be encouraged to find and follow their passion, especially in science and in pursuit of a career in science. However, they should not be trained or advised to think only about conducting research, and only pursue a career as a tenure-track faculty member. This type of advice may lead postdocs "to put all their eggs in one basket but then to drop the basket when it becomes difficult to carry" (O'Keefe, Dweck, & Walton, 2018, pg. 1653). If more women in science, and other under-represented students, are to be encouraged and supported to pursue careers in science, more information about career and professional development should be provided, including career pathways besides tenure-track faculty positions.

## Future Research

Based on the implications of this study, the following are recommendations for future research:

1. Replicate this study with a different profile of postdocs, such as those randomly selected from institutions, rather than purposefully selected, and in larger numbers.

2. Conduct a study on the impact of programs such as BEST and PBHS to see if and how they are helping postdocs and graduate students transition into non-academic careers.

3. Conduct a study on faculty who have worked on developing programs and practices to support non-academic career pursuits of their trainees.

4. Conduct a study with postdocs who successfully transitioned into non-academic careers and how they did it. This study could also specifically focus on what it means to "follow your passion in science," its resulting outcomes, and if and how individuals were able to find satisfaction in a life outside of an academic setting, especially since the purpose of doctoral education in the past has been traditionally spent preparing future scholars for a faculty career.

**Discussion Summary**

In this narrative inquiry, four postdocs shared their experiences transitioning into and out of the postdoc and shared their experiences with advising, mentoring, professional development and other types of social support. These postdocs reflected on their experiences, and how some advisors and mentors helped them advance to their goals throughout their doctoral and postdoctoral training. For others, they learned how to be and not to be a mentor and how to support students. Findings from this study suggest that participants used their individual agencies to move through their experiences and learned to develop their own notions of success and what work-life balance looks like for them.

Although there were only four participants, this was one of the first studies to provide a nuanced, rich insight into the lived experience of postdoctoral scholars and their transition into and out of the postdoc. In an area with so much focus on developing the future of the scientific workforce this is one of the few studies focused on understanding postdoc career motivations and how postdocs find and use information to make decisions about their careers. More importantly, it highlights how the relationship between advisors and mentors impacts the effort postdocs must put into finding and accessing career and professional development resources. Results from this study can be used to directly develop and enhance programs and strategies that institutions are

developing to help not only postdocs, but graduate students in general, prepare for careers

outside the academy or to develop alternative paths to tenure-track faculty positions.

**APPENDICES**

# Appendix A:  Survey Questions

Questions below will be asked as part of the process to identify participants to interview.

## Current Postdoctoral Position

1.  What is your current institution?
    - Michigan State University
    - Michigan Technological University
    - University of Michigan
    - Wayne State University
    - Western Michigan University
    - Other:


2.  What is the primary field of your terminal degree?
    - Biological, agricultural and environmental life sciences
    - Business Management/Administration
    - Communication
    - Computer & Information Sciences
    - Education
    - Engineering
    - Humanities
    - Life Sciences
    - Mathematics
    - Physical Sciences
    - Psychology
    - Social Sciences
    - Field not listed (e.g. Social Work)_____

3.  In what year was your PhD (or other terminal degree, eg. EdD, DFA, JD, MD, PsyD, etc.) conferred?

4.  Was your PhD (or other terminal degree, eg. EdD, DFA, JD, MD, PsyD, etc.) conferred by a U.S. based institution?
    - Yes
    - No

5.  If the answer is "No", from what country was your degree conferred?


6.  Is this your first postdoctoral position?
    - Yes
    - No

7.  When did your current postdoctoral appointment begin and when does it end? (Month/Day/Year)

8.  Please indicate which are the reasons below for accepting this postdoctoral appointment:
    - additional training in Ph.D. field
    - additional training in a different field
    - work with a specific person/in a specific place
    - no other option
    - expected in aspired career path
    - forced to take postdoc while waiting for desired permanent position to become available
    - waiting for a better job market
    - other reason. (please describe)

9.  Which best describes your primary long-term career goal as of now?
    - Don't know/Not Sure
    - Tenure track faculty position
    - Research position in academic setting, not tenure track
    - Research position in industry or business
    - Research position in government, national laboratory, or nonprofit
    - Administrator, manager, or professional in an academic setting
    - Administrator, manager, or professional in industry or business
    - Administrator, manager, or professional in government, national laboratory, or non-profit
    - Self-employed, work independently
    - Other, please specify

10. Do you participate in any professional development and/or networking activities?  Please check all that apply?
    - Postdoctoral Association on campus
    - Individual Development Plan
    - College Teaching Course/Training
    - Professional Develop workshops (CV, Resume, Cover Letter writing)
    - Networking Events
    - Social Events
    - None of the above
    - Other (please specify)

11. Please indicate the extent to which you agree or disagree with the following statement:
    Overall, my postdoctoral position has prepared me to fulfill my current career goals.
    - Strongly Agree
    - Agree
    - Neither Agree nor Disagree
    - Disagree
    - Strongly Disagree

12. Please indicate the extent to which you agree or disagree with the following statement: Overall, I would rate my postdoctoral experience positively.

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

13. If you could go back in time and start your graduate career over again, knowing what you know now, would you change your choice in:
- your current field of study
- your current career goals
- the institutions you attended
- your primary research advisor

14. Is there anything else you would change?

15. Is there anything else you would like to share about your career preparation needs?

16. Is there anything else you would like to share with us about your experience as a postdoctoral scholar at your institution?

**Demographic Information**

17. What is your gender?
- Female
- Male
- Non-binary/ third gender
- Prefer to self-describe _____
- Prefer not to say

18. What is your marital status?
- Single (never married)
- Married, or in a domestic partnership
- Living in a marriage-like status
- Widowed
- Separated
- Divorced

19. What is your year of birth?

20. What is your citizenship status?
- U.S. Citizen

- U.S. Permanent Resident
- International (Foreign National with Temporary Visa)
  - J-1
  - H-1B
  - O-1
  - TN-1
- Other

(If a non-U.S. citizen) Of which country are you a citizen?

21. Are You Hispanic or Latino?
- No, I am not Hispanic or Latino
- Yes, I am Mexican or Chicano
- Yes, I am Puerto Rican
- Yes, I am Cuban
- Yes, I am Other Hispanic or Latino – Specify

22. What is your racial background?
- American Indian or Alaska Native
- Native Hawaiian or other Pacific Islander
- Asian
- Black or African American
- White
- Other : _____

23. Thank you for participating in this survey. Would you be interested in participating in a one-on-one interview to discuss your career and professional development?
- Yes
- No

24. If Yes, please provide your contact information.

Thank you again for your participation.

**Appendix B: Three Series Interview Questions**

Questions below indicate topics to be addressed, and do not reflect exact wording or order in which topics will be addressed.

Stage One: Focused Educational History
- Can you tell me about your background?
    - Additional Prompts (if needed):
        - Where are you from?
        - Where did you grow up?
        - What do your parents do?
- Where did you go to undergrad? Why?
- Can you describe an experience you believe got you interested in this area of research?
    - Additional Prompts (if needed):
        - Did you participate in any kind of activities related to your degree field (e.g. undergrad research, summer research program, etc.)? If so, what was that research experience like?
        - Can you tell me about a story or about an experience that made you realize you wanted to study this further?
- Why did you decide to pursue a doctoral degree?
- What was your relationship like with your doctoral advisor?
    - Can you share a story that describes a typical interaction with your advisor?
- How you describe your general professional and/or career goals?

Stage Two: Postdoctoral Experience

- Is this your first postdoctoral position?
- Did you know about postdoc positions before you applied? Were they a part of your career trajectory?
- Why did you decide to apply to postdoc positions (in general)?
- What was it about THIS postdoc that made you want to apply? Did you apply to others?
- What was the most important reason for accepting THIS postdoctoral appointment?
- Can you share with me what a typical day in your life looks like?
    - Additional Prompts (if needed):
        - If you teach on alternate days, what do those days look like?
- Can you describe to me your experience with your current PI?
    - Additional prompts (if needed):
        - Can you provide recall a story or an incident where you had an interaction with your PI that you think is reflective of your relationship with them?
- What do you think you are learning from this experience as a postdoc?
    - How is what you are learning helping you (or not) understand get ready for a faculty position?
    - Is a faculty position, specifically a tenure-track position, something you are aiming for? If not, why not?
- How would you describe the general resources available to you at to help you in your personal and professional goals?

- Can you describe to me your experience using the individual development plan? Was it helpful? (Ask this question if indicated on survey).
- To what extent has your postdoc experience been helpful to you in helping you make decisions about the direction of your career? Can you share a story that provides an example?
- Did you talk to anyone or utilize any resources outside of the department/lab for professional/career advice? Can you share that experience with me?
- Overall how satisfied are you with the quality of guidance/mentoring provided by your PI?

Stage Three: Reflecting on Meaning

The first part of this interview will be reviewing documents (e.g. CV, Resume, teaching/research statements, etc.) and asking them to guide me through their development and why they highlight what they did in their documents. In addition, I will be asking several questions:

- Looking ahead, how likely is it that you will stay in your chosen research field after you complete your postdoctoral position? What role did this experience play in helping you make this decision?
- Is there anything else you would like to share about your career preparation needs?
- If you could go back in time and start your graduate career over again, knowing what you know now, would you do anything differently?
- Now that you know what the experience is like, what advice would you give someone else about getting a PhD?
-  What advice would you give a current job seeker?
- Is there anything else you would like to share with me about your experience as a postdoctoral scholar at your institution?
- These are all the questions I have for you. Do you have any additional for me?
Thank you again for your participation and your time.

Dear Postdoctoral Scholar,

My name is John Vasquez and I am a 4th year PhD Doctoral Candidate in Higher, Adult, and Lifelong Education at Michigan State University. I am seeking participants for my dissertation, which is under the supervision of Dr. Brendan Cantwell. The purpose of this study is to gain a more in-depth understanding of how postdocs differ in terms of their perceptions of tenure-track faculty careers, their self-appraisal for readiness for a career, and their ability to access and use career resources to help in their decision-making process about future career paths.

Participation in this study is voluntary and involves completing a brief screening survey that will take approximately 7-8 minutes to complete.  If selected, you will then be asked to participate in a three-part interview regarding your career and professional development. There is minimal to no risk associated with participating in this study. The minimal risk is that you may feel mildly uncomfortable due to being asked questions about your future career trajectory, however the benefits could include more clarity on what you want to do in the future. In addition, if selected and you participate in all three interviews, you will be compensated with a $75 electronic Amazon gift card.

In order to participate in this study, you must: (a) have received a doctoral degree in a science or engineering field and (b) be currently employed in a postdoc position.

Should you have any questions prior to or during the research study, you may email me at johnav@msu.edu, or email my academic advisor at brendanc@msu.edu. You may also contact, anonymously if you wish, the Michigan State University's Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or e-mail irb@msu.edu or regular mail at 4000 Collins Rd, Suite 136, Lansing, MI 48910.

This study was approved by Michigan State University's Human Subjects Institutional Review Board Project #00001984 on January 22,2019.

If you are interested in participating in the study, please click the link below to access the pre-survey questionnaire. Your responses will be completely anonymous and confidential.

Study Pre-Survey:  https://tinyurl.com/vasquezpre-survey

Thank you for your time and interest in this study!

Sincerely,
John A. Vasquez
Doctoral Candidate
Michigan State University
Appendix D

**Appendix D: Research Participant Information and Consent Form**

You are being asked to participate in a research study. Researchers are required to provide a consent form to inform you about the research study, to convey that participation is voluntary, to explain risks and benefits of participation, and to empower you to make an informed decision. You should feel free to ask the researchers any questions you may have.

| | |
|---|---|
| Study Title: | After the PhD: Perceptions and Resources Used by Postdocs to Make Career Decisions |
| Researcher and Title: | John A. Vasquez, Doctoral Candidate |
| Department and Institution: | Educational Administration, College of Education Michigan State University |
| Address and Contact Information: | 620 Farm Ln, East Lansing, MI 48824 (517) 918-2959 |
| Sponsor: | N/A |

## 1. PURPOSE OF RESEARCH

You are invited to participate in a research study because you are an individual holding a doctoral degree in a science or engineering field and engaged in a temporary period of mentored research and/or scholarly training at Michigan State University.

This study is being conducted by John A. Vasquez, a doctoral candidate in the College of Education at Michigan State University, and his advisor, Brendan J. Cantwell, Associate Professor at Michigan State University. You are being asked to take part in a research study, but before you decide to participate, it is important that you understand why the research is being done and what it will involve. Please read the following information carefully ask the researcher if there is anything that is not clear or if you need more information.

Background Information:
The purpose of this study is to gain a more in-depth understanding of how postdocs differ in terms of their perceptions of tenure-track faculty careers, their self-appraisal for readiness for a career, and their ability to access and use career resources to help in their decision-making process about future career paths. The primary research questions for this study are:

R1: What is the experience like to transition into and out of a postdoc?
R2: How do postdocs interpret their doctoral experience and decisions they made about their career?

## 2. WHAT YOU WILL DO

If you agree to the study, you will be you will be asked to complete a brief pre-survey and then asked to participate in a three-part interview over the course of several days each lasting about 45-60 minutes. During the first two interviews you will be asked questions related to your educational background and experience as a postdoc and how they contributed to your current career plans. In addition, you will be asked questions about your relationship with your advisor

and questions regarding career and professional resources you use. For the final interview, you will be asked to provide professional and/or career related documents (e.g. resume/CV, cover letters, personal or research statements) and ask questions related to your career and professional identity.

## 3. POTENTIAL BENEFITS

There will be no direct benefit to you for your participation in this study, except for possible clarity on your career goals and trajectory. However, I hope that the information obtained from this study may help institutions, including faculty, staff develop programs and strategies to better prepare doctoral recipients and postdocs for multiple types of careers in and outside the professoriate.

## 4. POTENTIAL RISKS *(This is a required element of consent)*

There are no anticipated risks associated with your participation. You may decline to answer any or all questions and you may terminate your involvement at any time if you choose.

## 5. PRIVACY AND CONFIDENTIALITY

For the purposes of this research study, your comments remain anonymous. Every effort will be made by the researcher to preserve your confidentiality. To maintain confidentiality, any notes, interview transcriptions, and any other identifying participant information will be electronically secured on an external hard drive in the personal possession of the researcher. Participant data will be kept confidential except in cases where the researcher is legally obligated to report specific incidents. These incidents include, but may not be limited to, incidents of abuse and suicide risk. In addition, no attempt will be made to contact any participant's advisor, mentor or principal investigator.

## 6. YOUR RIGHTS TO PARTICIPATE, SAY NO, OR WITHDRAW

Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to sign a consent form. After you sign the consent form, you are still free to withdraw at any time and without giving a reason. Withdrawing from this study will not affect the relationship you have, if any, with the researcher. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed.

## 7. COSTS AND COMPENSATION FOR BEING IN THE STUDY

For completing the pre-survey and participating in all three interviews you will be compensated with a $75 gift card to Amazon.com

## 8. CONTACT INFORMATION

If you have questions at any time about this study, or you experience adverse effects as the result of participating in this study, you may contact the researcher whose contact information is provided on the first page. If you have questions regarding your rights as a research participant, or if problems arise which you do not feel you can discuss with the Primary Investigator, please contact the Brendan Cantwell, Ph.D via email brendanc.@msu.edu.

If you have questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may also contact, anonymously if you wish, the Michigan State University's Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or e-mail irb@msu.edu or regular mail at 4000 Collins Rd, Suite 136, Lansing, MI 48910.

## 9. DOCUMENTATION OF INFORMED CONSENT.

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Participant's signature _____ Date _____

Investigator's signature _____ Date _____

## 10. Consent to Audio Record & Transcribe

This study involves the audio recording of your interviews with the researcher. Neither your name nor any other identifying information will be associated with the audio recording or the transcript. Only the researcher will be able to listen to the recordings.

The audio will be transcribed by the researcher and erased once the transcriptions are checked for accuracy. Transcripts of your interview may be reproduced in whole or in part for use in presentations or written products that result from this study. Neither your name nor any other identifying information (such as your voice or picture) will be used in presentations or in written products resulting from the study.

- I agree to allow audiotaping/videotaping of the interview.

☐ Yes ☐ No Initials_____

| Audit Trail: | Story 1 | Story 2 | Possible meaning |
|---|---|---|---|
| **Advisor:** | "He literally stole my authorship by putting someone else that never do anything, a Chinese that he affiliate with in China and put it right in front, and took my authorship." | "So I think that moment when my boss did that to me I just like, "I'm gonna take care of myself." And that's actually a lesson I'm learning…I'm too naïve… a lot of people tell me, 'You need to think about your own benefit. That no one's is gonna put your benefit beyond their own'… At that moment, you realize there's very few people that support you and you are heartbroken." | Faculty, in general, don't care about postdocs. It really depends on each PI personality and how they value postdocs. Some just use the postdoc as a tool to do more research. |
| **Research:** | "I like the lab setting, the science…I really want to stay in the sciences…" | "And I started feeling kind of trapped, you know, with the scientific environment" | "I realized I don't want to do science. however, I want to help train other minorities like me to DO science" |
| **Quality of life:** | ""…it is amazing, as you get older, you see that, that is so true. The more I get older, the more I am like wow, just don't fuss about thing, don't sweat about things, cause they will go and end where they are supposed to…" | "I was okay with not having that much free time. But when I had to put him [my partner] into the equation, I started, I was, that was, even harder. I started feeling that was not the type of life I wanted. I just, I wasn't enjoying it." | "I realized that what's important to me is family. I want time to spend with my family. In industry, it's all about pressure for results to make money for the company. In academia its pressure to publish for tenure. Either way there's pressure. |

**Table 6. Audit Trail – Data Display**

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