Exploring the Mental Health of Biomedical Science Doctoral Students in the Context of Academic Capitalism

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Abstract

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In 2018, Evans et al. called on policymakers and academia to combat the growing concern for graduate students' mental health (Evans et al., 2018) with particular concern regarding biomedical graduate students. Reduced emotional and mental well-being can be impacted by financial status, relationship with one's advisor, work-life balance, length of training period, and anxiety about navigating job opportunities outside of academia among other factors (Evans et al., 2018; Hyun et al., 2006; Mackie & Bates, 2019; Tsai & Muindi, 2016). This study aimed to uncover underlying connections between reduced well-being in biomedical science graduate students and the increasingly dominant paradigm of academic capitalism in higher education. By employing a constructivist grounded theory methodology, I developed theory connecting graduate student well-being and academic capitalism at a large flagship research university (LRU) in the mid-Atlantic region of the east coast. Data analyzed from interviews with students and recent graduates from biomedical science doctoral degree programs at LRU exposed salient concepts and phenomena. Three overarching categories comprise the findings: 1) contextual academic capitalism; 2) students' hesitation to pursue careers in academia; and 3) their dualistic feelings about their doctoral advisors. I present a theory in which academic capitalism plays a role in leading LRU biomedical science doctoral student participants to avoid academic careers as a way of protecting their well-being, to maintain their positive well-being by engaging in scientific research, remaining connected to the application of their work to better the human condition, and maintaining work-life balance and social connections. The implications of this study uncover ways the institution and graduate program can influence self-reported states of well-being as they may relate to factors of academic capitalism.

Keywords: biomedical science, graduate students, doctoral students, well-being, mental health, academic capitalism, grounded theory

Dedication

Starting in October 2023, all twelve operating universities in Gaza were targeted in Israeli attacks, leaving no university standing. I dedicate this body of work to the three university presidents, nearly one hundred deans and professors, and thousands of university students murdered by the Israeli army.

I also dedicate this research to the 14,500–and counting–future university students killed, the 12,000–and counting–wounded future university students, and to the Palestinians who birth future university students who are being murdered at a rate of at least 40 every single day since the war on Gaza began.

You are the embodiment of *sumuud*, and your memory and spirit kept me focused on my dream of a higher education uninhibited by capitalistic forces and accessible to all.

Acknowledgments

It has become clear that this section is among the most difficult to write. I could dedicate dissertation-length pages to the people and places to whom I'm eternally grateful for bringing me to this moment.

I must start by thanking my advisor, Dr. Karen Inkelas. The past four years were difficult, and I could have wallowed in ego-filled deprecation. But Karen isn't that kind of advisor, and I'm so grateful for that. Above all, she pushed my writing skills to a place I'm so proud of today, and she didn't give up on me, no matter how crazy I seemed. *Thank you, Karen.*

Senior Associate Dean Catherine Brighton had the honor of being my boss and my academic dean during this time, and I wouldn't have made it to this point without her. Her support, flexibility, kindness, empathy, and, above all, cheerleading gave me the physical and emotional tools to see this through. *Thank you, Catherine.*

I've said it before, and I'll say it again: I had the best committee. Drs. Amanda Flora and Alan Leffers were the absolute best. Their sense of humor, support, challenging and thought-provoking questions and contributions, thoughtful and attentive editing, persistent checking-in, and constant smiles were outstanding. *Thank you, Alan and Amanda.*

The first words of advice I heard when I started the doctoral program were to find myself a writing group, and boy, did I do that! I found myself a "bulldog" Jenny and a "bulldozer" Bern, without whom my overthinking, perfectionist, overanalyzing, and second-guessing self would still be writing the introduction. They reminded me daily that "a good dissertation is a finished dissertation." I'm sure they are just as grateful for all my saga-length midnight texts, weekly crying sessions, and "I pulled an all-nighter" irrational meltdowns. If I had to do grad school all over again (again) I wouldn't change a thing about the friends I made. You were the best part of this whole thing. *Thank you, Jenny and Bern.*

I started grad school in the fall of 2020 as I desperately clung to the simpler life the pandemic inspired. I was determined not to make any NEW friends. The universe had different plans for me and shoved a pack of amazing new "mom friends" into my lap over the next four years. It's easy to see how it was all meant to be. Kat, Anne, Allie, and Samira: My family would not be "still together" without them. The endless group texting left me soul-crying and belly-laughing; the co-scrambling to figure out whatever crazy thing we needed tomorrow for school, the meltdowns over lice, strep, or basketball drama. The number of times they saved my behind with playdates and kid pickups while accepting me in all my hot mess-ness. So much love to Samira for being my midnight "mom" text bestie and my midnight "dissertation" text bestie. She understands viscerally the challenges and triumphs of this path. She kept me going, one foot in front of the other, and never let me feel alone. *Thank you, Kat, Anne, Allie, and Samira.*

And then there are the ones who weren't new–the ones who knew me before, during, and will know me after, and who never let me take any of this too seriously. I am so grateful and overwhelmed with love for the most committed group of Wednesday breakfasters the world has ever known. Their patience while I tirelessly tested my new "liberal-pushing agenda" 😂 ideas on them way too early in the morning, and their commitment to our friendship despite my absentminded half-presence has been the rock of stability I needed during tumultuous uncertainty in the overall world and mine. *Thank you, Rachel, Dana, Paul, Roger, Jada, John, and Melissa.*

Speaking of the world and Melissa, our friendship, rooted in the tremendous respect I instantly felt for her when we met, has only overgrown with love. It isn't easy to express her impact on my life in words. We've left no topic unturned, no sentiment unspoken. We push each other to consider all spaces and views in all our discomforts and yet we both seem to find our way back to *radical love*. Her friendship is a literal reminder to me that the world is, in fact, beautiful in all its pain and trauma. Never mind this capstone–I would not have made it *in general* without her. *Thank you, Melissa.*

It is a proven fact that without Hot Yoga Charlottesville, I would not be here today. That hot, muggy, sweaty home away from home was there for me every day. It was the only constant in my life through the pandemic, dissertation, new job, mental health, family challenges, and genocide. HYC was where my heart, mind, body, and soul went to heal and find clarity. Lizzie Clark will forever be an angel for giving us that space and community. Amy, Julia, Sarah B, Allie, Deb, Melissa: thank goodness for them forever. *Thank you, HYC.*

And then there are my ride-or-dies—the women who will never get rid of me:

You know that thing they say about friends who pick up like they've never left off? Basanes and I are like that. She's known me at my worst and cheered me on while I fought to be my best. As we (almost) learned recently, she is my bail call. She always picks up, says what I need in 5 minutes or less, and has my back. Jaimee, her wifey Sarah, and their baby Lucy will forever be my chosen family. *Thank you, Jaimee.*

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Carla is the literal definition of a hype friend. I can't visualize how this would've gone without her: the late-night writing sessions, the late-night TikTok sessions, coffee, and yoga. She never let me lose faith in myself. She is a fierce and protective cheerleader who was always there to lift me up and keep me going. Her resilience, strength, and unshakable belief in me have been a constant source of inspiration. *Thank you, Carla.*

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wife. She taught me that listening, and humility, are skills every academic could stand to learn, not to mention a sense of humor. I love my sisters more than they'll ever know. *Thank you, Mona, Lamya, and Reema.*

The first doctor in education I ever met was my daddy, Dr. Ahmed Badr, and the first computer programmer I ever met was my mommy, Amal Abdullah. My parents were my first cheerleaders, who continued to believe in me when things didn't always work out. They inspire anyone who knows them and make our Palestinian ancestors proud. My dad is a 1948 exile from his village in Palestine, and my mom is UNRWA-educated from a Palestinian refugee camp in Lebanon. I stand here today because of my parents' struggle and commitment to education. I feel their love and pride with me every step of the way, and when I faltered, I visualized their faces, and it kept me going. I love them so much, and my heart bursts with gratitude. *Thank you, Mommy and Daddy.*

And finally, I must thank the three who have been part of this adventure day in and out, every second, of the last four years. They are the ones I love the most and yet who made this experience most challenging. My husband, Chris, and our children, Zayne and Laith, provided my strongest drive to finish; I could *not stand* to miss *one more* bedtime or movie night. They endured countless sacrifices and faced challenges that tested our resilience. Chris' unwavering support and patience in giving me the space and time needed to complete this work have been heroic. I know it wasn't easy, and I am grateful for his strength and understanding. Zayne and Laith's laughter and joy have were the light that guided me through the most challenging days. They reminded me daily of the future I'm striving to help shape and improve. Their endless energy and love were my greatest motivation. They kept me grounded and gave me the strength to push forward. I love the three of them fiercely and this accomplishment is as much theirs as mine. *Thank you, Chris, Zayne, and Laith.*

Thank you to every Palestinian warrior who came before me. I wear my lineage proudly as a descendant of the most educated refugee population in the world, and I promise to continue the fight for a free Palestine through access to education for all.

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Chapter I

Introduction

In 2018, Evans et al. shared “Evidence for a Mental Health Crisis in Graduate Education” (2018). They called on policymakers and academia to deploy intervention strategies to combat the growing concern for graduate students' mental health (Evans et al., 2018). They reported that graduate students are more than six times as likely to experience depression and anxiety as compared to the general population (Evans et al., 2018). In previous decades, incidents of concern around mental health—including the most severe, such as that of Jason Altom, a chemistry graduate student at Harvard University who chose to end his life in 1998, leaving behind notes and speculation about pressure and stress (Hall, 1998)—were once hushed incidences. With the Evans et al. paper came a turning point in the incremental acceptance by the academic research community that intervention is necessary to address graduate students’ well-being.

Altom was, and is, not alone. Over two percent of surveyed graduate students have plans to attempt suicide compared to one percent of adults aged 18 and over in 2015 (Garcia-Williams et al., 2014; Piscopo & Lipari, 2015). Almost half (45%) of graduate students surveyed experienced a stress or emotional-related problem over the last year, and more than half (58%) knew of a colleague who had a similar experience in the past year (Hyun et al., 2006). Over half considered seeking professional care due to their experience (Hyun et al., 2006). Self-reported stress levels, feelings of anxiety, seeking counseling for mental health needs, and feelings of sadness and overwhelm are specific indicators of diminished mental health and well-being, among others (Berry et al., 2020; Evans et al., 2018; Levecque et al., 2017; Mackie & Bates, 2019; Peterse et al., 2018; Russo, 2011; Stubb et al., 2011; “Time to Talk about Why so Many Postgrads Have Poor Mental Health,” 2018; Toews et al., 1993, 1997; Tsai & Muindi, 2016; UC Berkeley Graduate Assembly, 2014; Urbina-Garcia, 2020). There is particular concern regarding the significantly higher incidence of diminished mental health among biomedical graduate

students. Trainees in biosciences constitute the most significant fraction of graduate and postdoctoral trainees (Yamaner & Arbeit, 2020), making this an issue of particular relevance in the biomedical science graduate student population.

While studies implicate several predictors of well-being, many of them are influenced by institutional and programmatic structure and leadership. Diminished emotional and mental well-being can be impacted by financial status, relationship with one's advisor, work-life balance, length of training period, and anxiety about navigating job opportunities outside of academia among other things (Evans et al., 2018; Hyun et al., 2006; Mackie & Bates, 2019; Tsai & Muindi, 2016).

Preceding—and concurrent—to increasingly bleak reports on graduate student well-being, national mandates and policies over the last few decades specifically aimed to increase the production of young scientists to salvage and preserve the United States' place as a technological leader in the world (Rising Above the Gathering Storm, 2007; National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, 2011). During a time in American history when the national mission most strongly aligned with placing more scientists in research positions, studies continue to demonstrate fewer academic opportunities for graduates (Alberts et al., 2014; Zimmerman, 2018) and the lack of preparation of students for non-academic research positions (Her et al., 2018). Stress, burnout, and mental health problems like depression and anxiety threaten academic productivity, quality and quantity of research, rates of completion, and the likelihood of remaining in science after graduation (Nagy et al., 2019; Woo, 2019). Graduate students nationwide face abysmally high attrition rates of 50% (Cassuto, 2013), and biomedical science graduate students demonstrate specific susceptibility to attrition (National Research Council, 2011; Tsai & Muindi, 2016). Where did the national mission go wrong?

The twenty-year push to position the United States as a world leader in science and technology drastically shifted the underlying funding infrastructure of biomedical science

graduate programs and their research faculty, who make up the foundation of all doctoral training. Federal research initiatives and policy drove these shifts (Hurtado et al., 2017; National Institutes of Health, 2012b; Rising Above the Gathering Storm, 2007) and broad changes in support models within higher education strengthened them (Martínez Alemán et al., 2015, Chapter 4). They are the outcome of multiple interactive and overlapping changes in climate, policies, procedures, and cultures.

Changes in higher education policy, combined with reduced state funding and increased career-dependent incentives, placed biomedical academic research scientists in a highly competitive environment. Labs primarily depend on federal grant funds to survive, and such funds are limited. In 1973, the proportion of academic research and development paid for with federal funds was 69%, declining since 2012 and reaching 54% in 2016 (Science and Engineering Indicators, 2018). *Academic capitalism* is a concept that has garnered significant attention and debate in higher education. Slaughter and Leslie (1997) coined the term in their documentation of the shift from public funding to diversified sources of revenue, leading to the commercialization of universities and the pursuit of external funding through grants, contracts, and partnerships. It refers to the increasing commercialization, marketization, and entrepreneurial activities within academic institutions. This phenomenon has shaped the landscape of higher education, influencing how universities and scholars interact with the market, industry, and government. Economic and political forces began to reshape higher education systems worldwide in the late 20th century.

Academic capitalism—whether evident through competition for grants or in the pursuit of private patents and intellectual property—has become the dominating model in the departments and schools that house biomedical science graduate programs in the United States. The earliest outlines of academic capitalism suggested a correlation between highly competitive capitalist-like operations in academic science and a detrimental impact on faculty life (Rhoades & Slaughter, 1997; Slaughter & Leslie, 1997). In addition, scholars continue to point out the long-

term impacts on faculty stress and faculty-student relationships (Alberts et al., 2014; Mendoza, 2007). Works point to the changed mentor-student relationship due to increased grant application pressures, diminished personal and professional satisfaction, and increased pressures, all impacting the laboratory environment in the academic capitalistic world (Alberts et al., 2014; Stephan, 2012). Relationships with mentors, decreased satisfaction, and increased academic pressure have been implicated in student reports of well-being and positive outcomes (Byrom et al., 2020; Rummell, 2015). All this raises the question: Is it possible that academic capitalism is related to the growing mental health crisis among biomedical graduate students?

The Biomedical Science Graduate program (BIMS) at a large flagship research university in the mid-Atlantic region of the east coast (LRU) aims to produce high-achieving scientists who make significant and high-quality contributions to the biomedical sciences in various fields. However, this objective is threatened by the increased prevalence of chronic stress, high burnout, and the reduced quality of well-being reported by doctoral students nationally.

I worked as a doctoral program administrator in the BIMS department at LRU for ten years, during which time, students shared their experiences with poor well-being and mental health with me. They experienced reduced satisfaction in their overall health, academic engagement, social support, career prospects, and advisor relationships. Students reported the use of or seeking the use of professional counseling and medication as a means to cope with their sense of well-being. In addition, I anecdotally observed an increase in the number of requests for leave-of-absence and unofficial requests for time off for mental health reasons, as well as the delaying of academic milestones to cope with mental health obstacles to academic progress.

This study aimed to uncover ways the institution and graduate program can influence self-reported well-being through factors related to academic capitalism, such as career guidance, stipend levels, or informing future policy and reform. In addition to increasing the

understanding of LRU BIMS students' well-being, this work intended to learn more about how the institution and graduate program can influence self-reported states of well-being. Developing a theory connecting academic capitalism to the well-being of biomedical science doctoral students can improve LRU BIMS student experiences and outcomes through multiple facets.

Developing a theory that identifies meaningful links between the students' experiences and academic capitalism enables BIMS program coordinators and administrators to utilize the vast volume of academic capitalism research as a resource for developing and implementing actions to improve student conditions and outcomes. Academic capitalism is a subject of examination as an influencing factor on the lives of faculty (Park, 2011), career practices in academic science (O' Hagan et al., 2019), gender differences in academic science (Steinþórsdóttir et al., 2019), the structure of academic organizational units (Yang et al., 2021), biomedical research training practices (Lenzi et al., 2020), entrepreneurship in academic science (Axler et al., 2018), and many more. Identifying conceptual links between LRU BIMS student experiences and academic capitalism enables targeting programmatic and institutional solutions based on previously conducted research.

In addition to informing student-targeted programming, developing a theory about student well-being and academic capitalism informs institutional and programmatic stances on future policy and reforms that impact student well-being and biomedical science outcomes. Based on the outcomes of this work, recommendations for local, programmatic, school-level, institutional, and nationwide policy changes can be made. Those may include allocating funds, deciding budgetary timelines, adjusting the number of program matriculants, making curricular changes, increasing career guidance, adjusting lab member composition, adding mentorship training, adjusting stipend levels, and more.

This research aimed to further the understanding of the relationship between academic capitalism—including the structures and behaviors that accompany it—and the well-being of LRU BIMS students. By employing a constructivist grounded theory methodology, this

qualitative study assessed biomedical doctoral students' emotional and mental well-being experiences against the scaffold of academic capitalism. The research proposed here aimed to add to the limited database of qualitative studies that include science doctoral students' voices sharing their experiences of well-being. By interviewing the students, I hoped to answer the research question: "How is academic capitalism shaping the growing mental health crisis among biomedical science doctoral students?"

Despite the literature's significant dedication to the study of academic capitalism, it lacks an exploration of its downstream impact on graduate student well-being and mental health. This study aims to fill that gap. The next chapter, the literature review, starts with an overview of student well-being in higher education, specifically biomedical science doctoral students. Following, I review academic capitalism as a theory and framework and demonstrate justification for a theoretical connection between the two. Chapter three explains the chosen methodological approach and research design.

Keywords: biomedical science, graduate students, doctoral students, well-being, mental health, academic capitalism, grounded theory

Chapter II

Literature Review and Theoretical Framework

This study aimed to develop a theory illustrating any potential conceptual or actual relationships between academic capitalism and the well-being of biomedical science doctoral students. I asked, “How does academic capitalism shape the growing mental health crisis amongst biomedical doctoral students?” and began to answer it by exploring the extant literature on graduate student well-being, the characteristics of academic capitalism in higher education research, and the combination of both.

This chapter begins with a literature review of student well-being, including evidence of a mental health crisis in graduate education, focusing on biomedical sciences students. I will review the structural and organizational factors that potentially contribute to reduced well-being among graduate students. The section concludes with a justification for the study of graduate student well-being by describing the consequences of reduced mental health in that population.

Next, I will describe the evolution of academic capitalism, its impact on research in higher education, and the outcomes of its foothold in scientific research at universities. In this segment, I describe three reasons I framed this research around the theory of academic capitalism.

The last sections of this literature review bring the themes together. First, I describe the systemic imbalances in biomedical sciences academic research that are attributed to academic capitalistic mechanisms. Then, I pose questions about those mechanisms, the imbalances, and how they might be shaping doctoral students’ well-being. Finally, I present the purpose of this study in the context of gaps in the literature linking student well-being and academic capitalism.

Graduate Student Well-Being

Assessing potential links between academic capitalism and the well-being of graduate students in the biomedical sciences requires exploring the current state of mental health in that community. This section establishes the need for continued investigation of graduate student

mental health by reviewing the literature on their well-being, contributors to their reduced well-being, and the implications of not improving their quality of life. I pay particular attention to the biomedical science graduate student, summarizing qualitative and quantitative studies.

I begin by defining well-being in the literature and clarifying its definition in this study. I describe initial approaches to graduate student well-being research and the transition to studies focused on the biomedical science student experience. Then, I review possible underlying reasons for diminished graduate student well-being.

Approaching Well-Being in this Study

Well-being and *mental health* are terms and concepts used commonly in the literature across multiple disciplines. Despite this, a universally agreed-upon definition for either term remains absent. The World Health Organization (WHO) (2004) defines “mental health” as “a state of well-being in which the individual realizes their abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community” (p. 10).

Additionally, the WHO’s definition of “health” implicates general health status as a leading indicator of well-being: “a state of complete, physical, mental and social well-being and not merely the absence of disease of infirmity” (World Health Organization, 2004, p. 10). While the Centers for Disease Control (2018) stated there is no consensus around a universal definition of well-being, they add that well-being “at a minimum, includes the presence of positive emotions and moods … [and] the absence of negative emotions” (Centers for Disease Control and Prevention, 2018, loc. How is well-being defined?).

However, these definitions do not provide specific guidance for using or measuring well-being. Cameron, Mathers, and Parry (2008) call the term an “open-ended catch-all category” (Cameron et al., 2008, p. 227). The literature includes using varying conceptual and theoretical frameworks to guide researcher perspectives when approaching well-being among populations (Guthrie et al., 2017; Schmidt & Hansson, 2018; Urbina-Garcia, 2020).

Despite this, two overarching categories emerged to define well-being in psychological research (R. Ryan & Deci, 2001; Schmidt & Hansson, 2018). The first is that of psychological, or eudaimonic well-being, which views well-being as realizing one's full potential or fulfilling one's true self. This definition *separates well-being from self-reported happiness* and evaluates whether people's life activities align with their values and abilities. This approach to well-being argues that while some outcomes make people *feel* happy, they may not necessarily be indicators of psychological well-being (R. Ryan & Deci, 2001).

The second view of well-being is hedonic or subjective well-being (R. Ryan & Deci, 2001). Subjective happiness and the absence of self-assessed detractors of happiness grounds this definition of well-being. This definition places subjective well-being as an integral part of general psychological health and a critical component of overall health. Subjective well-being is predominantly used when examining student well-being and mental health (Schmidt & Hansson, 2018). In this study, I use the subjective meaning of well-being described by the students themselves.

Mental Health Crisis in Graduate Education

Graduate Student Well-Being and Mental Health. Quantitative, qualitative, and mixed-method approaches provide strong evidence of the need for mental health support and interventions in graduate student populations, predominantly in the United States, Canada, and Scandinavian countries. Earlier studies were typically quantitative, focused on the perception of "stress" and stress-model instruments, and usually targeted medical or law students, driven by concern about the high-stress environment in professional school (Heins et al., 1984; Toews et al., 1993, 1997). Toews et al. compared stress levels across graduate science students, medical students, and medical residents, and indicated that "special attention" should be paid to the graduate science students who scored higher on all assessments of stress, as well as women trainees in all three programs (1993, p. S48). A few years later, Toews et al. (1997) repeated a similar study, with similar results, this time including multiple universities in Calgary, Canada,

and concluded that stress levels of medical students and residents were “acceptable,” but notably did not include the graduate student results in that assessment. Investigators administered the Derogatis Stress Profile to medical, law, graduate, and undergraduate students, and the results indicated that medical students were not as stressed as graduate and law students (Helmers et al., 1997). Results of studies like these comparing graduate student stress and mental health to that of medical or law students often presented as a surprising secondary outcome of research primarily focused on students in professional programs.

The turn of the 21st century saw the emergence of investigations that specifically assessed graduate student mental health and well-being needs. In one study, graduate students and other students aged 25 and older had higher suicide rates than their undergraduate and younger colleagues (Silverman et al., 1997). Undergraduate women had half the suicide rates of those reported for men, but that gender difference evened out in older and graduate student populations in which there were no statistically significant gender differences (Silverman et al., 1997). These results highlighted the importance of investigating older and graduate student mental health. Almost half of graduate student survey respondents experienced a stress or emotional-related problem or feeling overwhelmed over the last year, and over half considered seeking professional care (Hyun et al., 2006). Approximately seven percent of graduate students at a large southeastern university who responded to an online anonymous questionnaire reported having thoughts of suicide (Garcia-Williams et al., 2014). Just over two percent reported having plans for suicide, and more than half indicated they were feeling nervous, irritable, stressed, anxious, or lonely (Garcia-Williams et al., 2014). While studies maintain that undergraduate students experience higher rates of feelings and behaviors related to poor mental health and are less likely to seek mental health support than graduate students (Eisenberg et al., 2007; Wyatt & Oswalt, 2013), the last two decades have seen an alarming increase in mental health issues among graduate students, who may be six times as likely to experience depression and anxiety as compared to the general population (Evans et al., 2018).

More recently, studies emerged exploring graduate student well-being in the specific context of the doctoral student experience. Across disciplines, doctoral students experienced negative mental health symptoms at higher rates than the general population (Rummell, 2015). A qualitative study on the socio-psychological well-being of Ph.D. students in the scholarly community—their feeling of connection and belonging to their academic community—found through open-ended question responses that more than half of participants experienced their academic communities as sources of burden (Stubb et al., 2011). Martinez et al. (2013) conducted semi-structured interviews with full-time doctoral students to learn how and to what extent they strive to obtain work-life balance. Their work constructed four themes around which they organized the students' responses. One of the themes that emerged showed that students strive for work-life balance by managing their stress levels and mental health, implicating mental health as an essential factor in navigating the doctoral student experience (Martinez et al., 2013).

Some populations of doctoral students are at higher risk of reduced well-being and mental health concerns. Haynes et al. (2012) categorized the definitions, descriptions, and examples of well-being as experienced by eight female doctoral students during their graduate careers into metaphors. The women shared their experiences of having roles and responsibilities that sometimes conflicted with their graduate student roles, causing increased stress (Haynes et al., 2012). Black doctoral students continue to persist and achieve while exacting psychological and emotional costs such as stress, exacerbated imposter phenomenon, and self-doubt, due to their racialized experiences in predominantly white institutions of higher education (McGee, Griffith, et al., 2019; Minnett et al., 2019). Transgender and cis-gender women in doctoral programs may be more likely to experience anxiety and depression than cis-gendered men (Evans et al., 2018). Reduced well-being and increased risk of mental health concerns among doctoral students can further intensify among minoritized populations.

Two studies were pivotal in inspiring a renewed focus on graduate students' mental

health and well-being needs. The Graduate Assembly at the University of California at Berkeley, a graduate and professional student body with the mission to “improve the lives of the University of California, Berkeley graduate students” (*The Graduate Assembly at UC Berkeley*, n.d.) published their findings from a survey of 790 graduate students. The survey assessed well-being and happiness using Satisfaction With Life (SWL) scores and depression using the Center for Epidemiologic Studies Depression Scale (CES-D), across forty different demographic and candidate predictors (UC Berkeley Graduate Assembly, 2014). In addition to extracting the top ten predictors of graduate student well-being, they found that Ph.D. students have higher levels of depression and lower levels of life satisfaction than master’s students (UC Berkeley Graduate Assembly, 2014).

Evans et al. published a study in the high-impact journal *Nature* that concluded that graduate students are six times more likely to experience depression and anxiety as compared to the general population, calling their results “evidence for a mental health crisis in graduate education” (2018, p. 282). The quantitative study used well-established scales for anxiety and depression and survey data collected from 2,279 students, 90% of whom were Ph.D. students. While the study participants represented diverse fields of study, the authors, all biomedical researchers, targeted their discussion to the biomedical graduate training community, explicitly referring to the culture and experience unique to students conducting research in bioscience labs (Evans et al., 2018). In the next section, I share the concerns around well-being and mental health outcomes among graduate students in the biomedical sciences.

Well-Being of Graduate Students in the Biomedical Sciences. Identifying the prevalence of mental health problems among graduate students in the biomedical science community has been of particular concern in the medical and scientific research community (Nagy et al., 2019; Russo, 2011; Tsai & Muindi, 2016). Biomedical science research students constitute the most significant fraction of graduate and postdoctoral trainees (Yamaner & Arbeit, 2020), statistically making this group a population of concern. Approximately 84,000 biomedical

graduate students enrolled in 2019, with approximately 18,000 being first-time students (Gordon et al., 2023). Moreover, as discussed in later sections, postdoctoral and faculty positions in STEM fields have declined, but student enrollment in doctoral STEM programs continues to increase. Enrollment of full-time, research-focused doctoral students in science, engineering, and health fields grew by four percent from 2020 to 2021 (Gordon et al., 2023). The University of California- Berkeley report (2014) found that 43 to 46% of graduate students in the biological sciences, physical sciences, engineering, and other related professions self-reported being depressed. Other sources indicate that 37 to 47% of graduate students in STEM have mental health concerns compared to 18.5% of the U.S. general adult population (Villarroel, 2020). These numbers underscore the importance of targeting biomedical graduate students in further examination of the status of their well-being.

In addition to being a numerically significant population of concern, graduate students and other trainees in science demonstrate increased susceptibility to adverse mental health and well-being outcomes (Chakraverty, 2020; Hish et al., 2019; Toews et al., 1997; Tsai & Muindi, 2016). Students in specific disciplines, such as science and engineering, are less likely to seek support and treatment (Lipson et al., 2016). Science research graduate students, including biomedical graduate students, are particularly vulnerable to factors that diminish well-being, such as academic competition, the grant support model in labs, Principal Investigator (PI) stress, and more (Chakraverty, 2020; Nagy et al., 2019; “Time to Talk about Why so Many Postgrads Have Poor Mental Health,” 2018; Tsai & Muindi, 2016).

In later sections of this chapter, I explore cultural and systemic factors that contribute to the increased vulnerability of doctoral biomedical science students to mental health concerns in the context of academic capitalism. First, seeing what the literature exposes as underlying causes for their reduced well-being is helpful.

Contributing Factors to Diminished Graduate Student Well-Being

The undergraduate student experience is the focus of most studies that examine the root

causes of reduced student well-being (Byrom et al., 2020). Even as the need for mental health intervention in graduate student populations became established, early attempts to address this focused on exploring the contributions to declined mental health previously observed in undergraduate students (Guthrie et al., 2017). Likewise, interventions found to be successful with undergraduate students were the first overlayed onto graduate students (Mackie & Bates, 2019). However, efforts to uncover contributing factors to student well-being specific to graduate student populations significantly increased over the last two decades, and the scope of relevant environmental factors examined has expanded as a result (Mackie & Bates, 2019; Peluso et al., 2011; Schmidt & Hansson, 2018).

Appreciation for the intrinsically unique experience of the doctoral research student experience began with the recognition that Ph.D. students, in particular, exist within a cross-over role between student and worker (Ab Marais et al., 2018; Hunter & Devine, 2016; Mackie & Bates, 2019; Peluso et al., 2011). Doctoral students contribute significantly to the research output of higher education institutions and work independently for most of their time as students. Many teach, apply for external and institutional funding, and receive financial support. Ninety percent of doctoral students in science receive financial support enabling them to conduct their dissertation work full-time compared to 33% of students in the social sciences, contributing to the perception of Ph.D. students in science as an academic working population (Ab Marais et al., 2018). This perception expands the list of potential contributing factors to their mental health to include work and organizational structure-related themes such as career and workplace concerns (Mackie & Bates, 2019).

Systemic reviews of the literature demonstrate that the top predictors of mental health first indicated in the 2014 Berkeley study remain representative, even with the expansion of studied potential environmental factors. The top ten predictors reported in that survey were Career Prospects, Overall Health, Living Conditions, Academic Engagement, Social Support, Financial Confidence, Academic Progress and Preparation, Sleep, Feeling Valued and Included,

and Advisor Relationship (UC Berkeley Graduate Assembly, 2014). The following sections include broad overviews of investigations into these themes as primary contributors to doctoral student mental health. At the end of this chapter, I return to these to make the case for linking them to environmental conditions in biomedical science research in higher education.

Career Prospects and Financial Confidence. "The largest source of anxiety for me is my job outlook. It is tremendously uncertain and thus fear-inducing," shared one of the graduate students surveyed in the Berkeley study (2014, p. 2), demonstrating the significance of this source of stress for many doctoral students. Future career uncertainty is a repeatedly emergent source of stress for doctoral students across various disciplines (Ab Marais et al., 2018; Huisman et al., 2002; Kurtz-Costes et al., 2006; Levecque et al., 2017).

Career prospects determine mental health outcomes among science Ph.D. students, particularly as the number of graduating students continues to outnumber available faculty positions (Levecque et al., 2017). Female Ph.D. students are particularly impacted by the stress of perceived lack of future employment (Kurtz-Costes et al., 2006). Data from the National Science Foundation's Survey of Doctoral Recipients indicates a robust shift to business, industry, and government positions from academic ones in the first ten years of postdoctoral careers, and increasingly more senior scholars are making the same shift (Finkelstein & Jones, 2019). Marais et al. (2018) suggested that doctoral students are aware of the rise in the number of doctoral candidates relative to career opportunities, leading to anxiety regardless of how much career guidance is provided to them.

In addition to future career prospects, doctoral students experience increased stress due to their financial situation. Financial insecurity may be the most significant stressor shared among doctoral students (La Touche, 2017). Parallels between workplace stress and the doctoral student experience highlight the role that financial duress is likely to play in reduced student well-being (Hunter & Devine, 2016), with women again experiencing particularly significant levels of stress from financial worries (Kurtz-Costes et al., 2006).

Academic Engagement, Progress, and Preparation. Graduate students' engagement with their academic research and day-to-day work is negatively correlated to depressive symptoms (UC Berkeley Graduate Assembly, 2014). Students who enjoy their doctoral studies are less likely to experience loneliness and isolation, factors that contribute to rates of attrition.

Many students in doctoral programs have experiences that combat their ability to engage with their doctoral work positively. Feelings of stress due to workload, academic pressure, graduate assistantship responsibilities, and lack of clarity on their progress toward graduation detract from their joyful experience of graduate research (Kausar, 2010; Kurtz-Costes et al., 2006; Mazzola et al., 2011; Oswalt & Riddock, 2007). The pressure to publish, deadlines, and frequent evaluations all contributed to stress levels, and in some science student populations, their total workload directly correlated to perceived stress (Mays & Smith, 2009).

Health & Living Conditions. Evans et al. (2018) found a good work-life balance to be negatively associated with their measures of anxiety and depression, indicating the importance of a good work-life balance to support mental health. Unfortunately, graduate students may lack work-life balance more than other student populations, a factor compounded by the targeting of extracurricular and cultural activities on college campuses to undergraduate students (Fox, 2008). Some students in Golde's (2005) study left their doctoral programs in science because of their reported inability to lead a balanced life while continuing their program. One student said, "it doesn't matter when you work as long as it's all the time" (Golde, 2005, p. 684).

In addition, general health conditions such as sleep, exercise, nutrition, and emotional and spiritual self-care all impact graduate student well-being (Barry et al., 2018; UC Berkeley Graduate Assembly, 2014; Wyatt & Oswalt, 2013). Poor sleep is one of the top three predictors of depression among surveyed graduate students (UC Berkeley Graduate Assembly, 2014), and doctoral candidates experiencing stress reported disruptions in sleep patterns or difficulty sleeping (Barry et al., 2018). The self-reported regular exercise and sleep hours were strongly correlated to reduced stress and positive mental health in Ph.D. students (Byrom et al., 2020).

However, as the authors pointed out, lack of sleep and overall diminished health are also symptoms of stress, so it is difficult to assess any causal direction between doctoral student stress and these factors (Byrom et al., 2020).

Advisor Relationship and Feeling Valued and Included. Graduate students' relationships with their mentor or advisor come up more frequently than any other in the literature as the culprit of increased student stress, and it is most strongly associated with reports of diminished well-being (Byrom et al., 2020; Jones-White et al., 2021; Mackie & Bates, 2019; Nagy et al., 2019; T. Ryan et al., 2021). The student-advisor relationship may be a critical difference between students in professional fields and those who conduct research and may account for the different reports of stress and well-being between graduate student populations (Peluso et al., 2011). Of the primarily biological science graduate students surveyed, 62.6% reported that they were very or somewhat satisfied with the guidance of their advisor in their first year. However, these rates reduced to 52.9%, 46.7%, and 43% in their second, third, and fourth/fifth years respectively (Russo, 2011). Doctoral student-advisor relationships consistently emerge as essential in doctoral student well-being, even as the research approach and theoretical frameworks used to examine those relationships continue to evolve.

Students self-report the importance of the relationship with their advisors regarding their well-being and satisfaction in graduate school. Diminished advisor relationship satisfaction was a significant predictor of depressive symptoms for students enrolled in doctoral experimental psychology programs (Peluso et al., 2011). Poor relationships with advisors caused stress in doctoral students (Schmidt & Hansson, 2018), and female Ph.D. students emphasized the importance of supportive faculty mentors even as they shared less supportive experiences with their female faculty mentors (Kurtz-Costes et al., 2006).

Some studies examine the doctoral student-advisor relationship in the context of organizational and workplace behavioral models and theories (Hunter & Devine, 2016; Levecque et al., 2017). Hunter and Devine (2016) found that a supervisor's experience level

and meeting frequency with their graduate students negatively correlated with students' reported emotional exhaustion. Levecque et al. (2017) categorized doctoral advisors by leadership styles. They found a statistically correlated relationship between "laissez-faire" leadership style and the risk of poor mental health outcomes of their candidate students.

Students' relationships with their advisors may impact their subjective mental health reporting, further compounding the results of studies on the doctoral student-advisor relationship. Of the graduate students surveyed who had anxiety or depression, 50% did not agree that their mentor provides "real" mentorship and the majority of them disagreed that their mentor provided support, had a positive impact on their mental and emotional well-being, or were an asset to their career (Evans et al., 2018, p. 283). Others found corresponding issues with social interaction in the academic community, students' expectations of themselves, mentor expectations of them, supervision-related challenges, resource-related challenges, research-specific challenges, sleep concerns, and overall health and family concerns (Barry et al., 2018; Byrom et al., 2020; Juniper et al., 2012; Levecque et al., 2017; Mackie & Bates, 2019; O'Meara et al., 2017).

Results from these studies serve as a reminder that it is difficult to tease out the importance of the advisor relationship in the range of environmental and institutional factors impacting student well-being and mental health. Growing bodies of work investigate the student-mentor relationship as a part of the departmental and institutional organizational environment (Appel & Dahlgren, 2003; Barry et al., 2018; Kaczan, 2015; La Touche, 2017; Levecque et al., 2017; Martinez et al., 2013; Schmidt & Umans, 2014; Stubb et al., 2011). Doctoral students have mental health concerns related to their roles and social positions as graduate students, and their mentor relationship distress is often described in conjunction with funding challenges and a sense of isolation (Grady et al., 2014). Students describe "invisible walls," confused perceptions, lack of transparency, and interdepartmental conflict as sources of stress (Appel & Dahlgren, 2003; La Touche, 2017). They feel a sense of ambiguity around university processes

and misaligned expectations between themselves and their departments (Kaczan, 2015). Students experienced “closed decision” processes, in which they could not participate in decisions that affected them, and role conflict (Levecque et al., 2017; Martinez et al., 2013), all of which are organizational factors and advisor-driven. Although the relationship with a faculty advisor is the most frequently reported source of stress and reduced well-being for doctoral students, Marais et al. (2018) find that the impact of the supervisor on well-being is not the most important, and remind us of the importance of assessing the many dimensions of the Ph.D. experience.

Ramifications of Diminished Graduate Student Well-Being

We must address the well-being and mental health needs of graduate students. Firstly, there is a moral reason to do so–every human deserves to feel happy and balanced in their vocation. However, beyond the moral obligation, the reduced subjective well-being of graduate students significantly impacts all levels of research and higher education.

Evidence shows that employees with poor well-being at work and experience high-stress levels report higher rates of absence due to sickness (Kinman & Wray, 2015). In addition to reduced productivity due to absence, reduced well-being is linked to reduced productivity while at work. Ph.D. students with mental health concerns may impact institutions broadly, as well as the functioning of large research teams. Ph.D. students conduct over half the research conducted by universities (Levecque et al., 2017), and their reduced productivity, reduced contribution, or attrition, in some cases, will affect the workforce of research and higher education research institutions. Their well-being also affects their productivity in their teaching roles and may impact how they imprint on future doctoral students (Gardner, 2009; Lovitts, 2001). Doctoral students play a significant role in achieving the objectives of higher education, and their performance affects student learning and success.

Ph.D. students have significant dropout rates, and doctoral students in the biomedical sciences have rates between approximately 40 and 56% (National Research Council, 2011).

Structural, programmatic, and organizational policies that negatively impact well-being may contribute to attrition rates in science graduate students, making it difficult for the industry to hire new scientists over time. Thus, well-being and mental health detractors in graduate student populations can threaten the viability and quality of the research industry as a whole (Levecque et al., 2017).

In addition to the impact on graduate programs and scientific advancement, there is indication of the potential impact of reduced graduate student mental health on general societal health and safety. For example, in the majority of cases of shootings on U.S. colleges and university campuses between 1990 and 2008, the shooters were graduate students or someone other than a non-traditional student (Fox, 2008). In summary, balanced, happy people are more productive, more likely to find employment, more collaborative, and more creative (Neve et al., 2013), and it is in society's—and higher education's—best interest for graduate students to report positive well-being.

The remainder of this literature describes the overarching changes in biomedical research in higher education as part of the shift to an academic capitalist model, with an emphasis on how these changes could–and do–impact any of the predictors of graduate student well-being reported in the University of California, Berkeley (2014) report.

Academic Capitalism

Original Theory and Updates

Slaughter (2018) posited that under the theory of academic capitalism, all actors in institutions of higher education—faculty, students, and administrators—utilize their efforts and resources (a portion of which might be state-supplied) to form relationships and networks with players in the private and corporate sector to generate profit. Slaughter and Leslie (1997) introduced the theory through their examination of technology transfer and the marketization of academic research. Later, Rhoades, Slaughter, and Leslie (Rhoades & Slaughter, 1997, 2004; Slaughter, 2018; Slaughter & Leslie, 2001, 1997), expanded the theory, applying it to other

revenue-generating behaviors in academic research primarily related to the exploitation of intellectual property. In the decades since, research on academic capitalism has expanded both in quantity and breadth of the topic, benefiting from the theory as a lens from which to examine the various impacts of the political, social, cultural, and economic ecosystem around institutions of higher education (Cantwell & Kauppinen, 2014).

Slaughter, Rhoades, and Leslie offered that academic capitalism results from neoliberalism, globalization, markets, and universities shaping higher education (Rhoades & Slaughter, 1997, 2004; Slaughter & Leslie, 2001, 1997). The early development of the concept described academic capitalism as the introduction of profit-driven decision-making in higher education through the institutional pursuit of market items such as patents and instructional materials (Slaughter & Leslie, 1997). The subsequent development of academic capitalism as a theoretical framework expanded the concept to include the encompassing culture within higher education in which *individual actors* decide to pursue profit over those that uphold the core mission of education (Slaughter & Rhoades, 2004). Academic capitalism describes faculty, students, and administrators who use state resources to create knowledge which is then utilized as a form of capital, bridging higher education with external capitalistic industries and economies and growing entire infrastructures within and across higher education to support the mission of bringing in more resources (Rhoades & Slaughter, 2004; Slaughter, 2018; Slaughter & Cantwell, 2012).

It is helpful to describe academic capitalism in terms of how it contrasts with a *public good* education model. When higher education- and the knowledge and learning it produces- is considered a public good, the community and citizens of the public have theoretical and actual claims to the benefits that emerge (Daviet, 2016). In his plea to restore higher education to its place as a common good for the public, Jon Nixon describes the necessity of a return to a higher education whose mission is to “fulfill a transformative role within a civic and increasingly cosmopolitan society,” an action he deems can only occur by higher education inserting itself in

the struggle for liberty and equality for all (Nixon, 2012). Nixon and countless researchers before and after present evidence of the stark shift in higher education from serving a public good to a more business-like model from the 1980s onward and an acceleration of that shift after the 2008 economic downturn. (Etzkowitz et al., 2000; Hoffman, 2011; Nixon, 2012).

The research question posed here—how does academic capitalism shape the growing mental health crisis amongst biomedical doctoral students?" —requires me to focus on the impact of academic capitalism on biomedical research in public institutions of higher education. The following section describes the timeline of events that broadly represent the manifestation of academic capitalism in the academic scientific research environment, emphasizing academic biomedical science research.

University Research and the Path to Academic Capitalism

It is helpful to contextualize academic capitalism by describing the historical relationship that academia played in the free market and by providing the timeline of shifts that researchers like Slaughter, Rhoades, Leslie, and many others identified as a shift towards academic capitalism. The decades of research around academic capitalism paint a picture of a complex web of mechanisms and factors that drove higher education to engage in market-like behaviors and even more complex mechanisms sustaining and strengthening the model.

Slaughter and Leslie (1997) identified four factors that played significant roles in the emergence of academic capitalism, including the globalization of world markets, the development of national policies that encourage applied research, declines in direct state support, and increases in faculty engagement in revenue-pursuing behaviors. These factors were and are not mutually exclusive players and, in fact, overlap, impacting each other. For example, the passing of policies like the 1980 Bayh-Dole Act, as described below, encouraged revenue-seeking behaviors within institutions of higher education but *also*, in part, drove the prioritization of applied versus basic research. Despite the complexity of these and other mechanisms implicated in academic capitalism, they provide an ideal organizing framework for

broadly summarizing a rich and complex timeline of factors that led to the model in higher education today.

Neoliberalism and Globalization of World Markets. The rise of neo-liberalism and the associated globalization of markets significantly contribute to the rise of academic capitalism in higher education (Slaughter, 2018). Neo-liberalism strongly emphasizes privatization, deregulation, individualism, and self-interest. The free-market principles that increased in popularity leading into and through the Reagan administration accompanied policies that benefited for-profit institutions and reduced public-sector support for higher education (B. Taylor & Cantwell, 2018). The prioritization of monetary policy and increased financial gains promote globalization by removing trade barriers and increasing international trade and investment. This shift in political and economic ideology through the 1980s was well-timed with with technological advances, leading to the most substantial global economic integration developed nations had experienced until then.

Globalization of world markets transformed higher education institutions and brought opportunities for global engagement and research. Restrictions on the knowledge-trade lifted over the last decades of the twentieth century due to technological facilitation, policy support, financial drive, or a combination of all three. Globalization facilitated student mobility, with increases observed worldwide in students pursuing higher education outside their native country (OECD, 2012). Global research collaboration accelerated scientific advancements and innovation, and increased cross-border programmatic and curricular partnerships, further enhancing institutions' global reach and reputation (Mowery & Sampat, 2004).

Additionally, increased neoliberalist attitudes and globalization posed challenges in higher education. The internationalization of students, staff, and faculty increased competition for positions and research opportunities (Knight, 2008), and institutions increasingly rely on adjunct and contract faculty, including international scholars (Bedenlier & Zawacki-Richter, 2015). Worldwide university rankings emerged with globalization, using standardized criteria

and normalizing international competition (Cantwell & Taylor, 2013). With globalization, universities have experienced increased pressure to improve international rankings and attract students (Knight, 2008). Institutions, increasingly tuition-dependent when neo-liberal anti-welfare mentality led to decreased public support for state provisions for higher education, further relied on international student tuition, and financial pressures influenced institutional priorities and decision-making (B. J. Taylor & Cantwell, 2019). Globalization contributed to cultural homogenization and westcentrism. English began to spread as the dominant language of instruction, resulting from Western-centered standardization and the normalizing of Western-valued disciplines and cultures (Wit, 2020).

Higher education STEM-related disciplines were—and are—particularly vulnerable to the effects of neoliberalism and globalization. The commercial potential of science and scientific research drives of economic growth (Argyres & Liebeskind, 1998). Neoliberal policies prioritize research with potential economic benefits and encourage the commercialization of research outputs (Carroll & Beaton, 2000). In biomedical science, this manifested as increases in patenting and licensing discoveries, the formation of startup companies, and seeking industry partnerships to monetize research findings. Increased competition for research funding in STEM fields leaves faculty members to pursue grants and contracts diligently and face increasing pressure to secure funding, publish in high-impact journals, and engage in industry partnerships to meet the demands of neoliberal metrics for performance evaluation and tenure/promotion (Carroll & Beaton, 2000). Importantly, as addressed in the next section, neoliberalism's focus on preparing students for the job market favors applied research, leading faculty and students away from broad-based scientific knowledge (Geiger, 2004). Finally, neoliberalist emphasis on efficiency and revenue generation raises ethical concerns in biomedical science, where the pursuit of profit and commercialization leads to questions about incentives and quality (Axler et al., 2018; Bekelman et al., 2003).

Support for Applied Research. Before World War I, universities primarily conducted

basic research, while applied research occurred in industry labs (Geiger, 2019). Wartime initiated university-industry collaboration, yet after its conclusion, the distinction between the two types of scientific discovery remained (Kenney, 1986). The earliest decades of the twentieth century saw tiny adjustments in university research's structural and financial support that set the stage for future overhaul. Philanthropic support towards specific research areas began to include fellowships to support graduate students, increasing student enrollment (Geiger, 2019). Industry research grew, and subsequently, industry-supported fellowships at universities (Geiger, 2019). Federal investment in applied research increased, and American universities strengthened their position globally thanks to a large, cheap graduate student workforce (Geiger, 2019). Finally, a robust research infrastructure emerged from private monies and the consistent commitment to research from institutional, regional, and national leadership (Geiger, 2019).

As early as post-World War II, in response to Vannevar Bush's (1945) pivotal call to the federal government to increase financial support of scientific research, growth in basic and applied research in higher education was fueled by increasing federal budgets and facilitation. The creation of the National Science Foundation in 1950 was driven predominantly by Bush's (1945) declaration of the importance of practical research driven by curious scientists to expand and increase human scientific knowledge.

The Increased competition around resources for research seen in the early turn of the century brought with it the increased value of "translational research"–- research that has the potential for direct medical applicability. Policymakers called for more direct linkages between industry and university in the early 1980s, aligning with neoliberalist ideals of efficiency and economic growth (Park, 2011). With funding hard to come by and lawmakers, budget-setters, and the general public eager to see tax dollars in research produce directly applicable cures and treatments, research scientists experienced a shift away from the type of environment where basic discovery for the sake of knowledge is supported and encouraged (Geiger, 2004, 2019;

Hoffman, 2011).

Critics of the view that a shift in priority from basic to applied research occurred due to stronger university-industry ties cite that universities still conduct a vast majority of what is considered basic research (Geiger, 2004; Hoffman, 2011; Kenney, 1986). However, even the critics describe manifestations of this shift, presenting them as separate from the impacts of academic capitalism. For example, Hoffman (2011, p. 451) describes the increase in "consumer-oriented research," a term that encompasses several behaviors that resulted from the increased ties between industry and academic research, including *the pressure to produce "impact-oriented research*", another way of saying that research became more applied and translational.

Declines in State Support. Perhaps the most influential factor in the decline of the public good university was the sharp decline in direct state funding for public higher education universities (B. J. Taylor & Cantwell, 2019). The consequences of reduced state funding have been long-lasting and range from the direct—increased reliance on tuition, resulting in institutions vulnerable to economic and enrollment conditions (B. J. Taylor & Cantwell, 2019)—to the complex and indirect such as shifts in teaching prioritization and an accelerated dependence on adjunct faculty (Martínez Alemán et al., 2015, Chapter 4).

Concurrent with unprecedented incentive opportunities from federal and government initiatives and private patent acquisition, states cut their disbursed budgets to universities beginning in the 1980s. The allocation cuts accelerated significantly during the Great Recession in 2008. University leaders faced strategic decisions regarding survival during a period of stark withdrawal of resources provided by the state for the support of public higher education institutions. Higher education institutions restructured and pivoted to models that encouraged, incentivized, and, today, depending on the school of affiliation, *require* faculty to generate external funding through research grants, contracts, partnerships with industry, or patents. Institutions directed internal resources at developing revenue-generating research. Specifically, in behaviors like these, in which administrators adjust higher education policy, structure, and

efforts to secure external funding, Slaughter and Leslie (1997) define *academic capitalism*.

The decline in state support for universities has placed financial strain on biomedical science programs (Alberts et al., 2014; Glimcher, 2018; Pew Research Center, 2019). The programs, schools, and universities where they reside have adapted over the decades by seeking alternative funding sources, making cost-saving measures, and reevaluating the priorities and structure of the programs. Programs and labs developed an increased reliance on research grants, which are more competitive and less readily available (Cantwell, 2015; Glimcher, 2018; Stephan, 2012). Universities may emphasize faculty securing external research grants and contracts, creating a more competitive environment for research funding (Coaldrake & Stedman, 1999; Fang & Casadevall, 2015; Slaughter et al., 2015). Faculty members may face increased pressure to secure research grants and contracts to support their salaries and research activities, impacting the time and energy available for teaching and mentoring students (Park, 2011). Some universities may allocate resources unevenly, with programs that generate more revenue or have higher external research funding receiving more support, potentially leading to disparities within the university (Bastedo et al., 2009; Slaughter & Taylor, 2016; B. Taylor & Cantwell, 2018).

Focuses on increased efficiency may lead to program or department consolidation and reduced in administrative staff or outsourcing services such as IT or facility maintenance, impacting the availability and quality of support services for students and faculty (Hutchinson, 2005; Yang et al., 2021). Finally, reduced state support for biomedical science programs can lead to increases in tuition. Universities have expanded scholarships to help biomedical science students cover the costs of tuition and living expenses but struggle to maintain competitive support packages, increasing competition between programs and the pressure to secure external funding (Thune, 2009).

Revenue-Pursuing Behaviors. The biotech and biogenetics boom of the 1980s, which included the first biotech patent and the start of the human genome project contributed to the

first significant increase in collaboration and interest between basic science researchers in academia and the private biotechnology industry (Bok & Education Research Complete, 2009, Chapter 4). The landscape of patenting and licensing was transformed from the 1980s onward. Credit for instigating the marked increase in patenting by university faculty belongs to the passage of the Bayh-Dole-Act, a law that provided universities with intellectual property rights for inventions the federal government funded (Stephan, 2012). Subsequently, those rights were extended to universities for inventions funded by other sources of support (Stephan, 2012). The *university* share of all patents issued by the U.S. Patent and Trademark Office went from 200 to 2000 to 3000 from 1969 to 1995 and 2008 respectively (Stephan, 2012).

Driven by the astounding rate of discovery in basic research, national innovation and health initiatives encouraged academic entrepreneurship in academic science. At the turn of the 21st century, reports documented the need for the United States to strengthen investment in innovation, technology, and science (Rising Above the Gathering Storm, 2007), motivating government initiatives to achieve this mission. *Rising Above the Storm* was issued by the National Research Council, warning that the United States needed to invest in research or lag dangerously behind other developed nations. The budget of the National Institute of Health (NIH) doubled between 1998 and 2003 (Stephan, 2012), and organizations such as the National Science Foundation (NSF) began facilitating partnerships between universities and industry through direct sponsorship and the development of research centers. To put this shift in context, the NSF had historically played the role of a depository for scholarly scientific knowledge- by 1990, it was directly funding and sponsoring significant percentages of research in public universities (Nixon, 2012; Rhoades & Slaughter, 2004; Slaughter & Leslie, 1997; Stephan, 2012)

The activities undertaken by academic scientists to collaborate with industry and market their research in application are referred to as “entrepreneurial science” or “academic entrepreneurship.” Activities such as patenting, forming spin-off companies, and pursuing

industry sponsorship for research are examples of behaviors that, while the cultural norm in higher education research today, would have been considered a significant break from the norms of academic science prior to the 1980s. As a result of and for continued promotion of the commercialization of academic research, universities developed and established specific support structures, policies, workforce, and resources. The changes came in the form of physical structures, like incubators and science parks, workforce, such as new administrative offices and technology transfer offices, to navigate legal and procedural processes (Perkmann et al., 2013; Siegel et al., 2003; Thursby et al., 2001).

Biomedical research faculty, students, and staff experience this shift. Students increasingly have opportunities for internships, research projects, and exposure to industry challenges with increased university-industry partnerships (Chatterjee et al., 2019; Lenzi et al., 2020; Sacco, n.d.; Valencia-Forrester, 2019). University biomedical science programs receive increasing amounts of industry funding, which is much-needed for program development and student support, but raising questions about potential conflicts of interest and the influence of industry on academic research (Fredricks-Lowman & Smith-Isabell, 2020; Mars et al., 2008; Wit, 2020). Universities provide increased opportunities to learn about the patenting and development of innovations. Faculty with industry experience are viewed by some programs as valuable, with their practical knowledge and industry connections, and biomedical science programs increasingly include professional development and career preparation in their curricula. Increased commercial activities have led to a more multidisciplinary and business-oriented approach in some university biomedical science programs (Reichman, 2022; Spinrad et al., 2022).

Academic Capitalism as a Theoretical Framework

To recap, the theory of academic capitalism is one in which all participants at institutions of higher education are driven to utilize their efforts and resources to generate profit (Slaughter, 2018). New drivers, incentives, and structures, along with multiple compounding factors,

ultimately led to “institutional and professorial market or market-like efforts to secure external moneys,” or in other words, *academic capitalism* (Slaughter & Leslie, 1997).

Researchers have used academic capitalism as a means with which to understand a multitude of phenomena in higher education including but not limited to institutional stratification and inequality (Reichman, 2022; Z. W. Taylor & Bicak, 2020), faculty labor and experiences (Bullard, 2007; Gonzales et al., 2014; Mendoza & Berger, 2008; Szelényi & Bresonis, 2014), governance and organization (Croucher & Lacy, 2022; Rubins, 2007; Sue-Yeon Song, 2019), experiences of female academics (O’ Hagan et al., 2019), and undergraduate student entrepreneurship (Mars et al., 2008) to name just a few. Cantwell and Kauppinen (2014b) justified the utility of academic capitalism as an ideal approach to examining various conditions in higher education due to the theory’s attention to structural *and* behavioral elements. Academic capitalism unveils the impact of neoliberal policy and surrounding governance on higher education’s organization, funding, regulation, and structure (Rhoades & Slaughter, 2004). In addition, it examines the market and market-like behaviors of administrators, faculty, students, and all individuals and groups in and around higher education (Rhoades & Slaughter, 2004).

Cantwell and Kauppinen (2014b, p. 6) explained that academic capitalism’s usefulness as a theoretical and conceptual framework for explaining shifts in higher education policy stems from the fact that it addresses structure and behavior *and* that it lends itself well to forming connections theoretically with other concepts that are useful in “making sense of knowledge-driven economies.” Academic capitalism draws on concepts with strong ties to organizational sociology, higher education studies, science and technology, policy in research, government and regime, and critical social theories. These theoretical and explicit links facilitate academic capitalism’s utility in assessing higher education’s social, political, and economic conditions (Cantwell & Kauppinen, 2014a; Martínez Alemán et al., 2015).

There are three reasons academic capitalism is beneficial as a framework for examining

the well-being of biomedical graduate students at a research-intense university. First, while the trends and behaviors associated with academic capitalism have penetrated most disciplines, they are most notable in the science, technology, engineering, and mathematics (STEM) subjects. Academic capitalism has been extensively described in biomedical research, making it an ideal framework for this work. Second, graduate students are essential producers of knowledge in research at universities (Slaughter et al., 2002). As measured by their acquired research funds, pace of publication, and production of data and research outcomes doctoral students' contribution to the economy is additional justification for using a model that centers the role of graduate students as knowledge producers (Larivière, 2012). Finally, this study has the potential to benefit from the extant literature establishing downstream effects of academic capitalism on those conducting research in higher education. In summary, academic capitalism centers my chosen context and participants providing relevant and established constructs for study.

Exploring Relationships: Academic Capitalism and Graduate Student Well-Being

After reviewing the consequences of academic capitalism on the nature of the biomedical research lab and the structures within which research resides on university campuses, the following sections summarize the systemic imbalance in biomedical research that is widely viewed to be a result of academic capitalism. As discussed below, this imbalance is the contextual basis for exploring potential conceptual and thematic relationships between academic capitalism and graduate student well-being.

Systemic Imbalances in Academic Biomedical Research

The perspective that academic biomedical research is ridden with "systemic flaws" is not novel and has been addressed by researchers of higher education as well as those in biomedical science (Alberts et al., 2014, p. 5773; Holloway, 2015; Koenig, 2019; Slaughter, 2018; Teitelbaum, 2008). While critics such as Maria del Pilar Mendoza make the case that faculty and academic culture remain unaffected by academic-industry partnership (2007;

Mendoza & Berger, 2008), analysts of higher education organizational models and leaders of scientific departments in higher education lean towards one overarching significant consequence of the current model of fiscal support: *increasing numbers of scientists competing for limited funding opportunities to conduct research at increasing costs*.

Alberts et al. (2014) eloquently summarized this central issue of mismatched supply and demand in biomedical research. The post-Vannevar Bush era described earlier was a period of exciting discovery in biomedical sciences in the 1980s. While states were cutting their budgets to universities, federal grants and private patent partnerships exploded. Those decades, thanks to federal support and incentives, brought remarkable discoveries, innovations, treatments, and cures, placing the United States undeniably in a position of leadership in biomedical scientific discovery (Alberts et al., 2014).

This period of abundant NIH funding came together with the growth of scientific doctoral programs in higher education, driven partly by increased federal training grant accessibility. Arguably, in 2010, the mission was accomplished to “ensure that the United states maintains its leadership in science and engineering to compete successfully, prosper, and be secure in the 21st century” (Rising Above the Gathering Storm, 2007, p. 11). However, federal budgets—specifically the NIH budget—have slowed significantly since the 1990s, with a stark reduction in funding for research following the 2008 Great Recession and its budget aftermath.

The predominant working model in biomedical laboratories is one in which graduate students and postdoctoral researchers conduct a significant amount—the majority—of the research. This model becomes increasingly relevant in a world where research faculty are increasingly tasked with applying for grant funding and are more reliant on trainees in the lab. As a result, scientists train as many scientists as possible. Federal budget decreases lead to declines in success rates of NIH grant applications, causing faculty to spend more time and energy applying for grants, thus needing more and more trainees in the lab. This combination of factors has resulted in *an imbalance between the number of dollars needed to operate, the*

number of dollars coming in, and the output of far more scientists than available positions.

How does competition for limited federal and private grant support impact the behaviors, decisions, and daily lives of scientists and their trainees in higher education? Moreover, does that shape doctoral students' well-being in biomedical science research?

Graduate Student Well-Being in an Imbalanced World

Declined government support, the advent of the global economy, and the emergence of the knowledge market have contributed to the phenomenon of universities and colleges participating in market-like activities to bring revenue to their institutions. Over the last few decades, this has drastically changed the atmosphere in biomedical science labs, which in turn has had a trickle-down effect on trainees, including graduate students.

Competition for grants and reduced availability of such funding has required scientists to focus on asking research questions that appeal to the goals of purse string holders, primarily exploring applied scientific questions and staying safe within the realm of feasible and narrow. Knowing the importance of academic engagement in self-reports of graduate students' well-being, focusing on applied science may play a role in scientific engagement-related well-being.

The need to produce more, publish in more prestigious journals, and acquire grant funding has led to an increase in the research workforce, including doctoral students, which has contributed to a saturated job market. How does the saturated job market impact doctoral students' feelings about their futures and careers? Hypercompetitive environments that pull faculty away from their research and toward grant applications and other bureaucratic obligations might contribute to isolation, lack of guidance, and a lack of connection with mentorship.

These factors may impact researchers and their trainees- especially their graduate students. Reduced career satisfaction, academic enjoyment, financial confidence, career security, connection to mentorship, and positive relationships in the lab are all factors linked to students' reports of declined well-being. Does academic capitalism, a symptom of the ever-

increasing hold of neoliberalist attitudes that shape higher education institutions, play a role in the increasing reports of diminished emotional and mental well-being and health in graduate student populations in biomedical research?

Academic Capitalism in the Lab: Proposed Study and Contribution to Literature

Evidence in the literature supports the need to learn more about biomedical science doctoral students' well-being. As demonstrated, this population is more susceptible to reduced well-being and increasingly concerning rates of declining mental health. Several factors impact students' well-being and previous studies of doctoral student well-being have primarily focused on isolated determinants. A multidimensional approach would allow for considering a complicated cascade of events and factors simultaneously creating academic environments in which these students struggle to have positive, happy experiences while in graduate school.

Concurrently, academic capitalism as a theory examines many phenomena in higher education sciences. It was a platform from which to investigate changes in the faculty work life and role in academics and industry (Bullard, 2007; Gonzales et al., 2014; Koenig, 2019; Mendoza & Berger, 2008; Park, 2011; Szelényi & Bresonis, 2014). Governance in higher education research was examined from the academic capitalist lens (Croucher & Lacy, 2022; Rubins, 2007; Sue-Yeon Song, 2019). Specific student experiences, predominantly around their career choices, their attrition rates, the exchange of their output as capital, and the experiences of minoritized populations have all been explored through academic capitalism (Hutchinson, 2005; McGee, Naphan-Kingery, et al., 2019; Mendoza, 2007; O' Hagan et al., 2019; Slaughter et al., 2002; Steinþórsdóttir et al., 2019; Thune, 2009).

However, the current gap in research appears to be the question of how organizational and procedural impacts of academic capitalism could be shaping doctoral students' well-being. Academic capitalism has yet to be a framework for exploring happiness, mental health, or well-being. I hoped to paint a clearer picture of how reduced state funding, prioritizing applied research, globalization, and revenue-pursuing behaviors may be impacting biomedical science

students' subjective well-being. Elucidating more on the subjective mental and emotional well-being of biomedical science doctoral students can help guide institutions of higher education in serving them, either by shaping strategies to combat reduced well-being or to reduce experienced harm from the academic capitalistic culture in research.

Chapter III

Methodology and Methods

This study explored possible **underlying relationships** between reduced well-being in biomedical science doctoral students and the increasingly dominant paradigm of academic capitalism in higher education. My goal was to formulate a theory about the relationship between student well-being and academic capitalism by talking to biomedical graduate students about their self-perceived well-being in the context of features of academic capitalism. I asked, "How is academic capitalism shaping the growing mental health crisis among biomedical science doctoral students?" and hoped to develop a theory on the relationship between two increasingly present phenomena: academic capitalism, and a graduate student mental health crisis.

Constructivist Grounded Theory: Rationale and Design

In chapter two I reviewed the research on academic capitalism as a theoretical framework and phenomenon, and graduate students' well-being. However, as indicated in chapter one, there remains a lack of established theory linking the two concepts. The constructivist grounded theory method uncovers meaning and theory through inductive reasoning from qualitative data (Charmaz, 2014; Glaser & Strauss, 1967). It is an ideal approach to examining theoretical links between academic capitalism and student well-being.

Grounded theory "moves research and researcher towards the development of theory" (Charmaz & Mitchell, 2022; Farrow et al., 2020, p. 45). A grounded theory approach provides a systemic method of making connections and constructing theories from meaning, which participants provide from their experiences, actions, and beliefs. A grounded theory approach allows for the creation of new theories with a critical perspective, aiding in understanding how biomedical graduate students experience their well-being in relation to systemic academic capitalism in higher education.

The objective of this study was to move from the specific (what students experience in

the culture and patterns of their daily lives) to the general (the relationship between graduate student well-being and academic capitalism). Based on findings from biomedical doctoral students, the goal was to construct a preliminary theory demonstrating relationships between academic capitalism and student well-being. Thus, it was critical to implement a study design that provided the flexibility to remain open to emergent concepts and themes, supported sensitivity to constant and intense interaction with the data, and allowed for a change in the research plan.

Grounded theory methodology provides the structure for this type of iterative study design. Effective grounded theory research relies on the researcher remaining engaged and open-minded to what the data are saying to guide them towards a culminating theory. The philosophical underpinnings of grounded theory impact each aspect of the research design, and the iterative nature of data collection, analyses, and theory generation becomes salient. Figure 1 is adapted from Chun Tie et al. (2019) and demonstrates the iterative relationship between the steps of the research design plan.

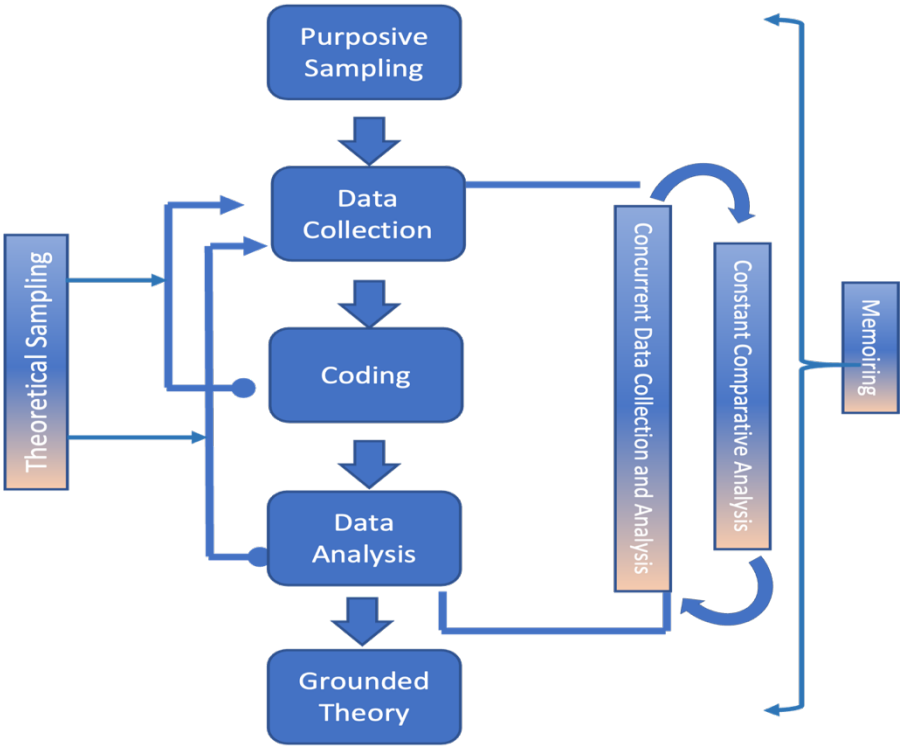
Participant sampling, data collection, data analysis, and theory formation are not linear or sequential steps in constructivist grounded theory methodology. Reviewing initial qualitative data allows ideas and concepts to repeat and emerge, enabling a flexible assessment of the data collection process and the data (Glaser & Strauss, 1967). The data is analyzed simultaneously and constantly throughout the data collection period. As the data is analyzed, the results further inform data collection, and the sampling approach is continuously reassessed. This process gathers as much information as possible to better lead to theory saturation. Simultaneous data collection and analysis is critical to grounded theory research (Charmaz, 2014). Without it, the researcher risks missing identifying patterns, connections, and concepts critical to the question(s) posed (Engward, 2013).

Constructivist Approach

This study concerned the graduate students' subjective hedonic well-being (Kahneman

Figure 1

Iterative Nature of Grounded Theory Research Design



et al., 1999). Meaningful dialogue about their happiness and satisfaction in graduate school could uncover multiple truths, allowing for the construction of multiple valid theories about the connections between academic capitalism and biomedical doctoral students' well-being.

This philosophical approach, paired with the belief that the researcher cannot separate their experiences and values from how they evaluate data, undergirds a constructivist philosophy (Mertens & Wilson, 2019). Constructivists formulate the focus of their research, including the intended participants, data collection, and data analysis, with consideration of the influence of their own beliefs (Guba & Lincoln, 2003). A constructivist approach in this study supported my goal to inductively derive an emergent theory about academic capitalism and declining well-being in biomedical graduate students.

Research Methods

The methods and procedures I employed closely follow those outlined for constructivist

grounded theory research (Charmaz, 2014; Chun Tie et al., 2019; Mills et al., 2017; Sbaraini et al., 2011). In the following sections, I outline those methods, including participant site, sampling techniques, data collection, and analysis. I will conclude this section by sharing my researcher positionality, how I addressed rigor and credibility, and any delimitations and limitations of this study.

Research Site

The recruitment site for interview participants was a large flagship research university (LRU) in the mid-Atlantic region of the east coast. LRU is a Carnegie R1 (The Carnegie Classification of Institutions of Higher Education, n.d.) institution. I aimed, using the research question, to elucidate concepts and themes around academic capitalism, and institutions with smaller-scale research missions were unlikely to be ideal representatives of cultures where academic capitalism has strong footholds. Additionally, institutions with Carnegie ratings less than R1 have smaller pools of doctoral graduate students.

LRU offers eight Ph.D. degrees within its umbrella[1] biomedical science graduate program (BIMS), including Biochemistry and Molecular Genetics, Biophysics, Cell Biology, Experimental Pathology, Microbiology, Neuroscience, Pharmacology, and Physiology. Organizationally, BIMS is housed in the School of Medicine (SOM) at LRU. However, BIMS-affiliated faculty have primary appointments in various schools, including but not limited to the College of Arts and Sciences (CLAS), the School of Engineering and Applied Science (SEAS), the SOM, and various clinical departments in the Health System. In addition to the BIMS program at LRU, participants were recruited from the Biomedical Engineering (BME) program, a Ph.D.-granting program housed in SEAS at LRU.

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[1]Typically, "umbrella" programs admit students that are undifferentiated, and who choose specializations later in their first year. The only degree program within LRU's BIMS program that recruits students directly through the BIMS applicant pool is the Neuroscience PhD program. The program falls under the BIMS organization and receives infrastructural, financial, academic, programmatic, and staff support from BIMS.

Ethical Considerations

Researchers in education have the responsibility to protect the “rights, privacy, dignity, and sensitivities … and also the integrity of the institutions within which the research occurs” (Strike & American Educational Research Association., 2002, p. 2). This responsibility is primarily involves obtaining consent, protecting from harm, and ensuring privacy (Drew et al., 2008). The first step towards this responsibility was to request and obtain approval from the university’s Institutional Review Board (IRB) to protect the research participants. This approval was acquired prior to any participant recruitment or data collection.

Consent. According to LRU's institutional review board, each participant was asked to provide verbal informed consent and was provided with a copy of the Information Sheet (Appendix A).

Participants consented to having their interviews audiotaped with the assurance of anonymity. They were informed that they could withdraw from the study at any time. They were also informed of the risk of speaking about sensitive topics such as mental health and emotional well-being, and resource documents were available should any participant experience distress and require them.

Privacy. The participants’ privacy was protected. Each participant was assigned a pseudonym, and the data was organized and stored without identifying information. Care was taken not to reveal identifying information such as locations or names of individuals.

Initial Sampling

Purposive criterion sampling was used to recruit the initial participant sample. Grounded theory research aims to create a theoretical model by learning about experiences within a specific and representative population (Charmaz, 2014). As such, initial participants were excluded or included based on their potential to provide information-rich data sets (Bryant & Charmaz, 2022). Table 1 outlines the exclusion and inclusion criteria used for the initial participant sampling.

Table 1

Initial Inclusion and Exclusion Criteria

Criteria Type	Criteria Description	Rationale
Inclusion Criteria	*Currently enrolled* in one of the eight Ph.D.-granting degree programs within BIMS at LRU. *Currently enrolled* in the BME program at LRU. *An alumnus* of the BIMS or BME program at LRU.	The initial sampling criteria were broad to allow for flexibility as the study progressed using theoretical sampling to guide future sampling process.
Exclusion Criteria	A *first, or second-year student* in either one of the BIMS programs or in the BME program.	First and second year students in BIMS and BME are primarily completing core coursework and their laboratory rotations. They have not selected mentors or doctoral research labs. As such, they may not be ideal sources of “rich” data about the culture and daily patterns in research affiliated with academic capitalism.

Participant Recruitment

Recruitment of the initial sample of participants was conducted in two processes concurrently in parallel, one for currently enrolled students and one for alumni participants. Participants had access to all the relevant information about this research, such as my contact information, the study description and rationale, consent, and information forms through a booking page they could access with a link or QR code. Grounded theory research participant recruitment can be time-consuming due to the evolving participant criteria (Bryant & Charmaz, 2022), and techniques such as this can reduce some of the time spent in the recruitment process.

Currently Enrolled Student Participant Recruiting. I began initial sample recruitment by emailing the administrators of the BIMS and BME programs requesting their assistance in distributing the recruiting materials. I explained my research objectives and asked program coordinators to distribute my recruitment flyer (Appendix B) to their students through their current listservs. In addition to working with program gatekeepers, I directly recruited participants using social media platforms. I posted Appendix B as an image-format flier on social media sites (Instagram, Facebook) and tagged the programs of interest at LRU. I employed snowballing recruiting techniques by asking students and colleagues to forward the recruitment emails and posts to their friends and colleagues.

Program Alumni Participant Recruiting. I directly recruited alumni participants using social media platforms and email outreach. I began initial sample recruitment by posting a participant recruitment notice on LinkedIn, Facebook, and Instagram, directed at BIMS and BME program alumni. I used the same image-format flier that I used for currently enrolled student participant recruiting (Appendix B). In addition, I employed snowballing methods as I recruited alumni by asking them to share the post or recruitment email with their alumni friends.

Theoretical Sampling and Theoretical Saturation

Following constructivist grounded theory methodology (Chun Tie et al., 2019) I coded

and analyzed the first interview immediately after it was completed to use the results to guide the next sampling criteria. This process, called theoretical sampling, is central to grounded theory design (Bryant & Charmaz, 2022; Charmaz, 2006; Glaser & Strauss, 1967) and allowed a theory to develop. For example, after the first few interviews, I realized I needed to ensure that the following participants were not affiliated with a specific program in BIMS/BME to ensure access to diverse experiences. I used theoretical sampling to avoid interviewing an over-representative number of alumni, who responded quickly and in large numbers to my recruitment notices. Table 2 displays the final list of participants using pseudonyms to protect their identities.

Table 2

Study Participants

Participant	LRU BIMS/BME Status
Anna	Alumnus, < 1 years.
Nathan	Current,5th year.
Matt	Current, 5th year.
Lyla	Current, 4th year.
Roger	Current, 5th year.
Dan	Current 5th year.
Amy	Current 4th year.
Alice	Alumnus, <2 years.
Holly	Alumnus, <1 year.
Joe	Current, 6th year.

As I analyzed the data initially collected from criterion-targeted participants, I examined them for gaps, connections, uncertainties, new questions, and emerging concepts. I used any emergent themes to select the criteria for the following participants. Other components of the data collection plan, such as the interview questions and format, were reassessed during each

data analysis session. This process led to data generation that was increasingly rich and focused on forming a theory.

Theoretical saturation is a concept similar to data saturation in qualitative research (J. M. Corbin & Strauss, 2015) but more specifically refers to the point in grounded theory research when new data collected does not add any additional insight to a formulating theory that is substantiated in the data thus far (Bryant & Charmaz, 2022; Charmaz, 2014; Chun Tie et al., 2019; Glaser & Strauss, 1967). Throughout the constant comparison of new data collected, a strongly supported final theory emerged if new data from additional participants continued to support my working theory. That indicated theoretical saturation, at which point additional interviews were no longer required. For example, when nine of the ten analyzed transcripts coded for the first phenomenon described in chapter four, I had reached theoretical saturation for that concept, as no new information would emerge.

Data Collection

Data was collected through semi-structured interviews with participants in the format of a series of open-ended questions. Interviews as data collection tools allowed for building rich, informative descriptions of participant experiences, feelings, motivations, and concerns (Hancock & Algozzine, 2016). The constructivist research design of this study benefited from a semi-structured interview format, allowing me to gain an understanding of the students' own experiences around their well-being.

The interview protocol used for data collection is included in Appendix C. I began the interviews with a reminder of my purpose, and I clarified my role during the interviews as a researcher. Then, I asked open-ended questions centered around answering my research questions, and prompting the student as needed to acquire more in-depth descriptions and information. The interviews were audio recorded and transcribed in preparation for data analysis.

Theoretical sampling requires researcher flexibility and reflexivity prior to and during the

interviews (Foley et al., 2021). Following the grounded theory approach, the questions steered each interview in the direction that I was led by emergent concepts and theory. The purpose of the interviews was to gain insight into programmatic and environmental factors affected by academic capitalism and learn about how graduate students perceive their well-being in the context of those factors. The prompts chosen in the initial interview protocol (Appendix C) were carefully selected after an informed process that consisted of a critical literature review exploring academic capitalism as a theoretical concept and as an influencer on conditions in academic research. The results of the literature review guided the focus of the questions to areas that consistently arose as targets of both academic capitalism and graduate student well-being such as mentoring, relationships with members of the lab and the scientific community, and the process of finding joy in scientific research. Foley et al. (2021) advise that the interview protocol should be "so succinct that going out to do the first few interviews might even seem a little intimidating: the researcher should be wondering-- is the interview guide sufficient to go by?" (p. 3). For these reasons, the interview protocol in Appendix C provided prompts, but avoided specific, long, and detailed questions.

Positionality & Researcher-as-Instrument Statement

The success of grounded theory research relies on the researcher remaining open and working to listen to what the data reveal. While remaining receptive to what the data exposed, I acknowledge that the way I collected, received, and analyzed the data was affected by my personal experiences and background. Disclosing my relationship with the research topic in memos, while peer debreifing, and in this capstone, is one of the steps I took to identify the impact my life story and experiences had on how I interpreted what I learned from the graduate students.

After completing my undergraduate degree, I spent two years conducting research in a neuro-behavioral-immunology laboratory at an institution of higher education. Following that, I was an active and enrolled student in a neuroscience Ph.D. program. I struggled with my mental

health during my experience as a graduate student, and that experience culminated in a failed defense of the qualifying exam. I petitioned to my dissertation committee at the time describing the challenges I was experiencing, and my petition to continue my doctoral studies was denied.

A few years after that, I served as the Neuroscience Graduate Program coordinator for nine years at an R1 university. My role included supporting graduate students during their journey from admission to graduation or, in some cases, to program departure. I supported students in the program through incidents in which they experienced significant distress during their time as doctoral students.

My personal connection to the research topic and my former identity as a potential participant was a benefit in conducting this study. My familiarity with the research culture and infrastructure within which the students reside and awareness of the of academic and research expectations they experience allowed me to join with them easily due to shared knoweldge. This context expedited my ability to be reflexive during interviews and data analysis.

However, due to my positionality, I exercised caution when interpreting and conveying of the stories of the participants. I employ reflexivity, bracketing, member-checking and peer debriefing to avoid projecting my own experiences into theirs (McGregor, 2018). Member checking, the process of regularly checking in with participants by sharing my interpretations of what I have learned from them, and confirming that they feel fairly and accurately represented (Charmaz, 2014) was especially critical. I utilized this often throughout the 60 to 90-minute interviews, repeating and synthesizing any themes or concepts that emerged during the interviews. Additionally important was the employment of peer debriefing as a tool to guard against my explicit and implicit biases. I peer de-briefed with colleagues throughout the analysis process. During the theory development phase I debriefed with my peer doctoral students during a works-in-progress writing group.

Data Analysis

Coding and Constant Comparative Analysis. Grounded theory data analysis utilizes

constant comparative analysis. This is a process of data analysis that allows for more abstract concepts to emerge that may be related to an evolving theory. In constant comparative data analysis, emergent codes are compared to other emergent codes, in real time, every time more data is collected (i.e., more interviews are completed). Codes are grouped into common categories by themes or concepts, and those categories are then compared to other categories and themes in the data. Emergent codes and themes continue to be compared across and within data as it is collected, allowing for theories to emerge (Chun Tie et al., 2019; Glaser & Strauss, 1967; Miller, n.d.; Sbaraini et al., 2011).

Grounded theory data is analyzed immediately after its collection (Bryant & Charmaz, 2022). The first stage of analysis is “initial coding” when I examined the interview for as many possible emerging concepts and themes as I can discern (Mills et al., 2017; Sbaraini et al., 2011). Using the concepts and theories from the literature review as guides, I assessed the data for relevance to my research question and broke it down, line-by-line, into smaller segments for comparison to other data sections or data sets. As broader categories emerged from the smaller segments, I progressed to intermediate coding, known as focused coding in constructivist grounded theory (Chun Tie et al., 2019; Glaser, 2016; Mills et al., 2017; Sebastian, 2019).

Focused coding is the process of further developing the emergent codes into categories around core variables (Age, 2014; Engward, 2013; Mills et al., 2017). I identified relationships between categories of the collected data, which allowed me to begin to develop a theory. Focused coding involved selecting the most significant initial codes and testing them extensive data. Focused coding provided the codes that had the most analytical power to categorize the data comprehensively and meaningfully. This step was important in helping me identifying patterns and relationships between the codes. As I analyzed data, I looked for contradictions of previously collected data, expanded upon previously emergent codes and categories, or upon new data that supported previously isolated categories and themes. Memo writing, described further in the next section, was an important tool for focused coding. Another tool in this phase

of coding recommended by Charmaz (2014, 2014) was the use of gerunds to focus the initial codes into this elevated-meaning code group. Gerunds, verbs ending in “ing,” emphasize actions and processes which assisted me in assigning them to relational categories during the next phase of theoretical coding.

The third and final stage of data analysis was theoretical coding. The theoretical coding stage of data analysis was when I integrated the data into a culminating and substantive theory (Chun Tie et al., 2019; Mills et al., 2017). In this final phase of the coding process, I deviated slightly from traditional constructivist grounded theory methodology and utilized axial coding methods. Axial coding is a process used in the Strauss and Corbin approach to grounded theory. It involves reassembling the data that were fractured during open coding to explore relationships between categories and subcategories. This step is about connecting categories to their subcategories and identifying the conditions, actions/interactions, and consequences that relate to those categories. I put the fractured categories and variables back together into a cohesive story, one that can help depict the relationship between academic capitalism and biomedical graduate student well-being.

The outcome of axial coding is a set of complex relationships that links categories to their subcategories, helping to form a coherent and nuanced theory. It creates a framework that explains how categories are related to each other through various conditions, strategies, and outcomes. The following chapter includes additional description and context for the axial coding relational paradigm I used for theory development, the Corbin and Strauss phenomenon theory coding paradigm (2015).

Table 3 displays an example of the evolution of the coding process that led me to the emergent phenomenon “Avoiding Academia Would be Better for my Mental Health,” described in chapter four. I started by grouping line-by-line codes into general categories. During subsequent coding, I refined the initial codes into gerunds, allowing a central phenomenon to emerge. The refined codes were assigned axial codes relational groups which will be further

elaborated in chapter four.

Memo Writing. The memo writing process is seen by many as the most critical part of the grounded theory methodology (Baid, n.d.; Bryant & Charmaz, 2022; Charmaz, 2006; Chun Tie et al., 2019; Engward, 2013; Miller, n.d.; Sbaraini et al., 2011). I wrote detailed memos immediately after each interview, and at additional time points during the analysis process. Memo writing was the tool with which I reflected on the interviews and provided me the space to capture my thoughts and feelings throughout the process. Memoing was critical immediately after the interviews so that my experience of them remained unaltered by the passing of time or by any reconsideration or reframing that occurred.

In addition to memo writing *after* the interviews, I wrote memos as I analyzed the data. In this type of memo, I share any insights I had as I compared codes and themes to each other. The memos were a place to describe and assign meaning to the codes and themes that emerged and where I shared the process from which my theory emerged. Bryant and Charmaz (2022) describe memos as the method in which researchers “conceptualize the data in narrative form” (p. 245).

Rigor: Credibility, Auditability, and Fittingness

Scholars of qualitative and grounded theory research have contributed volumes to the discussion and discourse around the ideal standards of credibility and trustworthiness in qualitative and grounded theory (Charmaz, 2014; J. M. Corbin & Strauss, 2015; Glaser & Strauss, 1967; Guba & Lincoln, n.d., 2003; Sbaraini et al., 2011). Chiovitti and Piran (2003) outlined the importance of distinguishing measures of credibility in grounded theory from other qualitative methods. The authors identified eight strategies specific to grounded theory with which to achieve standards of rigor that fall in the categories of credibility, auditability and fittingness (Chiovitti & Piran, 2003). These strategies guide my work based on the alignment with my research methodology, method, and objectives. Table 4 presents the eight methods of research practice for enhancing standards of rigor alongside the way I addressed each in this

study.

Table 3

Coding Process: Initial, Selective, Theoretical, Axial

Initial Code	Selective Code Round 1	Selective Code Round 2	Refined Gerunds for Central Phenomenon	Axial Code
Putting off the salary pay scale ladder by 5 years for a post doc really started to weigh on him.	career	Strategizing career next steps for what's best down the line.	**Confirming** that low academic faculty salaries factor in my decision to pursue a different career track.	Causal Condition
Academic salaries and the idea of doing a post doc are also reasons she doesn't want to work in academia.	finances	Confirming the importance of salary in my career choice.	**Confirming** that low academic faculty salaries factor in my decision to pursue a different career track.	Causal Condition
She wants to be somewhere where the translational aspect of the research is even more direct and clear than in academic research.	career	Ensuring that my research feels directly impactful on the world.	**Desiring** a stronger connection between my work and translational impact.	Causal Condition
She left that position for a job where she felt like she was going to help someone.	engagement	Caring that what I do matters.	**Desiring** a stronger connection between my work and translational impact.	Causal Condition

Table 4

Academic Rigor in this Grounded Theory Study

Standards of Rigor	Strategies Toward Achieving	Research Design Element Addressing the Strategy
Credibility	*1.* Let the participants guide the interviews.	*1.* Semi-structured interviews with general prompts and reflexivity during interviews.
	2. Check theoretical construction against the participants' meanings	*2.* Constant comparative analysis and member-checking after each interview.
	3. Use participants' actual words in the theory coding.	*3.* Initial coding using words from the interview transcripts.
	4. Articulate the researcher's personal views and insights about the phenomena	*4.* Memo writing.
Auditability	*5.* Specify the criteria built into the researcher's thinking.	*5.* Documenting the theoretical sampling and saturation process through memo-writing and documenting the coding process.
	6. Specify how and why the participants were selected.	*6.* Describing the theoretical sampling process and documenting it. Seeking and identifying a disconfirming case as required (Booth et al., 2013)
Fittingness	*7.* Delineate the scope of the research.	*7.* Describing the setting and sample process and documenting sampling.
	8. Describe how the literature relates to each category which emerged in the theory.	*8.* Memo writing, extensive journaling, writing the results. Audit train of evidence of the material form which the theory emerged.

Note: Adapted from (Chiovitti & Piran, 2003)

Delimitations and Limitations

As with any sound study, limitations exist. First, this study is limited to examining the experience of the *doctoral* student in biomedical science. As such, it excludes any potentially valuable information about how academic capitalism might impact other players in academic research such as postdoctoral fellows, undergraduate research students, lab technicians and staff, research faculty, and principal investigators. Another delimitation is the restriction to examining LRU, an R1 Carnegie institution. While academic capitalism has a wide net of impact in higher education and industry, to examine its impact most closely, I have chosen to limit my interview participants to those at an institution most likely to be deeply engrained in academic capitalistic behaviors; that is, institutions that explicitly aim to increase access to research funds.

There are limitations to grounded theory methodology and methods. It can be difficult to recruit participants because of the process of theoretical sampling: there is a need to continuously recruit participants while data is being analyzed and the recruiting criteria can be a constantly shifting. Reaching theoretical saturation can take a long time, and data analysis on a rolling basis means that it is important to organize large amounts of data and find ways to keep track of the information as I go forward.

Additional limitations to this work lie in the inherent interpretability of words from interviews. Data analysis of words as codes might leave out other important factors such as the participants' tone, mood, intention, etc., and it will be important to write detailed memos after each interview to avoid losing the meaning behind the words. Another limitation may be in the recruitment tools used: there may be a self-selective bias of participants who had specific experiences around their well-being or mental health due to the topic of research. In addition, bias due to my own experiences as a graduate student with mental health challenges may bias the perception of the words and meanings.

Summary of Methods

This study aimed to uncover underlying connections between reduced well-being in

biomedical science graduate students and the increasingly dominant paradigm of academic capitalism in higher education. My goal was to formulate theory about the relationship between student well-being and academic capitalism by talking to biomedical graduate students about their self-perceived well-being. Using a constructivist grounded theory approach, the methods I described in this chapter allowed me to uncover an emerging theory connecting graduate student well-being and academic capitalism. First, I recruited participants from a large research-intensive university's biomedical science doctoral programs using criterion specific sampling. After initial data analysis, I employed theoretical sampling to recruit additional participants. I conducted semi-structured interviews and employed reflexivity and theoretical saturation to move towards emerging theory. Data analysis was conducted in three phases including extensive memo writing documenting my process. Included in this chapter were the tactics I used to ensure academic rigor, and a description of the delimitations of this study and potential limitations.

Chapter IV

Research Findings and Results

The research in this capstone sought to explore how academic capitalism may be shaping the well-being of biomedical doctoral students. By identifying conceptual links between academic capitalism–and its associated structures and behaviors–and the well-being of doctoral students, this work resulted in a theory that facilitates the development of programmatic or institutional recommendations to improve students' experiences in these programs.

The findings consist of data from interviews with biomedical doctoral students or recent alumni. Following a constructivist grounded theory approach, the data were first analyzed using open coding. In chapter three I described the subsequent focused coding process in which open codes were developed into gerunds to identify common central phenomena, further refined, and then elevated into analytical categories for theoretical coding. Constant comparative analysis revealed essential meanings and patterns related to the central phenomena. Using a Strauss and Corbin-inspired method for theory development (J. Corbin & Strauss, 2008), relationships between concepts and central phenomena emerged during axial coding.

I organized the results in this chapter using core aspects of the phenomenon theory coding paradigm (J. Corbin & Strauss, 2008) to facilitate theory development and description. Following is an outline of contents of chapter four organized by the conceptual relationships identified during theoretical coding, including a review of the definitions of those relationships described in chapter three:

1. Contextual conditions: Corbin and Strauss' phenomenon theory coding paradigm defines contextual conditions as concepts that describe environmental conditions that influence how the central phenomena are situated, or describe the circumstances in which the participants' actions/strategies took place (J. Corbin & Strauss, 2008). The contextual conditions in this study were *conditions that represented academic capitalism in the participants' environments*. In the first section

of this chapter I describe the data confirming academic capitalism as the contextual condition in which the central phenomena emerge, and the participants conduct their graduate studies and research.

2. Central phenomena: Two central phenomenon emerged throughout the analysis process. These were identified as concepts that a) were salient throughout the interviews, b) existed in the context of academic capitalism, and c) were conceptually relevant to graduate students' well-being as identified in the literature.
    i. Causal conditions: Each phenomenon is discussed in the context of its related emergent causal conditions. These were codes in the data that answered the question, "why did this phenomenon happen?"
    ii. Actions/strategies: Actions/strategies were codes that represented participants' actions or strategic thinking that resulted from the phenomenon.
    iii. Consequences: Consequences were identified in the data as outcomes of the actions/strategies taken by the participants.
    iv. Intervening condition: In the case of one central phenomenon, a variable emerged that impacted or mediated participants' actions and strategies related to the phenomenon. This is an intervening condition.

This chapter begins with evidence emergent in the interviews of the participants' context of academic capitalism. Coded from the transcripts, these data served as the contextual condition relationally linking to causal conditions to both central phenomena, and eventually serving to map the connections between academic capitalism and well-being. Those maps will be discussed in the fifth and final chapter.

After describing the participants' contextual conditions, the chapter continues with a description of the central phenomena through the voices of the interview participants. The phenomena are a) "Avoiding Academia Would Be Better for my Health" and b) "My Advisor is Great, But…" The participants described variables that influenced the phenomenon's

occurrence (causal conditions), any purposeful actions they took in response (actions/strategies), and any emergent consequences or intervening conditions related to the central theme. The chapter concludes with a summary of both central themes, and their relational theoretical concepts.

Academic Capitalism as the Contextual Context

The students and alumni who participated in this research were never directly asked about academic capitalism. The interviewer explained the term to students who requested additional information after the interview. Nevertheless, central elements of the theory of academic capitalism emerged throughout our conversations. The following three sections organize research findings demonstrating the context of academic capitalism according to the central themes of the original theory as described in the literature review in chapter two.

In the Lab: Neoliberalism, Globalization, and Reduced State Funding

Data results indicated that the impacts of neoliberalism, globalization, and reduced state funding–as described in the theory of academic capitalism–are tangible to doctoral students in biomedical science programs as part of their academic context and culture. Seven of the ten interview participants shared different elements of these concepts in ways that are particularly meaningful for discussions about student well-being.

Concern about the increasingly competitive job market for academic scientists was common among the participants. While Roger expressed relative confidence in securing an academic postdoc position if he wants one, when it came to securing a faculty position he said, “but that next stage, the job market's tough.” Lyla saw other students in her lab struggle to find positions, and even though “they eventually get it,” it is “not a given, a hundred percent quick thing!” Anna had been concerned about the job market from the start of graduate school and connected it to her sense of financial security when she said:

> I have known since I started graduate school that I wanted to continue on tenure track … and it’s a really competitive path to choose. So, job availability honestly has been my

biggest concern as far as my financial security.

Despite successfully securing a postdoctoral grant and a three-year postdoctoral contract, Anna confessed, “I would say I'm still in that same spot where it just feels so competitive and it feels so hard to get there.” Lyla's fear of being less competitive due to her international citizenship compounded her concerns:

> I mean, the economy is getting worse and worse … if there’s two people applying for a job, one you have to sponsor a visa, one a citizen with the same credentials, then I mean, it’s also a fear that I would be outcompeted based on just my citizenship.

Pressure to meet neoliberal metrics for performance evaluation and tenure/promotion is tangible to all the students interviewed. Roger connected much of his graduate school strain to the pressure to publish and “external pressure and stress just from the academic environment at large.” Students' academic and research culture ingrains in them so profoundly the expectation that labs must secure funding that, in some cases, their descriptions included their underlying assumption of the indispensable nature of the funding system. For example, when Alice was explaining why she hesitated to consider a tenure-track career, she said:

> The grant system is extremely competitive and necessary because the type of research requires so much money to do. And so these PIs are constantly thinking about how to get more money, and if they don’t get the money, they don’t get to do the science and the people that they employ can’t work there anymore. There’s lots of labs who run out of funding, and then students and postdocs have to go somewhere else and completely uproot what they were working on. And so there’s, I think a lot of stress on PIs to make sure that funding keeps coming. And there’s only so many places that it can come from, and it’s a long process, and a lot of it has to do with how famous you are and if you fit a certain appeal to whoever’s in the room reviewing the grant at the time. And so there’s a lot of subjectivity, a lot of luck that I think goes into it, which I think adds a ton of stress to the system. And it’s part of the reason why I didn’t want to do it is I feel like you didn’t

> have as much control over this process. It didn't matter how good you are at science, how good of a mentor you were, the funding was still kind of uncertain, kind of a popularity contest.

Finally, Joe summarizes systemic issues in academic biomedical research that epitomize academic capitalism. When describing students' recent demands for increased stipend support, he portrayed the picture of competing demands between the research and academic arms of the institution and department. He indirectly brought to light the impact of reduced public-sector support for academia, prioritization of self-interest, and increased pressure to secure funding and publications:

> And then even in our department … we've had issues where the class size continues to grow, the budget grows and the class size grows. And the question is like, okay, you could just take the same amount of students and pay them better. And there's always pushback to that because the department has to produce a certain amount of stuff and they're trying to meet their deliverables in terms of here's how many students we trained, here's how much research we're putting out, these are the publications. And so I think in a lot of ways the interests of the students specifically are at odds with the interests of the institution and at odds with the interest of the administration because they are required to get outputs from the students, which are not necessarily, they're not student growth. They are metrics related to student growth and those two things are not the same.

In the Lab: Support for Applied Research

Half the students indicated that biomedical science culture favored applied and translational research over basic research. While none of them felt directly pressured to change their area of study or research question, most understood the importance of manipulating their scientific area of exploration to speak to the current priorities of funding organizations. Roger and Dan shared the cultural expectation to focus on applied and therapy-based research. Roger admitted that one can "respect and know what basic science is" but maintained that applied

approaches “feel more tangible ... and more measurable … that does kind of come from the culture.”

Dan described the importance for a lab that wants to publish in high-impact journals to approach research from a disease-based or translational point of view and said he had heard people in his environment say, “I want to do this, but I can’t publish in *Nature* if we’re just working on something that has nothing, anything” referring to a basic scientific question.

Amy and Anna describe the impact of the applied nature of their research on their funding. Anna’s lab was “dead focused, laser-focused on applied, finding therapies;” that was “their entire motivation for everything.” However, Anna approaches science from a “very curiosity driven point of view.” She explained how she maintained that approach while appeasing grant reviewers by framing research objectives as translational: “honestly, … I tell funders that’s the goal but that’s not necessarily [my] goal there.” Amy described the need to “lean into politics a little bit” to secure funding to conduct research. When faced with selecting a which biological mechanism to focus on in one particular study, they realized one of their choices was a particularly popular mechanism in pharmaceuticals. This drove their framing of their research objectives in grant applications:

> I think we did have to play the politics game a little recently. We finished this paper where we had gotten this [biological mechanism] going, and then we had to pick which … we wanted to test. … There were clues that made us think that this … was working through [biological term] like a lot of these drugs hitting the market right now.
>
> There was a little bit of a, “oh, maybe that’s the one we should test right now, just for that public perspective!” So, we have, I think, leaned into politics a little bit in that aspect. It’s kind of bitten us in the butt a little bit too. You get a lot of backlash when things are controversial. So, it’s a game between getting people’s attention, but also you don’t want so much attention that everyone’s coming at you.

Finally, while Joe admitted “it is kind of lame that the things that dictate what we study

are dictated by what can be funded," he shared appreciation for the "structure of deliverables and … final packages that you can present and use to show [your findings]." He acknowledged that these grant-writing frameworks for presenting research questions may not need to be funding-dependently motivated but that "the structure that exists right now, I've found to be better for myself than kind of no structure in that way."

In the Lab: Revenue Pursuing Behaviors

Nine of the ten students interviewed described revenue-pursuing behaviors around them in their doctoral programs, predominantly from their advisors. Many of them described their advisors spending an increasing amount of time in their office writing grants, attending meetings, and taking on an increasing number of administrative duties and positions as their careers progressed. None of the students described their advisors being in the lab much anymore. Lyla experienced this transition since her advisor became tenured while she was their graduate student:

> First years, [advisor][2] was very available. … now after [they] got tenured, [they've] been super busy so it's harder to find. Before it would be easier to reschedule our one-on-one. … I think part of it is finishing certain papers or things that [they] need to publish with people, writing grants. … it's just part of [their] job.

Dan and Joe described their advisors' jobs as to procure funding for the lab. They distinguish between those whose job is to produce science, like graduate students and postdocs, and the lab PIs—their advisors—whose job is securing funding. As Dan put it, "they're getting the money, they're not really engaging with the science as much." Amy saw her advisor in so many meetings all day that she guessed they must be writing grants "at night and on the weekends. I know [they are] writing. I've seen them [the grants]. I don't know when

[2] To protect the identities of the participants and their advisors, all advisors have been assigned gender-neutral pronouns. The pronoun changes are indicated in any participant quotations.

[they're] writing them."

Non-grant-writing revenue-pursuing behaviors may also be occurring with some of their advisors. Joe's advisor is starting a center at the institution and is "trying to get a drug that [they] think could potentially [get to] … clinical trials so it can be used." Matt senses that his advisor has "aspirations" and is "not very forthcoming" about them. Matt's advisor spends "a large amount of [their] time … [on] calls with people, and [they're] not very willing to share who [they're] talking to and why." While Matt knows this does not confirm anything specific, he implied that his advisor may be forming partnerships to align with their aspirations in biomedical sciences.

Phenomenon 1: "Avoiding Academia Would be Better for my Health"

Nine of the students interviewed either confirmed their intention to work outside of academic research or shared strong reservations about that path as they considered their future career goals. Nathan, Lyla, Holly, and Joe always knew they wanted to focus on something other than R1 institution academic research. For Joe, becoming a research PI is "all the parts of doing science I dislike most, just concentrated in one position." Lyla said academia was "never" her "purpose. I don't see myself having this big questions for all my life- I'm not motivated for that."

Holly and Nathan wanted to be teaching faculty when they started graduate school. Holly has since realized that teaching professors "don't make the sort of money that I felt like I would need to feel financially stable for the life that I wanted to live" and has decided to leave academia altogether. Nathan has always wanted to be a teaching faculty, does not want to be an R1 PI, and is hoping to find a way to remain around research. But, he is not attached to that idea:

> If someone said, you're never doing science again for the rest of your life, I'd be fine. … I enjoy it. I would prefer to still be in the mix of it, and I would prefer to not just be a lecturer. So, I'm looking at the intermix of those two.

Matt, Roger, Amy, and Alice all plan to complete or have completed academic postdocs but remain apprehensive about life as an R1 institution researcher. Matt feels that “from a mental standpoint, mental health, existing as a human being, I think that the industry side of things is a lot more desirable.” Roger is open to changing his opinion but based on “observing my PI and other PIs in the department, I don’t know if that’s the lifestyle for me.” Amy confirms that the tenure process would be the primary reason she might elect out of academic research: “The idea of the insecurity of tenure terrifies me a lot. I think that might be the reason I don’t pursue an academic PI position. … because of the stress of trying to get tenure.” Alice started graduate school with dreams of having her own lab in a university, but as her:

> well-being deteriorated, as I saw really how the field was and how people treated each other, even as you became a PI people are still awful to each other, I started looking at other options and I looked at literally everything … outside of academia.

Finally, Dan planned on a complete career shift that requires learning new skills and potentially working his way up from the beginning: “I kind of feel like I’m not going to be using my Ph.D., but I don’t really care that much about using my Ph.D. I care more about doing what I want to do.”

The concept that LRU BIMS/BME students avoid or strongly reconsider careers in academic research emerged clearly and consistently across all but one interview participant, classifying “Avoiding Academia Would be Better for my Health” as a central emergent phenomenon in this research. The following sections describe the data that supported emergent relational concepts categorized as *causal conditions*, *actions/strategies*, or *consequences*. A single interview case provided evidence for an *intervening phenomenon*. Table 5 is a summary matrix of the findings related to this central phenomenon described in the following sections.

Table 5

Findings Summary Matrix: "Avoiding Academia Would be Better for my Health."

		Phenomenon 1: "Avoiding Academia Would be Better for my Health"								
		Causal Conditions				*Actions/Strategies*			*Consequences*	
Participant	Phenomenon	Low academic faculty salaries	Work-life balance & mental taxation	Grant writing, publishing, & preparedness	Translational impact & pace of discovery	Changing career-related goals	Strategizing postdocs & career moves	Rejecting the lifestyle	Security	Happiness & preparedness
Anna										
Nathan	X	X	X	X	X	X	X	X	X	X
Matt	X		X		X	X	X		X	
Lyla	X	X			X	X	X		X	
Roger	X	X	X	X		X	X			X
Dan	X	X				X				
Amy	X	X	X	X		X	X	X		X
Alice	X		X		X	X	X		X	
Holly	X	X	X	X	X	X	X	X		X
Joe	X	X	X			X	X		X	

Note: "X" symbolizes the emergence of the concept from interview data with participant.

Causal Conditions

Four conceptual causal conditions emerged concerning the participants' hesitation to pursue careers in academic research. Causal conditions were variables that influenced the students' academia avoidance and helped explain why the phenomenon occurred.

The four causal conditions were: a) low academic faculty salaries; b) issues around work-life balance and mental health; c) the volume of grant-writing, publishing and academic preparedness required; and d) the translational impact of research.

Low Academic Faculty Salaries: "I'm Not Doing It, I Just Could Not." Eight students referred to financial insecurity or low faculty starting salaries as a reason for their reduced interest in pursuing a career in academic research or teaching faculty positions. For some, this included their perception that time spent as a low-paid postdoc would contribute to their sense of overall lost income over time. Dan bluntly said, "postdocs are really, really underpaid." For Lyla, the financial sacrifice of doing a postdoc is "too much." Roger felt more comfortable considering it as an option because his girlfriend is "planning on going to industry so we'll have dual income which will help … it would be another four or five years where I'm still not as financially stable as I'd like to be."

Amy admits that finances drive her; she does not want to struggle during "the tough months when you have to replace your windshield or things like that" and is already considering the impact a faculty salary would have on her ability to raise future children the way she hopes to. Alice left her postdoc job because they don't provide retirement account benefits: "it was really important to me to get a job that was making matching payments to a 401K and that I had enough money to be putting in a Roth." She had concerns that by pursuing an academic faculty track, she would continue to need to make up for "that time I had lost all of that investing opportunity."

Holly and Joe have similar thoughts about pursuing teaching faculty roles. Joe

considered becoming a teaching professor “for a hot minute … the downside of that being how punishing and unrewarding that career is and how it's consistently being lopped off in favor of adjunction.” Holly said of her sister, who is a teaching faculty member at a different institution, “I knew the issues she was under … what her pay looked like … what sort of work she was putting in … even she said … I wouldn't want to do this just for the financials of it.”

Nathan, a student in a discipline of biomedical sciences with some of the highest scientist salaries across all industries, expressed frustration with the lost income time in the academic model:

> I mean, the assistant professors that started five years ago in [program], they put in over a decade into the field of research. And they come out with their starting salary, like $92,000 as a PI. I’m not doing … I just could not ... I know how much they work ... That was something that I realized. That, *five* years from now! That pushes me back! The opportunity cost that really started to sit on me.

Work-Life Balance and Mental Taxation: “You Better Freaking Love it!” Seven students described the importance of work-life balance in their career choice, particularly in their considerations against a career in academic research. As mentioned previously, Joe succinctly summed up that becoming an academic researcher would be “all the parts of doing science I dislike most, just concentrated in one position.” Others explained which specific parts of a life and career in academic research could be mentally taxing and clash with their value systems.

Grant writing came up as a specific barrier to work-life balance. Nathan remembers his PI reveling in the undisturbed time over holidays that allowed [them] the time to write grants: “[they’re] just so happy. No one’s emailing … and [they’ve] finally got the time to write grants. That is not who I am. I will never be that way with science.” This realization, in conjunction with his thoughts about salary mentioned earlier, helped crystalize his decision for him, “It’s like, okay, well if this is the world, you better freaking love it! And those things never quite connected the way that I think it needs to do to go be a successful PI.”

Roger, on the other hand, worries about what it would do to his sense of the person he wants to be in the world: “Is there only one way to exist in that environment? … to fully … shift [my] value system back to grant writing and … external pressures? I don’t know … that’s what makes me most … wary of pursuing that.”

For those who have or have had advisors with poor work-life balance, the importance of it as a factor in their career decision seemed more straightforward. Alice’s advisor had “terrible work-life balance, even though [they] let us have our own work-life balance. It was clear [they] didn’t hold that standard for [themselves].” Alice saw her advisor leave to spend time with their daughter most days, which Alice appreciated as behavior that stands out in academia. However, her advisor then:

> would work on the weekends … would wake up at 3 or 4 AM every day to work and … was just an incredibly hard worker, but it was very clearly unhealthy for [them] and wasn’t a good example for any of us.

Holly felt that advisor work hours and work-life balance behaviors are “passed down” and learned from others in the lab, even if never explicitly stated as expectations or policy. Similarly to Nathan, Holly’s thoughts about salary compared to work-life balance helped her make a career decision. When she talked about her decision to work in biotech, she shared that towards the end of her time in graduate school, she:

> finally started to understand and maybe accept that my well-being wasn’t what I thought it was, and that I started to accept that maybe the hours that I worked and the lack of work-life balance I had were actually not great. And that no matter how nice I found my PI and how much I genuinely enjoyed [them], there was also still quite a bit of pressure to produce or to keep things going and to be able to keep stuff moving.

Watching her sister work extended hours as teaching faculty for low pay, she realized how much you’d have to love the work to do it. She said of her sister, “She was like, if it wasn’t for the fact that I love doing this, I wouldn’t want to do this.” Hearing this, Holly realized she did

not love research enough to make the lifestyle sacrifices required in academic research.

Some students perceived the need to publish constantly, to acquire funding, and to achieve tenure as deterrents to their future mental health. Matt finds that the “irrationality of that system … would be very taxing on me, despite the ability to have what people call academic freedom.” When asked about her career priorities, Amy freely shares: “happiness and mental health, quality of life!” As mentioned previously, Amy has concerns and stressors around the tenure system. In later sections will include Amy's insightful thoughts about the academic tenure process. However, in the context of career considerations and her mental health, she says of tenure, “it sounds silly because it sounds like, oh, that’s job security and I know it is, but it’s this, it almost feels like they just keep moving the goalpost for us to finally be able to take a break. And I think I'm getting a little tired.”

Grant Writing, Publishing, and Preparedness: “I Just Scoff at That.” Participants frequently referred to the amount of grant writing and publishing required to maintain an academic research faculty position as a deterrent towards that career path, sometimes with the added context of feeling inadequately prepared. Even though Nathan enjoys developing the argument part of writing a grant, when it comes to the pace and volume expected as a PI, he said, “I just scoff at that!” Similarly, Dan said the volume of bench work required to keep a lab running was a negative point on his pro-con list when considering careers.

Roger has not ruled out academia, but watching his PI go through stretches of tight funding and cycles of grant submissions made him worry that it “seems like a kind of tough lifestyle at times and a lot of external stresses, especially when funding is tight.” Like Roger, Amy has not ruled out an academic research career but feels she does not “have all the skill sets to do that, especially the writing.” She feels she is a “very weak writer” and would “love to learn how to write the grants.” She is aware that it is “an unrealistic expectation to have a fully functioning lab without being able to pull the money in” and while she believes she has the skill and ability to “troubleshoot and experiment or … brainstorm an experiment … come up with the

idea" she does not believe she's "quite ready to write these 20-page grants yet."

Holly realized early on "it was stressful. It looked stressful being in charge of … the funding situations." She recognized the responsibility that running a lab carried, saying, "I don't want to get in into a situation where I need to be constantly concerned about … these external factors." Additionally, she understood the responsibility the role carried toward others, and that "you'd then become responsible for graduate students, postdocs." That felt like a "what-if-game" to Holly, having to make guesses at how much funding her lab would have, how much it could produce, who it could support, and for how long. It was clear to her that academia needed restructuring:

> sometimes I recognize the broken system in academia, and that this is not a solid model. Graduate students are suffering. Everyone is kind of suffering here right now in various ways except for maybe a select few people who have become chosen and are largely male and white and older and are just white and female who have privileges. They're the ones who can do well, and will sit here, and tell you that there's nothing wrong with this system.

Holly would have liked to be a part of a solution to this stressful system; leaving academia was not her first thought. She explained that to "try to fix a system," she'd need to be a participant in it and she was not comfortable with that. As a result, she pivoted out of academia entirely.

> And I was like, no, I'm not happy with the concept that I would need to continue suffering through these various stages to get to a place where I could try to do something about this. And I wish there was a way … I could get to … a position where I could start helping, without having to go through this. But that … doesn't really exist … and I still love the bench site. I still love my bench science. So that was how that got rolled out.

Translational Impact and Pace of Discovery: "I Felt Like My Work Mattered." Five participants wanted to conduct science in environments where their pace of discovery would be

more significant than at research universities, and to feel a greater connection to the translational impacts of their work. Lyla did not see herself in a university “doing research forever. I like more fast-paced, smaller projects, get it done, see an outcome faster!” She eventually wanted to work somewhere where “things are even more translational than at the research school level.” Matt was similarly excited about doing translational science, and said when talking about his future hopes, “if it's at all possible that the stuff that I do can help people broadly, I think that would be fantastic!”

Holly, a scientist at a private company now, expressed her joy about the efficiency of discovery at her new job:

> We still get a lot done, but it’s just so different. And yet we’re still doing rigorous stuff. … I feel like I have gotten more forward progress in the product I’m developing right now in a time span than I got in similar progress, in a similar time span, in my thesis work.

When Alice experienced mental health declines at times as a graduate student, her sense that what she was working on mattered and impacted people positively motivated her to continue. It helped her realize that doing more translational work would provide her with a mental tool to get through the more stressful parts of a job.

Nathan would’ve been happy in any biomedical science field but would’ve ensured that “what I was doing could lead to something that would have an impact on someone or something.” It was important to him that his work had a real-life impact.

Actions/Strategies

The students engaged in behaviors and decision making that demonstrated their objective to get around, avoid, or improve the causal conditions that led them to avoid academic research positions. I categorized these behaviors as actions/strategies, in relation to this phenomenon. The concepts and codes were categorized as actions/strategies regardless of whether the students were conscious of them as responses or strategies. The actions/strategies that emerged are a) remaining open to changing their professional goals, b) being strategic with

their training, postdoc choices, and career moves, and c) rejecting the lifestyle demands of academic research.

Changing Career-Related Goals. All the students who were either not going into academia or had strong reservations about doing so–nine in total–exhibited behaviors and attitudes that demonstrated their willingness and ability to shift their career goals over time. Goal-changing behaviors bring the students' career objectives into better alignment with their stated values, and with their reasons for rejecting life as an R1 institution PI.

The students who did not plan to become PIs from the beginning of graduate school nevertheless exhibited behaviors and attitudes that demonstrated *career flexibility* because of their experiences in graduate school that solidified their perceptions about the taxing nature of academia and research. While Nathan's original goal to teach remained, he shifted away from his initial plan to do the obligatory postdoc. In addition to realizing that a postdoc position wouldn't help him acquire the skills he wanted– "teaching as a postdoc is kind of frowned upon … you're not there to teach"–Nathan's personal life developed while in graduate school. Knowing that a postdoc would not enhance his teaching resume *and* would delay his financial goal to support a spouse and family motivated him to explore creative options outside of a traditional postdoc.

Lyla, who also never wanted to be a PI, demonstrated a shift in her interests from "the research [to] doing something more people-driven," like science policy as result of her experiences in graduate school. She realized she might not want to be behind the bench all the time, and remained open to changing her goals again when she graduates. Joe, another student who never had the intention of becoming a research PI, developed his "own reservations about going back into industry ... I really like front end science, but at the same time I'm okay not necessarily doing the science firsthand," demonstrating his openness to pivoting his career path. Experiencing the stressors of academic research led Joe to take into consideration the stressors of science research everywhere.

Holly changed her goal from becoming a teaching faculty to working in industry. As an alumnus, she recognized that her willingness and ability to change resulted from her experiences and observations as a graduate student. As mentioned previously, Dan hoped to change careers entirely and may not end up using the degree he is earning in school right now, demonstrating a drastic shift in career goals from when he joined the program.

Matt, Roger, and Amy, who plan to keep a career option in academic research open and to complete postdocs, demonstrated that they have made career goal changes while in graduate school. Matt's view on the purpose of the Ph.D. has deviated, leading him to question his career purpose and lean away from academic research. Roger has shifted from his previous certainty about an academic career: “Yeah, not sure, I mean I will see, things can change, but I just feel like I don't know if that's for me.” Moreover, as elaborated in the following section, Amy “opened up [her] mind” to non-traditional postdoc options to combat her concerns about pay, work-life balance, and other issues.

Arriving at graduate school with plans to be a PI one day, Alice's declining mental health as a graduate student led her to explore non-academic career options. When those didn't pan out, she changed her goals again and accepted a postdoc position, hoping for a vastly different experience from her doctoral student ones. After a very positive postdoc experience, she demonstrated goal-changing behavior again when she affirmed her desire to stay out of academic research and made another career goal change toward industry.

Career goal-changing emerged as a relevant and salient theme throughout the interviews. Students veered away from careers in academic research by utilizing goal changing as one of their actions/strategies.

Strategizing Postdocs and Career Moves. One strategy is to refuse to pursue an academic postdoc, as Nathan has decided to do. Another is to explore postdocs with fairer compensation and quality of life. Amy had been researching postdocs in Europe, which have different funding structures and are sometimes university-biotech partnerships. She is attracted

to the shorter tenures, better salaries and benefits, and improved quality of life potential. Matt hopes to “pick a postdoc that has a little bit more fair compensation, I know some places that do that.”

And similarly, Lyla admitted, “If it was a postdoc inside of industry, I would consider it.” Holly and Alice strategically chose jobs in industry. Holly found a job in industry that is “a bit of a unicorn,” and Alice is in a sector of industry with “good job security,” in a field that always interested her.

Another action the students employ is strategically positioning themselves for increased career flexibility. Joe was not worried about the next steps or sacrificing “just to get my foot in the door” as long as he finds a job that “will pay well” because he was confident that once he is “in the door somewhere, if I don't like it or I feel like I'm less taken by it, I can start to look for other places once I have that stability under my feet.” Amy hoped to find a postdoc in which she can explore research and development theory, making her more competitive in that area and allowing for an easier transition to industry if needed. While the field she is in “is really hot,” she was making plans for when that cooled and departments downsized. She was looking for “good foundational postdoc training” that would allow her to move around and find a new niche.

Roger was taking advantage of his institution's teaching resource center, leveraging their programs and tools to make him a more attractive hire for teaching faculty. He was also leaning into the discovery that he valued “more mentorship.” He wondered if he could find a postdoc “more geared towards teaching, maybe liberal arts college” to tap into that aspect of himself. Dan was taking courses outside of his school of enrollment to facilitate his planned career change after he graduates and continued to pursue external sources of learning to keep himself engaged. He found a way to utilize the resources around him in actively pursuing a career outside of academic research even while still a doctoral student.

Rejecting the Lifestyle. Finally, the students employed the action/strategy of rejecting the lifestyle sacrifices in academic research they had come to observe as graduate students.

For some, this was a rejection of the imbalance in effort to compensation, as Nathan described, which motivated him to steer clear of life as an R1 institution researcher.

For others, it was a rejection of a system and a life where their happiness and well-being were secondary to the job. Amy rejected the increasingly common seven-year postdoc in America, which drove her to explore European postdocs: “I know a lot of people who've just been beating themselves up in a postdoc for way too long and I'm like, you deserve to be happy.” Alice experienced a deterioration of her mental health in academia, which pushed her to explore a life in industry: “that's currently what I'm doing, and I really like it.” Moreover, Holly lit up while talking about the biotech company she works for:

> My company's whole model is they don't want the heavy turnover ... their whole model is … we want to make people happy here so that they will be here for a long time. We know that we will succeed more as a company if we can keep people here happy and working, and we can keep these thoroughfares of thought, and we're not going to be replacing people every two, three, years and then getting discontinuity in what we're doing. And so, my company puts a premium on doing things to help us. … I get my medical and dental insurance for free, even with my husband on it. It's less than a dollar off my biweekly pay to have those things.

Their statements demonstrated an active rejection of the well-being detractors in academia they witnessed or experienced as graduate students.

Consequences

I categorized outcomes or results of the students' actions/strategies related to rejecting careers in academic research as consequences in the relational mapping of this central phenomenon.

Security. Five of the students expressed their security and confidence in job prospects outside of academia. Nathan felt good about his choices in education and degree in terms of being able to “end up in big pharma; they make good money; they actually enjoy what they do.”

Despite his desire to teach, he felt secure in this backup plan. Matt did not worry about his finances; he expected his salary to be “more than 30 grand” when he graduates, referencing his graduate student stipend. Lyla confirmed that “the money is not an issue” after she graduates, and expressed her confidence in getting a job in biotech or industry if she needed or wanted one.

Joe believed his doctoral degree was “much more broadly applicable than other Ph.D.s” and that it “raises the ceiling of what [he] could potentially get into.” Alice shared this sense that her degree provides general job security:

> I guess I just have a general belief that I'll make it work. So even if my field completely disappears for some reason, there's enough transferable skills as someone with this type of Ph.D. that I could get another job that's even not in my field. So yeah, I mean there's always a worry about future stability, but not because I don't think I'd be able to get another job, but more just, it's more like in the context of the world and inflation.

Happiness & Preparedness. Students shared that they felt prepared for a career outside of academia and, when applicable, that they were happy in those careers already. Holly described her work-life balance and her ability to enjoy her life without that “little voice in the back of my head saying I'm letting myself get distracted from what I should be doing.”

Roger said that participating in the teaching preparation program has “helped a little” regarding his anxiety about the next steps in his career. Amy felt more “stable,” having considered some “good foundational postdoc training” that might help her avoid the insecurity of tenure, which “terrifies [her] a lot.” Nathan and Amy's sense of preparedness for jobs outside of academia comforted them, even though Amy was still considering a future as a PI and Nathan primarily hoped to teach.

The students shared a sense of security, happiness, and preparedness because of their actions to address their concerns about a career in academic research. A participant, Anna, is the only one who stood out from the rest. The next section describes the concepts that emerged

from the interview with Anna and formed an intervening condition through analysis.

Intervening Condition: Remaining Committed

According to Strauss and Corbin (2008), intervening conditions impact actions/strategies related to the central phenomenon. An intervening condition emerged from the interview with Anna, as she eventually stood out as the sole student participant who actively chose to continue a career in R1 institution academic research and not consider any other options.

Anna acknowledged her fear of the job market's competitive nature and high expectations to publish and acquire funding. In that sense, her expectations did not deviate from those of the rest of the participants. What did, however, was her assertion that she planned to forge ahead regardless: “I have known since I started graduate school that I wanted to continue on tenure track academic path, and it's a really competitive path to choose.”

Potential factors that contributed to Anna's deviation from the central phenomenon and action/strategies salient with the other participants were the extraordinary levels of faculty guidance she received and her extensive academic research background. Prior to graduate school, Anna worked in five different research labs and was able to narrow down her specific scientific interests. She had two faculty mentors in different fields advise her through applying to graduate schools, and she targeted the lab and advisor with whom she completed her doctoral work in her application for admission and subsequent lab rotations. She had even begun conducting research in that lab while technically rotating in other labs.

She garnered a “small boost of confidence” when she successfully wrote a grant for, and was awarded, a training, then postdoctoral, grant. She actively solicited advice from no less than seven tenure track faculty, independently of each other, when she was applying for postdocs, publishing her papers, or considering next career steps: “That helped me out tremendously in that process, and so I did feel very prepared, but I attribute it 100% to them. I spent so much time on the phone with these people from my past.” Anna's experience as a student with supportive mentorship, preparation in writing grants and papers, and extensive time

at the bench emerge as intervening conditions in the case of “Avoiding Academia Would be Better for my Mental Health” as a phenomenon.

Summary: “Avoiding Academia Would be Better for my Health”

Nine of the ten students interviewed plan to either altogether avoid careers in academic research or have strong hesitations when considering whether to pursue one. The students were concerned about the lack of work-life balance and the high mental taxation in exchange for low academic salaries in academic research careers, as well as the expected rate and volume of grant writing and publication. In addition, they craved more directly translational work and a more exciting pace of discovery.

The students employed actions/strategies to combat these, including remaining open to and following through on changed career goals, being strategic with postdoc opportunities and career moves, and rejecting the lifestyle demands of academic research. As a result, students felt security in their job prospects outside of academia, and a sense of preparedness.

Extensive research experience prior to graduate school paired with extraordinary levels of faculty guidance emerged as potential intervening conditions, as in Anna's case, who was the only participant interviewed who remained entirely committed to an R1 tenure track career.

Phenomenon 2: “My Advisor is Great, But…”

A secondary phenomenon emerged from the data indicating that while most students interviewed have very positive relationships with their doctoral advisors, they all described inadequacies in their advisors. There are varying degrees to which students felt positively or less so about their advisors. However, the common causal factor thread related to advisor inadequacy is salient even in the most minor complaints.

The following section describes the concepts that emerged, during coding and analysis, that represent the doctoral students’ positive feelings about their advisors and the causal conditions for those sentiments. Then, I present evidence from the interviews demonstrating the duality of their feelings and the causal conditions leading them to criticize their advisors. Table 6

is a summary matrix of the findings related to this phenomenon described in the following sections.

Table 6

Findings Summary Matrix: "My Advisor is Great, But…."

Phenomenon 2: "My Advisor is Great, But…"												
			Causal Conditions					*Actions/Strategies*			*Consequences*	
Participant	Great	But	Advisor supports work-life balance	Advisor is a good person	We are a good fit	No path to graduation	Advisor's behavior	Separating from science	Using other sources of support	Managing-up and filtering content	Appreciation and empathy emerge	
Anna	E	N	X	X	X		X	X	X			
Nathan	E	E	X	X	X	X		X		X	X	
Matt	N	E		X		X	X			X		
Lyla	E	E	X	X		X	X	X		X	X	
Roger	S	S	X	X	X	X	X				X	
Dan	S	S		X	X	X	X	X	X		X	
Amy	E	N	X	X	X	X		X			X	
Alice	E	E	X	X			X	X			X	
Holly	E	E		X	X	X	X	X	X	X	X	
Joe	E	N	X	X	X		X	X			X	

Note: "X" symbolizes the emergence of the concept from interview data with participant. "E" symbolizes *enthusiastic* expression of the phenomenon, "S," *subtle*, and "N" *not-so-great* and *not-so-bad.*

My Advisor is Great…

Seven student participants enthusiastically shared their appreciation for their advisor. When asked how she felt about her advisor, Anna lit up and said, “Overall positive impact! I don’t think that I could have chosen a better mentor for me!” Nathan said, “[They’re] a fantastic mentor in the lab, but also in life.” Joe shared, “My mentor’s great. I have no complaints really.” Amy laughed while recounting how she asked if she could join her advisor’s lab before the rotation was over. “I always joked that I popped the question too early, and [they] got all uncomfortable. But it all worked out in the long run, and I’m really happy with the decision.”

Alice shared her experiences with three different advisors since she switched advisors a few years into her doctoral program and had a postdoctoral PI after she graduated. She shared many positive attributes about her dissertation PI and spoke fondly of them. While her sentiments about her first graduate school advisor were generally negative, Alice credited them with being the advisor who had made her the most excited about doing science, offering, “We just had a very similar, I think, creativity, around science that I really liked.” When it came to her postdoc advisor, Alice quickly gushed, “My PI was amazing!”

Two students, Lyla and Holly, distinguished clearly between the beginning and the end of graduate school regarding their feelings about their advisor. Lyla said, “It was great for the first years.” Holly shared:

> I would say that for a lot of my time, I still do! I still really appreciate my advisor. … one of the things was [they were] one of the good ones … [they weren’t] in that black-and-white bad space … Have I come to accept that we were in shades of gray? Because that’s a reality? Yes.

I categorized Dan and Roger’s advisor sentiments as “Subdued.” They did not present their positive feelings about their advisors as emphatically as the others but described many positive sentiments about them. Dan and Roger maintained the same subdued expression level

regardless of what they were discussing. Therefore, I interpreted their lack of excitement when talking about their advisors as a factor of their relaxed personalities and not a reflection of their feelings about their advisors. Dan said, “My mentor’s great. I have no complaints really.” As I will demonstrate in causal conditions, Dan mentioned several attributes in his advisor that he seemed happy about but did not make any general statements about it being an overall good relationship or choice.

Like Alice and her first doctoral advisor, Matt was noticeably less content with his advisor than the other students. Matt was the only student who did not describe his relationship with his advisor as generally positive. I labeled this as an advisor who is “Not So Great.” Nevertheless, even Matt described a couple of positive attributes I describe in the following section.

Causal Conditions. Causal conditions for the sentiment the participants shared that their advisor “is great” are salient emergent concepts that students repeatedly referenced as reasons they appreciate and value their advisor or their relationships with them.

My Advisor Supports Work-Life Balance: “I Want you to Live Your Best Life.”

Seven of the ten participants directly referred to their advisor’s encouraging and supportive attitude towards the student’s work-life balance as a central reason for their positive advisor relationships. Anna described their lab environment as “nine to five … it wasn’t like a long-work-hours-kill-yourself type of situation.” Nathan spoke in extensive detail of how important and positive it was that his advisor was supportive of the first year in school he spent in a long-distance relationship with his girlfriend. Nathan described the importance of his advisor’s role in that relationship and said, “He's always been supportive of my relationship with my wife. … And so that is something that I never felt like I had to sacrifice or had to explain or had to tiptoe around.” Nathan attributed their lab culture to his advisor’s attitude towards work-life balance. He talked about a colleague who recently became a new parent: “He’s been in and out of the lab trying to deal with being a dad, and none of those things ever raise any eyebrows. Everyone’s been understanding.”

As an international student who has struggled with physical and mental health, Lyla's advisor's understanding of the importance of taking care of life outside of the lab is crucial:

> So, things that I really value about [advisor] is … understanding that I'm international, and always being supportive of me going home or when my dad was sick, me going home for an extended period of time with my own health issues. [Advisor] has always been supportive, and been open.

Roger explained, "I feel [advisor's] expectations as far as work-life balance and just, time spent in the lab, are reasonable." Joe appreciates that he can decide how to structure his time. Sometimes, he leaves the lab early in the afternoon to play a sport or exercise and then returns. His advisor once said, "listen, I want you to live your best life, whatever's healthy for you, and your schedule as long as you're still working and contributing." Joe valued this attribute that contributed to their positive relationship.

Amy learned that her advisor was "very mental health positive" under tragic circumstances when Amy lost a friend to suicide early in her graduate career:

> And then I think I knew already that [advisor] was a very nice person, but how I was able to talk to [them] about that pretty quickly had a huge aspect on I think why I wanted to join the lab quickly.

Even though Alice's advisor did not lead by example, they encouraged work-life balance for their students and members in the lab. Alice felt that, especially compared to her first lab, the department she was in fostered that attitude in general:

> It was much more family-oriented, and therefore no one was made to feel bad if they left to go pick up their kids from school or had obligations outside of lab. And so generally I would say the culture was a lot healthier.

Participants frequently referred to their advisors' support of work-life balance as one of the reasons for their positive feelings toward them. The following section covers another reason they stated–the general sense that their advisor is a good person.

My Advisor is a Good Person: "If You're Racist or Sexist, you're out of Here." All ten participants had something positive to share about the inherently good nature of their advisor as a person. Even in the case of Matt, who had a limited number of positive references to his advisor, he said, "I think at the end of the day, my appreciation for [them] is that [they] are a good person." Lyla values her advisors "as a human being." Nathan immediately sensed that his advisor was "very transparent and honest." As described previously in this chapter, Amy was grappling with academia and the tenure system, and her admiration for her advisor was central to that. Here, she was grappling with the idea that her advisor may not receive tenure and need to leave the university:

> I think that that's my biggest fear, and that's when I doubt the system the most, is when people start talking about, well, [advisor] could go. And I'm like, well, [they] are the reason that I'm here. And if [they're] not here … I am sure that I could still be here. But I really truly look back at my Ph.D. experience, and I'm like, that was a cool time. That was a time full of growth, and hard times, and good times. And I've learned a lot about my mental health, and I've learned a lot about science, and *all* of that has to do with this style of PI that [they are]. And if that's not favored in the system– I don't know if who *I* want to be is going to be favored in the system.

Participants shared positive advisor characteristics that fell into the following categories: their advisors cared about them, their advisors are available and accessible, their advisors cared about diversity and inclusion, and they could talk to their advisors about anything. Eight participants highly appreciated the *availability and accessibility* of their advisors. Anna remembered fondly that:

> The best thing about [them] was [they] were always in [their] office across the hall with the door open, and so much to the chagrin of all the other labs on the floor, we would just yell at him– we, being me mostly, from the lab!

Lyla, Nathan, Dan, Amy, Alice, Joe, and Holly also described their advisors as available

and accessible. “Anytime you want!” Dan said. Amy described her mentor as having an “open door policy” and being “very responsive on Slack,” and Holly’s dissertation advisor was “extremely accessible, which I think was awesome. It really helps with your growth in the lab, it helps you feel more supported and integrated in the lab.”

Even in the case of the more senior PIs, whose administrative duties were heavy, accolades about their availability were salient. Joe shared that his advisor’s “availability is limited, but [they are] very accommodating … whenever you need that availability, [they] make it happen.” Moreover, Holly, whose relationship with her advisor tensed towards the end of her graduate school career, said, “she never stopped being very present in asking about what you were doing, and popping in and out. There wasn’t a day where you didn’t interact with her at least two, three, times.”

Eight participants demonstrated in different ways that *their advisors cared about them* and other lab members. Anna said her advisor “was really good about keeping us safe,” when discussing lab work during the pandemic. Lyla said she valued that her advisor “gives me the impression that [they] care about [their] students, more than just as a production machine.” Amy said of the lab, “we know that if we were to ever need something, [they are] going to do everything [they] can for us.”

When Alice found herself switching advisors in the middle of grad school, she prioritized finding a new mentor “who was going to help me finish my Ph.D. in the healthiest way possible. … I was trying to look for labs that would support the type of research that I was … doing but that much higher priority was finding someone who was going to be kind to me, who cared about communication, who was generally interested in helping me succeed.

Holly and Joe’s advisors demonstrated their care by taking their financial commitments to them seriously. Holly explained that her advisor was careful about not taking on more students and staff than she could support: “We kind of knew where her priorities lie; she knew that her priority was that she took us on as grad students.’ Joe’s advisor was explicit: “[They are]

like, okay I now run a very large lab. A lot of these people have families. I need to make sure that their position here is never in jeopardy. And [they] take that very seriously."

Being able to *talk to their advisor* about anything and being in a diverse and inclusive space were important qualities to the participants, contributing to the image of their advisor as a good person. Nathan said, "we talk about everything, from lab to personal life too, and that's something that I enjoy." Lyla shared a similar sentiment, "I feel like I can trust him with certain aspects of my life … we've had very honest conversations about … personal things."

Amy was sure that every lab member was "in a situation where … I think we've all been in a personal situation where we've had to tap on [advisor's] shoulder … and it was always just like, what do you need from me?" It was essential to Lyla that her advisor be international like her so they would understand her need to return home for visits. Anna's advisor has an explicit conversation with anyone who joins their lab, as she described:

> Yeah, it's very, with anybody who rotates with him or any of the techs, anybody, he tells you on your first day what his approach is and his expectations for you. … And he was like, "my expectations for you are that you are going to work really hard to make sure that this team operates to the best of its ability" ... and he's big on inclusion and things like that. And so, all that, green flags all around! … It was like my first day when I came in–well, he did it on the phone, and then he did it the same first day on my rotation–And then he said, … But he is very, very serious. "If you're racist or sexist, you're out of here just to let you know," on the first day! Yes. Wow.

Overall, the participants strongly felt that having an advisor who is a good person, who cares about them and the lab, who is available, accessible, willing to talk about anything, and supportive of diversity and inclusion significantly contributes to positive feelings about their advisor.

We are a Good fit: "We're Both Open-Minded and Creative." The final causal condition to participants sharing positive sentiments about their advisors is fit. The concept of

good fit between advisor and student emerged predominantly as expressions of appreciation for the trust they received from their advisor, appreciating transparency and honesty from their advisor, feeling appreciated and recognized by their advisor, and feeling inspired and supported by their advisor.

At least half of the participants expressed that they appreciated their advisor's trust in them, whether in the sense of autonomy they felt in their work or in their ability to explore science and be creative. Dan's advisor had the open-mindedness to encourage Dan to explore a question within a discipline that was novel to that lab. Dan felt that he'd "gotten a lucky spot personally, just for my lab and my PI." Nathan feels a sense of ownership and autonomy from his advisor, and Amy's advisor never shuts down her ideas. Her advisor "lets [her] just kind of go in and sketch on [their] board … and then I can leave it there for a week … and he just never comes to me, and I like, this is a stupid idea." Similarly, Anna's advisor let her explore her ideas freely and:

> fed into it too. [They were] just as excited about my ideas as I was. And so that was, honestly, graduate school was one of the happiest times of my life. It was the first time that I had been given the freedom to do that.

Four participants expressed the importance of transparency and honesty from their advisor and their role in the participants' positive feelings towards them. For example, Amy's advisor was open with them about their upcoming tenure submission process, including sharing their backup plan with the lab should they not receive tenure and stay at the institution. Holly's advisor was very open about their funding situation and the lab budget. These examples were cited by the participants as reasons for their appreciation and good feelings about their advisors.

Advisors who made their students feel appreciated and recognized their achievements received praise from the participants, even when they said they did not need those affirmations. One of Matt's few positive comments about their advisor was, "I think [they] do a good job of acknowledging when you do something or when you complete a lot of work." Roger's advisor

was “incredibly helpful to him,” mainly when he was down, by giving him consistent feedback and assuring him he was “making progress even at times when it’s really not felt like it.” Amy’s advisor celebrates grant and paper submissions, regardless of the outcomes: “We do champagne on submission, so I think everyone should do that. Yeah. Not celebrate the outcome, but the work put into it.” Appreciation and recognition were essential for the participants when they felt like their advisor could be a good fit for them.

Finally, seven participants described feeling inspired and supported scientifically and academically by their advisors. Examples include Amy, whose advisor was flexible with her alternative learning style and needs; Dan, whose advisor was open to trying different projects and ideas; Alice, whose advisor supported her desire to publish a more extensive paper than she needed to graduate; Holly, whose advisor backed her in her programmatic leadership initiatives in the program which were not directly related to her research; Joe, whose advisor inspired him by always seeming to know what the following question in the project should be, and many other examples. The students felt most positively about their advisors when they recounted examples of their scientific awe of and feeling supported by them.

But…

The participants overwhelmingly shared positive sentiments and characteristics about their advisors. However, almost all the participants shared grievances about their advisors, impacting their relationship with them at varying points in their careers. Seven participants established that they had times when their relationship with their advisors was particularly rocky or worse.

Nathan, Matt, Lyla, Alice, and Holly were explicit about those times and experiences. Lyla asked, “Do I think our personalities are the best match for a mentor/mentee? I don’t think so anymore. … that’s just something that happens.” Nathan shares that there has always been “a little bit of tension there, especially as I’m coming into my last 12-ish months here.” Matt summarizes his feelings about his advisor:

> Yeah, I think overall [they've] been very frustrating, very, very frustrating, and for what seems like bad reasons–and not frustrating because I didn't understand something like that–frustrating because [they were] legitimately wrong or caused something to happen that affected people or has opinions on how to get worked on that are unreasonable.

Holly came to a place of acceptance while she contemplated her relationship with her doctoral advisor:

> But also, I do know I've come to accept and understand, I think accepting is part of it. I feel like for a while I kind of thought I didn't want to accept that there were problematic behaviors there, but again, I kind of figure it out later.

Alice's experiences with her first advisor were so drastic that she changed advisors halfway through her doctoral program. She described sexism, discrimination, slandering, and terrible working conditions. She was much happier in the lab where she completed her doctoral research. However, she had some less severe criticism of her advisor, described in the following causal conditions.

As described earlier in this chapter, Roger and Dan remained "subdued" in their expressions, and their criticisms of their advisors emerged as general frustrations with them or with the systems in which scientific research resided. Roger shared, "I mean, [they] certainly have [their] flaws," and Dan expressed some frustrations with his advisor, mainly around different preferences and working styles.

Finally, three participants, Anna, Amy, and Joe, clearly pointed out that any inadequacies they described about their advisors resulted from the fact that no one is perfect and were quick to point out that their good sides far outweighed their "not-so-good." I thought of these cases as the parallels to Matt's "not-so-great" advisor.

The following section describes the causal conditions that emerged as reasons for the second part of the central concept of "My advisor's great, but…" These would be the salient reasons that participants attributed to their less positive feelings about their advisors and

reasons for their potentially less positive relationships in some cases.

Causal Conditions. Participants repeatedly referenced two overarching concepts as reasons for frustration or tension with or dislike for their advisor. These concepts are related to the shared sentiment that advisors did not necessarily put students on the straight and narrow path to graduation or sentiments that fall under the general category of not being the most excellent fit for each other. Each of these had three sub-categories that emerged, which I highlight below.

No Path to Graduation: "It Became Problematic, how to Finish the Degree." Seven participants shared their belief that their advisors did not prioritize their degree completion, whether intentionally or unintentionally. In some cases, participants believe their advisors hurt their time-to-degree directly. One student's comment is well-representative of what most of them shared: "I think it's interesting that you mentioned time to graduation. I don't think [they] think about that at all."

Two concepts emerged under which most participants' descriptions could be categorized. First, six participants shared that their advisor was *too hands-off* and did not provide enough guidance, management, or direction. Nathan summarized his thoughts on this topic: "Sometimes students want to be micromanaged. Sometimes students need a little bit of that." While Roger pushed back on that specific style, the sentiment behind his comment agreed: "A little more structure would be nice– a little more guidance. Yeah, you don't want micromanaging, but you would appreciate a little more management. Amy was hesitant to share but said, "I'm not good with deadlines. And [they] would never be like, you need to have this on my desk right now. But maybe that would be beneficial to me, but I wouldn't know."

Lyla and Matt were specific about their disappointment in the lack of guidance they had received. They felt clear that it was their advisor's job to map out degree requirements with them, help set realistic timelines and objectives, and teach them how to approach research in a way that allows them to complete a dissertation. "I don't know, I'm here to learn … I don't know

the scope. … I don't have that experience of seeing five years, where I have to be or what I have to produce," Lyla expressed with frustration. Matt talked about the moment he realized he had to teach himself how to finish:

> But as it became more and more apparent that I've learned the majority of the things I was going to learn how to do, and the research, in terms of my thesis, wasn't very well planned out … it became kind of problematic about how I was going to execute, finishing the degree.

A *lack of trust and conflicting priorities* between the participants and their advisors was the second category of concepts that emerged when discussing the students' advisors' role in their degree completion. Holly admitted that her advisor told her about other people and scenarios they probably should not have. Nathan and Matt describe their advisor's gaslighting behaviors independently of each other and used the term "like a salesman" when describing their advisors' behaviors. "I think every person in the lab has had a conversation or been encouraged to do something that was not their best interest at all, but it was pitched as if it was right," Nathan shared. Similarly, Matt said, "And if there's any confusion on your part, [they'll] make you think you're not confused without actually addressing the confusion sometimes." Matt had frustrations about meetings and phone calls, the results of which drive the research in the lab and about which his advisor is not forthcoming.

Lyla feels conflicted between her roles as a student and advisee and as a producer in the lab. She feels terrible thinking about how her lack of academic progress impacts them: "It's also [their] career. It's important for [them] to publish, things like that … which makes it personal and influences how you feel about yourself." Nathan is nervous about talking to his advisor about his goal to be a teaching faculty because "for [their] own lab empire, I think part of [them] would prefer if I stayed in the academic research world." Matt has a similar sentiment:

> I would say yeah, mentoring is not high priority for them. because [their] motivation is get papers out, get recognition, do the things of productivity and not, what do you need as a

student to become actualized in being a scientist.

Data from the participant interviews highlighted that the students do not feel supported in their path toward the doctorate by their advisors precisely because they do not get enough guidance or direction, and their advisors have competing priorities which led to some distrust between them about objectives. Next, I describe the second emergent critique of their relationships with their advisors, which is that they lacked a good fit for one another.

Advisor's Behavior: "Very, Very, Frustrating!" Eight participants described their frustrations with their advisors, which fell into three conceptual categories: advisor conflict avoidance, participant confusion about expectations, and personality clashes.

Managing interpersonal conflicts in the lab as an essential skill in an advisor emerged from the interviews as a salient concept. Anna wished her advisor was a better communicator and could have helped more when she had relationship issues in the lab: "The thing that gave us any friction that we had was because he's conflict-averse and struggled with that."

Lyla knew that her advisor had good intentions, but that did not help: "[they're] such a good person, [they] don't like to hurt people, so you can actually see [them] holding back, but … then it's more trying to make it as a problem … that to me isn't positive." Roger felt the same way, sharing that his advisor was not great at conflict management, and Alice said both the advisors she had in graduate school could be passive-aggressive sometimes.

Students were *confused about their advisor's expectations*. Lyla's measures of success when her mental health was suffering were tough to navigate:

> Sometimes expectations are just hard because it's like I am sitting down in this desk, I showered, I came to lab, I made food. I won my day. If I only did one line of code, I'm proud of that, but that's never going to be in line, of course, with the expectations of a Ph.D. in research.

Holly recalled how she and her lab mates realized one day what it was like:

> And now we called it, it was like, having, when your parent tells you they're disappointed,

> I'm not mad, I'm disappointed. That was a lot of it. And you're like, oh god, [they're] very disappointed in us. And as I kind of said, one of my senses of academic achievement was feeling like progress is being made and that [they] felt like I was making progress. So then to have [them] think that this isn't good, this isn't working. I'm disappointed in how this is going, that compounds onto my own disappointment that it wasn't working.

Furthermore, finally, five students shared behaviors they found frustrating in their advisors, which I categorized as personality differences between the students and their advisors across the board. These ranged in nature from styles of work, such as Dan, who does not enjoy meetings and has an advisor who does, to examples more serious, such as Alice's first advisor, who used slander and exclusion from meetings as punishments for not working late:

> [They were] very famous for saying, people who don't work on Christmas day don't get Nobel prizes. [They] would walk around at eight o'clock at night and anyone who wasn't in lab, [they] would send emails to, and say that we shouldn't be scientists and that we should consider other jobs and that the people who were working in the lab were going to be rewarded and that we were going to be punished. And that usually resulted in being excluded from meetings. [They] would talk about us to other people.

All the participants had something critical to share about their doctoral advisors. These fell into two conceptual causal condition categories. Students believed their advisors did not guide them clearly and intentionally toward graduation by being too hands-off, not providing enough directives, untrustworthy, and having competing priorities. Students were also frustrated with their advisors' behaviors, and they described differences in their personalities and work styles and their inability to manage conflict or have difficult conversations. In the following sections, I will describe emergent actions/strategies from the interviews.

Actions/Strategies. After constant comparative analysis, the interview data revealed central emergent strategies/actions that students utilized to maintain their well-being despite the duality and complexity of their advisor relationships. These actions were: a) separating their

identities from their scientist/graduate student ones, b) utilizing other sources of support, and c) learning how to manage-up and filter content from their advisors.

Separating from Science: "De-Identifying as a Student Has Been the Best Thing."

Eight participants referenced their identities as graduate students compared to the rest of themselves, and seven directly referred to the importance of separating those parts of themselves as a means of protecting health and well-being.

Dan described this process as essential and talked about the importance of trying to identify with values and characteristics more than careers or types of contributions in maintaining his happiness in graduate school:

> De-identifying as a graduate student has probably been the best thing for wellbeing. Self-definition is a huge part of wellbeing. … I think people want this sort of easy definition of themselves, and then when that thing breaks down, it's hard to get back to that thing. … you can say that I'm "a scientist", or you can say "I'm a hard worker". Those are just very broad terms. But if you, for some reason, get out of science, can't work in science anymore, that definition of self comes a little bit hazy again. But if you can [self-define] in any other context … that *hardworking* definition … can help that sense of wellbeing.

Joe pushed back against the idea of it being a protective mechanism but agrees that the fact that he separates himself results in protection of a sort:

> I think maybe because I've not tied as much of my identity while I've been here to my research and that kind of disconnects almost shields me from a lot of that.

Most participants described how they changed in graduate school and actively worked on separating their ideas of success and self from what happens in the lab or with their advisor. Nathan said:

> I had a lot of moments where I allowed the Ph.D. to define my happiness, to define my joy, to define my self-worth. And now when things are great, I let it make me feel better.

> But when things are bad or if I'm not feeling it, or if you're in a rut or something's not working, you name it, that stuff really only affects me for two hours and then it's just moving on. But a lot of that's just having perspective of being in the program for long enough. And so yeah, I do have joy. I do enjoy the work that I do.

Lyla explained how she would come to realize that students either experience difficulty in graduate school and decide it is too much and leave, or "you start accepting certain things and just roll with other stuff … put importance in my personal life as a balance for when days are not great in the lab, for example." Amy even physically compartmentalized her graduate school identity because her partner lives in another city. She would like that to change in the future but admits that "for survival, in this four-year experience, it was really helpful."

Moreover, Holly can compare, now that she is out of graduate school and working, what it means to separate those parts of herself for the benefit of her health. Looking back, she realizes that she never had an identity outside of being a scientist and a graduate student. She recognizes how much happier she feels now that she has invested in other parts of herself.

Using Other Sources of Support: "We Would try to Solve it Together." Participants relied on their friends and other lab members to navigate the complications of advisor relationships. As described earlier, Anna utilized five or six other advisors as a graduate student. Dan worked and trained with a postdoctoral candidate in his lab, which he found to be a positive experience– so much so that he advises young graduate students not to get hung up on how physically available their advisor might be:

> I don't think it's always necessary to have a graduate student–PI relationship where you see them and meet with them every day. I think the smaller lab, it probably is more necessary, but if you can find at least one mentor that is pretty close to the science, I think that is ideal, at least for me.

Holly worked with other graduate students in the lab to alleviate their uncomfortable experiences with their advisor:

> And sometimes if I didn't have something work, but the other person was kind of stressed already about something going on, we would sometimes devise together the timing of when we would tell our PI about things to try to figure out how to not make the other person's thing worse. That level of, yeah. So, there was that level of management.

Managing-Up and Filtering Content: "Now I Know how to Sniff Those Out." Finally, students learned to "manage-up," like in Holly's example above, or ignore their advisors sometimes. When referring to the times his advisor tried to lead him down a particular path in the lab, Nathan said, "and so now, I know how to sniff those out and say no. But for many years I didn't." Similarly, Matt shared, "now I've learned if [advisor] says something, [they] might be trying to do the salesman thing, and I really need to learn to stand my ground and say, well, actually that's going to be a negative thing."

Lyla and Matt are both more focused on their objective. Lyla started out wanting the lab to grow and wanting to help however she could. However, "By this point, it's like, I just need to graduate." Matt utilizes this tool as well:

> But I think for me, the biggest thing with my mental health right now is how are the things I'm doing on a daily basis facilitating completing my thesis so I can get my degree?

Holly and her lab mates eventually learned ways to avoid feeling on the spot and disappointed in themselves ahead of meetings with their advisor:

> We kind of said in detail to each other, let's not, don't go in there without having a plan of action because at least if you can go in there and have a plan of action, then [advisor] knows that prerogative will then be made; and that we're not just stuck somewhere.

The participants described actions and strategies they used, wittingly or otherwise, to respond to the complexity of their relationships with their advisors in graduate school. Many of them realized that separating their sense of success and identity from the successes and failures of their science was helpful and protective. They found ways to utilize other sources of support and guidance. Furthermore, they learned to "manage-up" and ignore some of what their

advisors said or suggested.

Consequences. According to Strauss and Corbin (2008) consequences are not a required component of a phenomenon relationship axial coding paradigm, and after the first few rounds of coding, I anticipated this phenomenon would not have an emergent consequence. However, many coding iterations later, an outcome produced by the students' actions and strategies related to their dualistic feelings toward their advisors emerged. The students gained perspective from their actions, which, in combination with the impact of their contextual context, including stories from their peers, led them to express a common, salient sentiment. The participants were acutely aware that they had advisor relationships that were much better than most of their peers. Sub-concepts within this consequence concept emerged, and I describe them in the following section.

Appreciation and Empathy Emerges: "I Have it Better Than Others." Some participants said they felt lucky because their peers were in more challenging situations with their advisors. When talking about how much his advisor's support helped him during his "low moments," Roger shared that he'd "certainly witnessed in several of my peers that that's not always the case, which just compounds things even further, and I feel very common." Similarly, Dan said that when he speaks to his friends, he hears "a lot of stories about PI-student interactions that have gone awry." Holly said that even though she recognized things were not perfect, her advisor "well, she was one of the good ones."

Part of recognizing that their advisors were "good ones" included developing ideas about the academic research context and its role in their relationship with their advisor. These concepts were that even advisors could not protect students from the competitive and stressful academic research environment, and their advisors were under the pressure of competing incentives out of their control.

Holly shared her perspective, looking back, that "no matter how nice I found my PI and how much I genuinely enjoyed [them], there was also still quite a bit of pressure to produce or to

keep things going and to be able to keep stuff moving." Dan explained his thoughts on this:

> I think that I can see the efforts of academia to try to get at students' wellbeing with small events and things, but I think the real issue is between students and PIs because there's a different, and then postdocs and PIs, because there's different incentives at play. And I think that there's a lot of pressure at the PI level to get tenure, and that kind of clouds a lot of their judgment in trying to help their students and understand what their students need because they have to get things done, but at the same time be careful with not overworking their students. And I hear that story a lot.

Roger and Nathan acknowledge how hard it would be for an advisor to make this experience easier. Nathan does not think "[advisor] protects me from the beast that is academic and graduate research and the Ph.D. process," and Roger's comments support that sentiment: "Even with an advisor that I think has been fairly supportive, I've had some very hard times."

Participants seemed to develop ideas about the difficulty of the nature of their advisors' roles and recognized efforts from their advisors to address that. They shared their appreciation that advisors had developed over time and improved their mentorship skills. Nathan admires that as his advisor has had more postdocs and students come up through the lab, they refined their approach to trust, autonomy, and management. Lyla recognizes the difficulty of being the first one, "maybe I'm just the first one that [they're] going to make some mistakes with and then eventually [they'll adjust how [they] feel with that." Dan shares that perspective about his more senior advisor:

> I don't know if it's something that we can actually expect from every PI in the department. He has a ton of experience. I don't know how he was 20 years ago, and I'm sure he wasn't this good. But yeah, I think he's someone we can aspire to look for the type of mentor to be.

Other participants shared similar thoughts, and some extended that idea to recognizing that their advisor had developed a greater understanding of the student's style over time. Amy

explained how her advisor was able to adjust their method of teaching and communication with her to accommodate her reduced auditory retention: “I don’t know if [they’re] trying to do this for everyone, it might exhaust [them] but I know that’s definitely helped my success in the long run.”

A consequence of the students’ ability to separate their self-worth and identity from their successes and failures in the lab and with their advisors allowed concepts around understanding of empathy towards and appreciation for their advisors to emerge. Next, this portion concludes with categorizing the emergent data around the meaning of well-being to the participants.

Summary: “My Advisor is Great, but… ”

Seven of the ten students interviewed shared dualistic feelings about their advisors; they had much positivity to share about that relationship but also significant criticism. The remaining students shared varying levels of positive and negative sentiments as well.

Students value advisors who support work-life balance. They appreciate advisors who are good people and make them feel cared about, like they can talk to them about anything, who are accessible and available, and who curate a diverse and inclusive atmosphere. Students appreciate advisors who seem like a good fit. Those advisors make them feel appreciated, recognized, supported, and trusted, inspiring them and giving them trust and transparency.

In parallel, students did not appreciate that their advisors did not guide them to a straight path to degree, and criticized advisors who were too hands-off, who cultivated a lack of trust, and who seemed to have conflicting priorities and objections. Students recognized advisor relationships that didn’t seem to fit, particularly when they felt confused about their advisor’s expectations and frustrated with their behaviors. Many of them wished their advisors were not as conflict averse as they are.

Participants learned to manage-up and filter out content from their advisor and find a sense of self outside the lab. They also learned to utilize resources and support outside of their advisor. As a result, participants gained a sense of empathy and appreciation over time. They

recognized the difficulty of their advisor's job, the external pressures on them, and their efforts to improve their mentorship skills and adjust their styles to suit their individual students' needs. The last chapter combines these relational categories into a theoretical narrative, illustrating how they connect and the relationship between academic capitalism and LRU BIMS/BME student well-being.

Chapter V

Discussion

Through this capstone study I set out to develop a theory illustrating any influence academic capitalism may exert on the well-being of doctoral students in the biomedical sciences. I posed the research question, “how does academic capitalism shape the growing mental health crisis amongst biomedical graduate students?” and worked to answer it by systematically coding rich qualitative data that emerged from semi-structured interviews with biomedical doctoral students and alumni. Both a central phenomenon emerged, as well as a secondary one. Through constant comparative analysis, conceptual relationships with the phenomena emerged, and a theory unfolded via an iterative analysis process.

This fifth and final chapter begins with a summary of the emergent results described in chapter four. Then, I discuss the relationship between academic capitalism and biomedical doctoral students’ well-being and reveal the culminating grounded theory. The final sections cover this study's implications for practice and limitations.

Summary of Findings

Data analyzed from interviews with students and recent graduates from one of the eight doctoral degree-granting programs in the BIMS or BME programs at LRU exposed salient concepts and phenomena in those discussions. Three overarching categories comprise the findings: 1) contextual academic capitalism; 2) students’ hesitation to pursue careers in academia; and 3) their dualistic feelings about their doctoral advisors.

A Context of Academic Capitalism at LRU

Academic capitalism is tangible to doctoral students in BIMS and BME programs, regardless of their awareness of the theory or concept. Evidence of the impacts of neoliberalism and reduced state funding is within students’ expressions of the stressful nature of the academic job market, indicating an understanding that there are more scientists than academic jobs available. They shared their feelings of stress about the pressure to publish in high-impact

journals, to achieve tenure and promotion, and to receive external funding as often as possible. Students described the competing objectives of education and research, evidenced by individual advisor behaviors.

Academic capitalism favors applied scientific research, and the students' experiences indicate their awareness of this favoritism. They described framing their questions of inquiry to fit within research objectives that federal and private funding agencies prioritize at any given time. The theory of academic capitalism highlights the revenue-pursuing behaviors of individuals in addition to systems and institutions. Some participants described their advisors' primary function as the procurement of funding for the lab, and most students shared that their advisors do not conduct any scientific research anymore but rather spend much of their time applying for grants or publishing research, which increases desirability for grant awards.

The effects of academic capitalism, as described in the literature review of this capstone, are detectable to the interview participants. Those coded concepts and categories serve as the contextual foundation for the grounded theory developed and described in this chapter.

LRU BIMS/BME Students Want to Leave Academia After Graduation

Interview participants overwhelmingly have either already left or plan to leave academic research after graduation. Those who intend to complete academic postdocs are leaning toward leaving academia afterward. Participants cite low academic salaries in postdoc and starting faculty positions, in comparison to the salaries garnered in industry positions, as a reason for their desire to leave. They felt careers in academic research require a great deal of commitment to accept the mental taxation and lack of work-life balance that accompanies that career. Combined with the amount of publishing and grant-writing expected, they did not perceive it as a desirable path. Participants considered alternative careers to achieve more significant translational impact and experience a faster pace of discovery.

Students responded to these feelings by demonstrating flexibility with their career objectives, strategizing their next moves while in graduate school, and actively rejecting the

lifestyle academics in research endure. As a result, they expressed security in their job prospects, preparedness for non-academic careers, and contentment in their work-life balance in those careers.

LRU BIMS/BME Students Concurrently Like and Critique Their Advisor

The doctoral student/alumni participants overwhelmingly liked their advisors. They appreciated their advisors' support and encouragement to have work-life balance. They viewed their advisors as generally good people who care for them and make themselves available to their students to talk about anything. Some felt they matched well with their advisors and appreciated their transparency and advising style.

However, many of the students also shared frustrations with and critiques of their advisors. Most of them did not believe that their advisor had their students' timeline to graduation as a priority, and several participants described their advisors' competing priorities interfering with their academic progress. Some complained that their advisors did not provide enough specific guidance. Many students found their advisors frustrating, whether due to their inability to manage conflict in the lab, inadequate expectations, or generally frustrating behaviors.

Students found that separating their graduate student/science identity from other parts of themselves, such as self-worth, was critical to maintaining their well-being in graduate school. They also learned to "manage-up," carve their paths to graduation, and ignore some directives from their advisors. They leaned on other members of their lab or support networks. In many cases, this led to students feeling compassion for the pressure their advisors were under and recognizing that other students had worse scenarios with their advisor relationships.

Introducing the Theory: Academic Capitalism and Graduate Student Well-Being

The literature review in chapter two considered the consequences of academic capitalism on the nature of the biomedical research lab and the structures within which research resides at research-intensive university campuses. As demonstrated with concepts that

emerged from the data in chapter four, interview participants experienced the concrete nature of these consequences. Academic biomedical research is fraught with systemic imbalances widely viewed as the result of academic capitalism. In this section, I lay the groundwork for a theory built from the data presented thus far that links this systemic imbalance and graduate student well-being.

In review, the imbalance of academic capitalism is one in which increasing numbers of scientists compete for limited funding opportunities to conduct research at increasing costs (Alberts et al., 2014). Graduate students and postdoctoral researchers conduct most biomedical research at research universities (Alberts et al., 2014). Faculty are increasingly tasked with applying for grant funding and rely more heavily on trainees in the lab to conduct the research, resulting in programs and departments recruiting as many trainees as possible (Hoffman, 2011; Nixon, 2012; Slaughter et al., 2015; Spinrad et al., 2022). Federal budget decreases lead to sharper competition for limited funding opportunities, and reduced state-dollar allocation to universities increases the dependence on external sources of support to conduct research and operate degree programs (Hoffman, 2011; Nixon, 2012; Slaughter et al., 2015; Spinrad et al., 2022). These factors lead to an *imbalance between the number of dollars needed to operate and the number of dollars coming in, as well as an output of far more scientists than available positions.*

In considering this imbalance, a theory emerged demonstrating relationships between this reality and many factors predictive of graduate student health (UC Berkeley Graduate Assembly, 2014). Conversations with LRU BIMS/BME students about their well-being as graduate students at an academic capitalistic R1 institution shed light on the multifaceted nature of their motivations and behaviors around career choices and well-being.

In the following sections, I introduce these relationships in the context of the literature discussed previously, demonstrating how central aspects of academic capitalism shape LRU BIMS/BME students' actions and strategies toward maintaining their well-being. Finally, I will

illustrate the concluding theory broadly before sharing implications for practice and limitations of this study.

Neoliberalism, Declines in State Support, and Well-Being

LRU BIMS/BME students were anxious and stressed about pursuing academic careers, as evidenced by their overwhelming desire to avoid academic careers or strongly consider alternatives. They are not alone in this experience. The discovery that *the academic job market is saturated* is understandably a deterrent for many would-be academic scientists and is a significant stressor reported by biomedical graduate students during their time in graduate school (Byrom et al., 2020; Kausar, 2010; T. Ryan et al., 2021; UC Berkeley Graduate Assembly, 2014).

Additionally, saturation in the job market for scientists has led to an increased length of training positions for new Ph.D.s. In 2012, new investigators waited an average of 4-5 years to receive federal funding compared to 1 year in 1980 (National Institutes of Health, 2012a). In 2012, the average ages of biomedical science Ph.D.s receiving their first tenure track position and their first NIH Research Project Grant[3] (R01) grant were 37 and 42, respectively (National Institutes of Health, 2012a). In 1980, 16% of NIH grant recipients were 36 or younger. By 2014, that number was 3% (National Institutes of Health, 2012a). Biomedical science graduate students spend an average of 6.3 years working on their doctorates, surrounded by postdoctoral researchers who spend more extended periods in their fellowships and take longer and longer to find permanent career prospects (National Institutes of Health, 2012a). It is thus not surprising that LRU BIMS/BME students cite concerns about the mental taxation of academic careers and the *amount of mental dedication required* to succeed.

[3] NIH R01 grants provide funding to support research on discrete specified projects to be performed by named investigator(s) in an area based on the mission of the NIH. There are special considerations for early-career scientists, and the NIH R01 is NIH's most-used, largest, and oldest grant program.

Anxiety over career prospects, coupled with front-row seats to the increased pressure on faculty mentors to apply for and receive grant funding, makes it additionally unsurprising to find that graduate student trainees experience a lack of confidence about their financial prospects as academic researchers when considering their financial futures (Ab Marais et al., 2018; Byrom et al., 2020; Huisman et al., 2002; Hyun et al., 2006; Kurtz-Costes et al., 2006; Levecque et al., 2017). LRU BIMS/BME students are no exception. They expressed their concern about *pressures to publish and secure funding in academia*, coupled with the perception of losing potential income during years spent in *low-salary training positions*. Furthermore, they face the prospect of starting faculty positions that offer *lower salaries compared to those in industry* and biotech sectors.

Academic job saturation, increasing lengths of academic training required, and intense pressure to fund their labs in exchange for low salaries are all ways in which the participants felt the effects of neoliberalism in their labs. They described the pressure their advisors were under to meet neoliberal metrics for performance evaluation, such as publication volume and measure of administrative responsibilities. Student participants experienced the competing demands of the research and academic arms of the institution and had concerns about the mental taxation of navigating survival in academic research. The ripples of reduced state funding at higher education institutions were apparent in their descriptions of increased pressure to secure funding and publications and their concerns about faculty research position availability and low salaries.

Student participants found increased well-being in financial security, which played a part in their decisions to adjust their career goals. They do not want to struggle for basic needs such as “replacing a windshield.” When describing their concerns about low academic postdoc and faculty salaries, some participants cited their future goals to start a family. Others referred to the importance of having retirement savings. The importance of relationships and connections, essential components of well-being, was demonstrated by their decisions to be flexible with

career goals and strategize their next career moves, including evaluating alternative postdoc opportunities and jobs outside of academia.

Participants shared that engaging in scientific research was essential to maintaining their well-being as was maintaining a healthy work-life balance. The participants' valuing of work-life balance contributed to the dwindling attractiveness of pursuing a tenure-track career and pursuing tenure. Amy's discomfort with the tenure system encouraged her to consider alternative careers. As Figure 2 depicts, academic capitalistic neoliberal forces and declines in state support for research at higher education institutions push LRU BIMS/BME students away from academic careers. Nevertheless, their love of engaging in science and their commitment to stability and a healthy work-life balance enable them to push back and find other scientific paths.

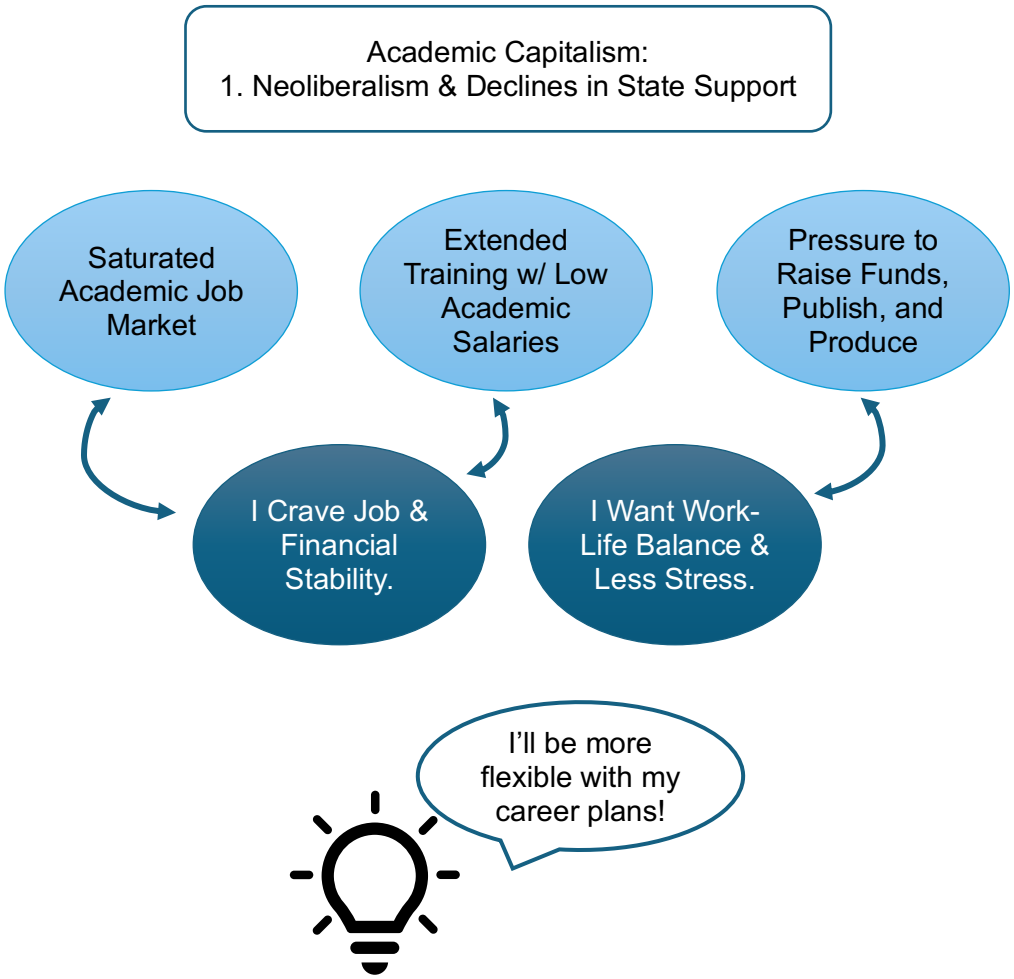
Revenue-Pursuing Behaviors and Well-Being

Chapter four highlighted several examples of how LRU BIMS/BME students experienced the revenue-pursuing behaviors characteristic of academic capitalism at research universities. Participants' advisors spent more time applying for grants and writing papers for publication as their careers progressed, and almost none of their advisors conducted scientific research in the lab. The students view the job of a laboratory PI as primarily securing funding. The students described their clear sense of conflicting priorities between the student's academic objectives, mainly to graduate, and the advisors' to maximally produce scientific content. Students shared experiences demonstrating their awareness of their role as primary knowledge producers and the lab as a business. They described the external pressures and stressors on their advisor and themselves to publish and receive grant funding as much as possible.

Many of the concepts that emerged as causal conditions to the two central phenomena described in chapter four materialize here as outcomes of the revenue-pursuing behaviors of academic capitalism. Most participants criticized their advisor's ability to guide them straight to graduation. Whether advisors directly suggested additional projects that delayed their time to

Figure 2

LRU BIMS/BME Student Well-Being in the Face of Neoliberalism and Declines in State



graduation or whether they lacked the skills and knowledge to advise the participants on how to achieve milestones to graduation best, participants felt this was a factor of their *advisors' prioritization of production in the lab over academic goals* and shared a general sense of distrust for their advisor in some cases. In addition to feeling their path to graduation was not prioritized, students shared *frustrations around being confused about their advisor's expectations and wished their advisors were better managers of interpersonal relationships in the lab*.

The participants highly valued work-life balance. They appreciated their advisors for encouraging their work-life balance and, in the same vein, were acutely aware of their advisors'

poor work-life balance, which they often attributed to the perpetual need to write grants and submit papers.

Considering the academic and career pressures described previously, faculty investigators and their students experience challenges in maintaining positive, healthy relationships. In addition to the stressful impact of capitalistic demands created by a highly competitive publication and grant environment, the physical demands on faculty's time contribute to a culture that may feel less caring, less nurturing, less committed to training, and, in the worst cases, toxic. Participants combat this by working to separate their sense of self-worth from their achievements in the lab. They learn to filter content from their advisor as needed and rely on their support structures to block negative impacts from their advisors' frustrating behaviors. The participants actively reject the poor work-life balance that comes with academic careers and adjust their career goals and objectives accordingly.

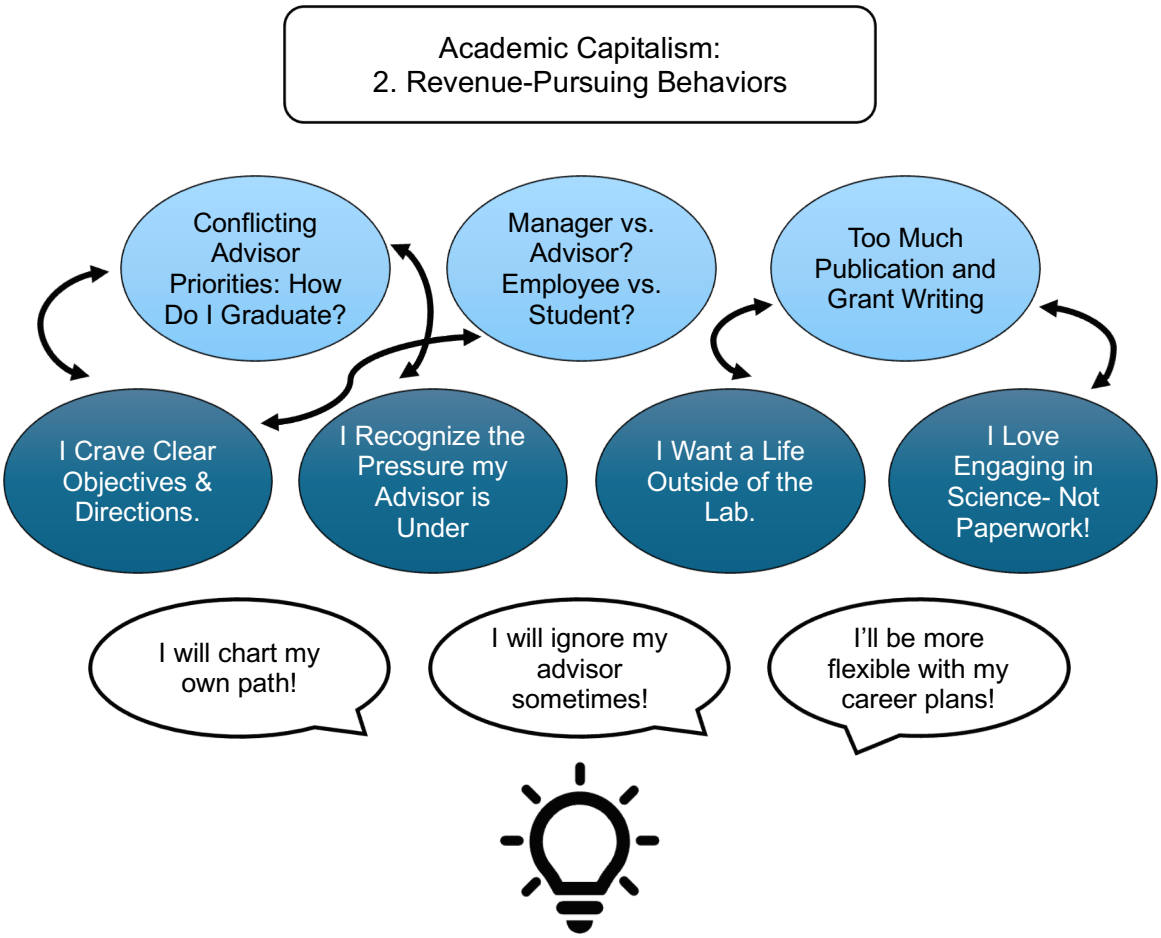
Ironically, and as some of the participants experienced, the labs that receive the most funding also tend to have larger workforces and environments where faculty advisors are less likely to be seen in the lab and more likely to be spending their time applying for grants, sitting on grant review committees, serving on publication peer-review groups, and fulfilling the bureaucratic tasks that come with running a lab like a business. Some students, like Dan, find environments like this particularly valuable since the chance of having senior advisors such as postdocs and senior scientists in the lab and the flexibility and freedom to explore science due to stable funding is high.

In an environment where the same academic capitalistic system that students find themselves in today once funneled faculty advisors through their academic career pipeline, it is not surprising that they lack the mentorship training, the time for one-on-one cultivation of relationships, and the atmosphere conducive to thoughtful and intimate scientific processes, collaborations, and relationship forming. Students learn this themselves as their time in the lab extends into their fourth or fifth year. Participants described their empathy for their advisor and

recognition of their pressures. They acknowledged that academia is challenging, and advisors

Figure 3

LRU BIMS/BME Student Well-Being in the Face of Revenue-Pursuing Behaviors



do not have the power to shield them from that.

Reports directly link trainee well-being to the lab environment (Mackie & Bates, 2019) , and the incapacitating demands on scientists have a trickle-down effect on their ability to mentor, train, and provide environments where students can maintain positive well-being and emotional and mental health. However, LRU BIMS/BME students use their sense of what well-being means to them and their prioritization of work-life balance to use tools that combat the stressful impacts of revenue-pursuing behaviors in their labs (Figure 3).

Support for Applied Research

Looking closer at the impact of increased reliance on external funding sources in biomedical research within higher education, we find additional potential contributors to factors predictive of student mental health. Alberts et al. (2014) explain how a hypercompetitive environment for limited resources can lead to significant shifts in scientific approach and thinking. One is the reduced willingness—or even ability—to take scientific risks. When grant funding is limited—fallen from “30% to the low teens” from NIH, for example (Alberts et al., 2014)—all the players involved feel the urgency of a successful, positive, scientific outcome. Researchers spend the bulk of their time applying for grants and feel the pressure to propose sure-fire studies with limited exploration of new techniques, fields, and avenues to increase their likelihood of being funded. This conservative approach is further rewarded by funding agents and reviewers who feel the same pressure to allocate limited resources to questions that are likely to provide answers.

LRU BIMS/BME student participants have a distinct awareness and understanding of the need to “play the politics game.” They describe their understanding of the importance of framing questions in ways that are “laser-focused on applied … therapies” and on packaging grant applications in language that taps into the most coveted therapies and applications. They *recognize the need to develop research questions around funding and publishing trends*.

Even Anna, who approaches science from a “curiosity-driven point of view” and does not support the expectation that all research questions should be therapy-driven, has found peace in the process. She formulates her questions in ways that speak to funders; knowing their support enables her to continue research from her standpoint and basic-question approach. Moreover, Joe, who finds it “lame” that funding dictates research questions, finds value in the systematic, organized, templated approach that the grant application process provides researchers.

Beyond accepting this as practice, process, and culture, what came as a surprise was their *active embracing of the cultural ideology that applied research is more valuable and worthy*

of research than basic science. Most participants described the importance of feeling a strong connection between what they do and direct human impact and equated this with research with a directly translational objective. Some participants tap into that connection to get through difficult times in the lab or with their advisor. Many participants agreed or accepted that biomedical science was more exciting when approached from a disease-based or translational point of view. Lyla said she would not conduct scientific research if her only option was basic research. For her, it is incredibly personal–she works in cancer research, and cancer has touched many members of her family, including herself, most recently.

For many participants, this connection to translational work strongly ties to their sense of well-being. Engaging in scientific research is a vital component of their positive state of well-being, and for many of them, recognizing that they want more robust ties to applied solutions and faster paces of discovery further motivated them to change their career goals and strategize their next moves to put themselves in places where those stronger connections and faster paces are palpable, such as industry, biotech, or even in other countries. Amy shared that she had been seriously considering postdoc opportunities in Europe because, according to her, 1) European universities have strong ties to industry, providing her with an opening to industry afterward if she chooses, 2) the funding model is different than the U.S., and institutions are trusted to allocate funds to areas of research as needed, 3) the quality of life is better, and 4), the length of postdoc appointments are shorter. In fact, some students may consider science-related fields, away from the bench, to influence the movement of research from bench to therapy more directly. For example, Lyla was considering a career in science policy to, as she described, feel more connected to “people-driven” work. The connection to translational work emerged as an important part of the participants’ engagement in science and overall well-being.

For many participants, this positive feeling about conducting exciting and translational science has equally strong ties to their relationships with their advisors. Most of the participants described their advisors as supportive and trusting when it came to exploring science. They feel

appreciated and recognized by them. Even when or if they are confused by their advisor's objectives and feel a lack of direction from them, there was a sense in our discussions that the student participants have deep underlying respect and appreciation for the work their advisors conduct daily. Once more, the most extreme cases are often the most demonstrative. Alice had an experience with her first advisor in graduate school that was traumatic and which, in her opinion, did permanent damage to her well-being. Nevertheless, even when speaking of that advisor, Alice shared, without a prompt from the interviewer, that that first advisor made her the most excited about science.

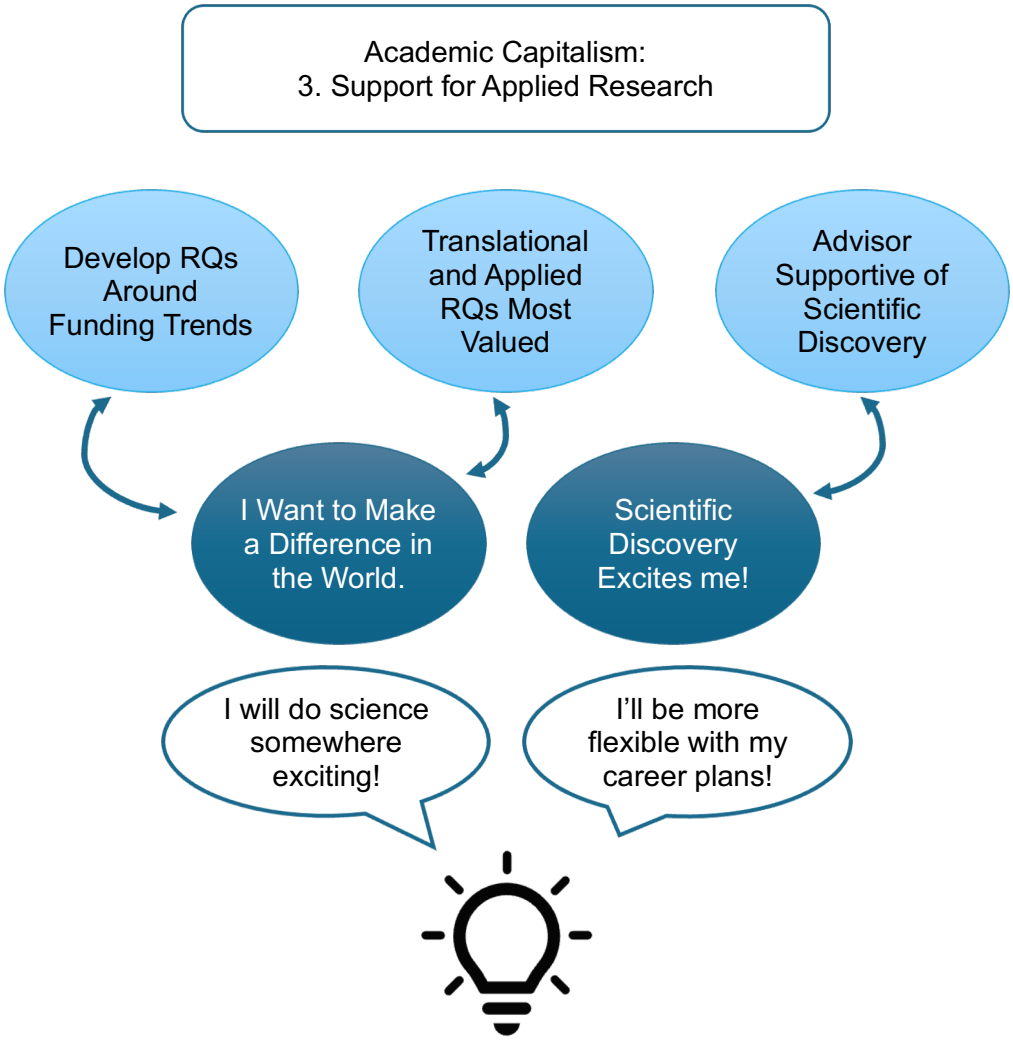
The participants felt disillusionment with the lifestyle and structures within academic research, yet when they can separate their sense of worth and identity from that of their graduate student identity, and after learning to "manage-up" and tune out what they perceive to be unhelpful noise from their advisors, they gain compassion for the role their advisors hold, and the pressures and responsibilities that come with it within the system in which they reside. This compassion enables them to have a dualistic view of good scientific fit with, admiration for, and inspiration by their advisor while also disliking all the parts about them that come from the academic capitalistic environment in which they operate. These dualistic feelings contribute to their decisions to remain in science but try to leave academia (Figure 4).

Putting the Theory Together: LRU BIMS/BME Students Avoid Academia but Stay in Science!

As competition for grants and financial support has increased, so has the need to publish, particularly in high-impact journals. This pressure has extended directly to graduate students, who now spend more years in their doctoral programs where their mentors push them to publish—often a requirement for degree conferral—in these journals. This pressure to produce contributes further to the ongoing highly competitive and highly stressful cycle around academic progress. Academic scientists—and their graduate students—must produce more, do so faster, publish in the "best" journals, and frame research questions that are fundable and

Figure 4

LRU BIMS/BME Student Well-Being in the Face of Support for Applied Research



answerable, all the while increasing the size of their labor force in the lab, continuing to apply for funding, and proving that everything they do is directly translatable to medical practice or pharmaceuticals.

Academic capitalism, manifested as the stressful cycle described above, plays a role in LRU BIMS/BME student participants' decisions to avoid academic careers as a way of protecting their well-being. In addition, the participants overwhelmingly chose to pursue scientific careers. Of the ten students interviewed, only one had plans to change careers and

leave biomedical sciences. It is notable that even in the most extreme case, in which Alice's mental health deteriorated in graduate school so much that she regretted graduate school altogether, Alice chose to continue a career in science and was happy with that choice as of her interview. The theory I presented thus far suggests that this phenomenon is the result of a combination of factors, including scientifically inspiring advisors who are good people, the positive impact of scientific engagement on participant well-being, a culture that elevates applied and translational studies, and a strong belief in the value of work-life balance.

Participants maintained their positive well-being by engaging in scientific research, remaining connected to the application of their work to better the human condition, and maintaining work-life balance and social connections. They disliked everything about daily life as an academic researcher but admired and appreciated the person that their advisor was and their advisor's scientific contribution. The perfect solution for participants was to change their career goals and strategize ways to stay in science but remain happy. They chose paths that allowed them to conduct fast-paced translational work that makes a difference yet go home at the end of the day to be with the ones they love and do the things they care about outside the lab (Figure 5).

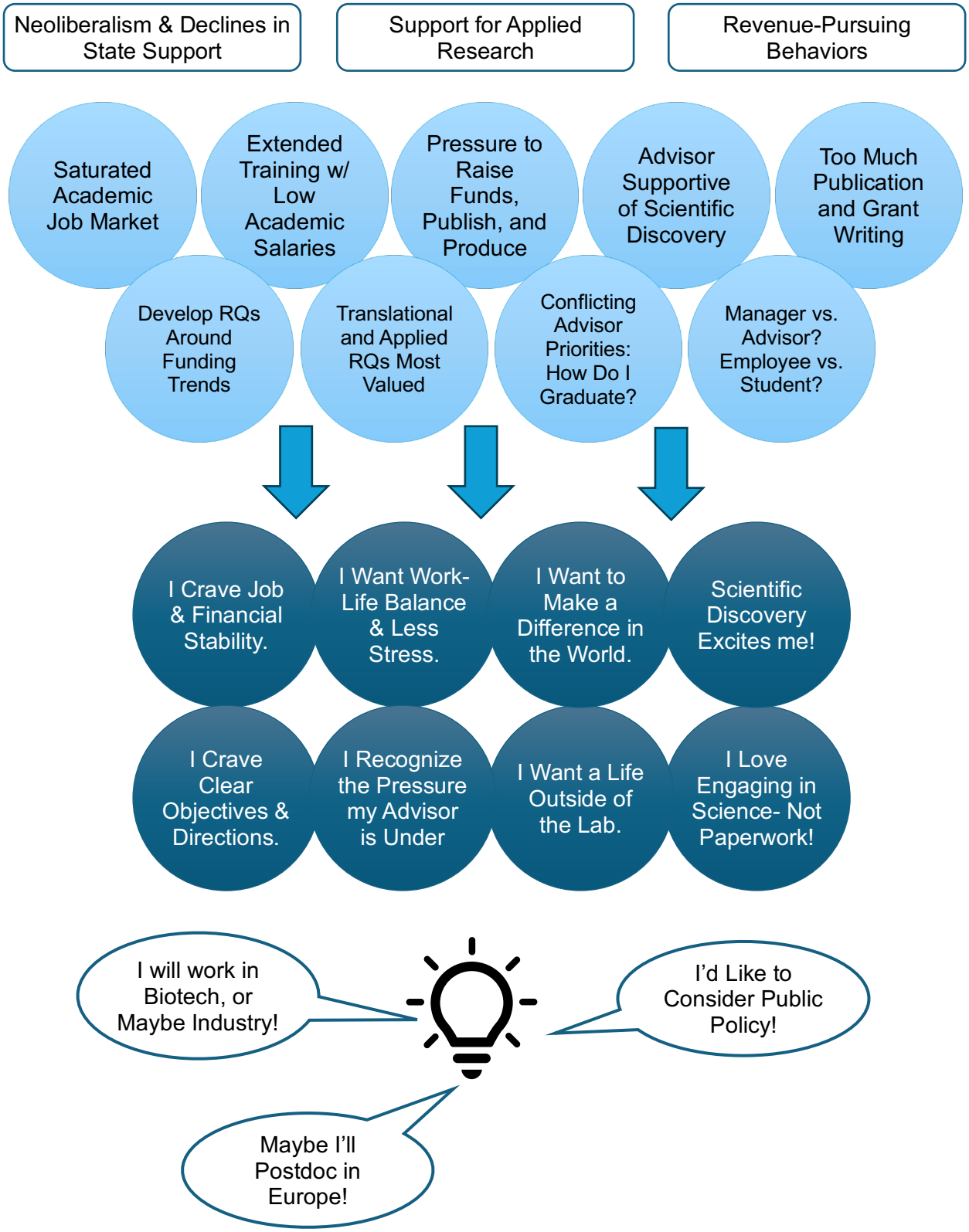
Implications for Practice

There is evidence for diminished health and well-being among graduate student populations (Berry et al., 2020; Evans et al., 2018; Levecque et al., 2017; Mackie & Bates, 2019; Peterse et al., 2018; Russo, 2011; Stubb et al., 2011; "Time to Talk about Why so Many Postgrads Have Poor Mental Health," 2018; Toews et al., 1993, 1997; Tsai & Muindi, 2016; UC Berkeley Graduate Assembly, 2014; Urbina-Garcia, 2020) and particular concern regarding the significantly higher incidence of diminished mental health among biomedical graduate students.

Biomedical doctoral students conduct their graduate research and complete their dissertations at research-intensive institutions of higher education, such as LRU. These institutions are established within the now-dominant culture of academic capitalism manifested

Figure 5

Academic Capitalism Shaping LRU BIMS/BME Doctoral Student Well-Being



in institutional and individual behaviors and belief systems. This study sought to explore biomedical science doctoral students' well-being in the context of their environment–academic capitalism. I asked, "*How is academic capitalism shaping LRU BIMS/BME student well-being?*"

As disclosed in Chapter Two, there are several predictors of well-being in graduate students, including financial status, relationship with one's advisor, work-life balance, length of training period, and anxiety about navigating job opportunities outside of academia (Evans et al., 2018; Hyun et al., 2006; Mackie & Bates, 2019; Tsai & Muindi, 2016). Not only did many of these factors emerge from this research as central components of doctoral student well-being, but many are within the realm of influence by institutional and programmatic structure and leadership. The objective of this study, through constant comparative analysis and theory development, was to *uncover ways the institution and graduate program can influence self-reported states of well-being as they may relate to factors of academic capitalism*.

Thus, the following sections include a series of recommendations for practice resulting from the concepts and grounded theory that emerged. These recommendations seek to improve LRU BIMS/BME student reports of well-being. The recommendations are calls for action directed at three levels of infrastructural administrative units implicated in the experiences of LRU BIMS/BME students within the context of academic capitalism. They are a) BIMS/BME degree programs and affiliated departments, b) the overarching school and institution, and c) the federal entities that manage and regulate grant funding in science, such as the NIH.

Finally, these recommendations aim to contribute to LRU BIMS/BME students' positive experiences while in graduate school and self-reported well-being. They are not intended to be a means of reversing LRU BIMS/BME student departure from careers in academic scientific research. However, a trickle effect of addressing systemic flaws may be a shift in academic research culture and infrastructure, ultimately resulting in fewer departures over time.

Programmatic and Department Recommendations

Supporting Doctoral Students on the Path-to-Degree. After they complete their

coursework, BIMS/BME doctoral students required more explicit and individualized guidance in designing and mapping out their path to a degree. With the pressures and time constraints on academic research faculty described in detail over the last few chapters, it is not reasonable nor feasible to add to the responsibilities of lab PIs and doctoral advisors. While the doctoral advisor is the only person who can explicitly train and guide a biomedical doctoral student through the scientific inquiry process required to complete a dissertation, other untapped support sources are available to students.

Many graduate programs, including the BIMS/BME programs at LRU, have allocations for program support staff. Additionally, departments affiliated with graduate programs typically have several support staff position allocations. These staff may already provide unofficial advising to the students, as they are typically doctoral students' first points of contact during recruiting and remain their logistical and administrative support persons during their time in graduate school. Depending on the existing program support structures, programs may not require significant adjustment to expand support staff portfolios to include individual academic advising for doctoral students. In other cases, they may need to change staff structures and roles slightly, perhaps increasing the academic qualifications of some staff and enhancing their job descriptions, providing the structure to provide students with increased and more appropriate guidance.

Students need to be aware early in their academic careers of first-author publication requirements in their respective degree programs, empowering them to discuss similar requirements that require long-term commitment and far-out planning with their advisor. This proactive guidance is an example of the enhanced support students could receive from a staff advisor. Other examples would be regular check-ins, assessing trajectory, mapping out degree milestones such as qualification exams, dissertation proposal submissions/defenses, etc. Regular check-ins also provide opportunities for connection and relationship building that the participants sought. They also provide students with a structured opportunity to identify as

graduate students without facing their competing knowledge-producer roles, as may occur with their advisors. Furthermore, professional advising staff with minimal science backgrounds may assist students with “playing the game,” as participants called it, teaching them to frame research questions in “fundable” language and formats, for example.

Participants overwhelmingly described advisors that are too “hands off,” and indicated their increased stress about paths to degree completion and unclear expectations of them. Professional advising staff could alleviate the pressure on research faculty to provide the individualized academic care doctoral students need. It would provide doctoral students the support and structure they need to feel supported in progressing forward.

Faculty Advisor Mentoring and Training Programs. Student participants complained that their advisors were conflict-averse and lacked the skills to manage interpersonal conflicts in the lab. This complaint is unsurprising because their advisors are trained scientists rather than managers. Research faculty take on the lab management role as well as the roles of mentor, teacher, and trainer all while maintaining productivity in publications and grant submissions. Biomedical research faculty have three or four jobs within their scope of responsibility.

Providing faculty with more robust mentorship and training programs and the hands-on training needed to manage people would be an impactful way to address graduate students' well-being in the lab. Opportunities to learn about how to have difficult conversations, how to interview graduate student candidates to join the lab including how to determine fit, and how to tap into different skills and strengths from different members of the lab, are just a few examples of the “soft skills” that faculty advisors might benefit from which could ultimately lead to students feeling less frustrated during their time in graduate school.

Additionally, faculty would benefit from mentorship from senior faculty. Participants observed that their advisors learned over time how to serve their students better– senior faculty have a lot to share with junior faculty, and the learning curve might decrease if faculty participated and partnered in mentorship programs focused on skills needed to advise doctoral

students.

Institutional Recommendations

Allocations for Administrative and Laboratory Staff. Institutions of higher education could support the well-being of doctoral students in research labs by easing the burden of laboratory productivity from their student population. Participants described conflicting priorities with their advisors and lack of trust. These sentiments originated from incidents such as their advisors suggesting additional projects or lines of inquiry that did not contribute to students' degree progress.

Conversely, faculty researchers must continuously produce in the lab to publish in high-impact journals and submit grant applications. School and institutional level allocations towards career staff scientists, lab technicians, and lab managers alleviate the burden of production from graduate student trainees. Increasing staff/career scientists positions is potentially part of a long-term solution to the supply/demand imbalance in biomedical science as part of a restructuring of federal grant distribution (Alberts et al., 2014), however, school/institution level hiring is an alternative mechanism with which to provide labor support, also easing the imbalance. Additionally, institutional staffing aleviates the dependence on R01-like grants, potentially providing advisors an opportunity to shift their focus to their students' academic objectives.

Expand Career Paths and Opportunities for Trainees. Participants expressed feeling anxious and stressed about the competitive job market. While they were notably less stressed about their opportunities outside of academia, they needed guidance or advice about the many options and opportunities available to doctoral graduates of biomedical sciences programs. Stress about career options and lack of clarity about the future are documented sources of detractions to student well-being, and evidence from this study further supports that. LRU BIMS/BME students want opportunities to make informed decisions about their next career steps. They are creative, excited, open-minded, and bright. By the time they graduate, they will

have acquired advanced critical thinking skills; they are and will be invaluable in many fields beyond academia or biomedical industry/biotech. Institutions of higher education must provide partnerships and opportunities that give graduate students the knowledge and hands-on experience they seek to succeed in various fields. Amy was attracted to the partnership between higher education, private start-ups, and biotech in Europe. American universities, specifically LRU, have the infrastructure, capacity, and knowledge base to form similar opportunities for training and skill-gaining for their students.

Federal Institution Recommendations

Consider Restructuring the Laboratory Labor Force. Academic research scientists and scientists at national research institutions have contributed informed and valuable suggestions for ways in which restructuring of funding appointments could have significant impacts on addressing the imbalance in biomedical science described previously (Alberts et al., 2014, 2015; Cuss, 2014; Resnick, 2014). These suggestions have the potential to impact the doctoral student experience in ways that address issues participants raised in this study.

For example, restricting trainees from being appointed to research grants increases the grant personnel allotments toward postdoctoral and staff scientists. A side effect of this would be an increase in number of positions for newly graduated Ph.D. students, and longer-term positions for scientists who are not tenure track research faculty. In addition, expanding the reach of training grants and fellowships by increasing the number of them available, the number of appointments on them, and expanding eligibility to international students provides the structure for student support in graduate school within the constraints of these types of funding packages. Typically, that means greater oversight of academic outcomes from the granting institutions, higher standards for student appointment and selection, and regular review of appointee packets. These types of restructuring help balance the number of scientists produced and the number of postdoc/research scientist positions available and reduces students' time in graduate school. As demonstrated previously, competitive environment, lengthy trainee tenure,

and lack of academic guidance and oversight are all factors LRU BIMS/BME students cite when sharing their stressors in graduate school and detractors from their well-being.

Consider Redesigning Grant Award Mechanisms. Like restructuring the labor force within research labs, redesigning grant awardee selection mechanisms and award allocation has the potential for direct and swift positive improvements to the daily experiences of LRU BIMS/BME students. Alberts et al. (2014) suggested how the current grant-awarding systems reward safer scientific choices and favor large research programs. The authors suggested expanding the types of awards to include those that reward creativity, risk-taking, originality, and standards of excellence–alternative criteria for funding that have the capability of expanding funding access to more early-career scientists while also prompting and encouraging quality standards (Alberts et al., 2014). These suggestions address concerns and fears participants raised about participating in the funding game, the highly stressful nature of the tenure process, the minimal sources of funding, and the requirement to frame everything as a bench-to-bed translational line of inquiry.

Study Limitations

LRU, an R1 Carnegie institution, is deeply ingrained in academic capitalistic behaviors and, as such, has made an ideal research site from which to examine well-being in an academic capitalistic context. While academic capitalism has a broad net impact in higher education and industry, the research design-–qualitative constructive grounded theory–provides rich, substantive data reflecting these participants and this study site exclusively. This study was limited to interviews with students and recent LRU BIMS/BME program alumni. It is not generalizable to all biomedical science doctoral students and programs or to all contexts in which academic capitalism is apparent.

This study was limited to examining the doctoral student's experience in biomedical science. As such, it excludes any potentially valuable information about how academic capitalism might impact other players in academic research, such as postdoctoral fellows,

undergraduate research students, lab technicians and staff, research faculty, and principal investigators.

Additionally, a limitation of this study was the participant recruitment tool. It is possible that that there was a self-selective bias in the participant volunteer process; people with specific experiences around their well-being or experience in graduate school might have been more likely to sign up, for example. As a result, I may have unknowingly interviewed a population that does not represent LRU BIMS/BME well.

An additional limitation is the potential impact of my bias as researcher. My prior experiences with mental health challenges as a doctoral student in a biomedical science program impacted my interpretation of transcripts and contributions from participants. In addition, my current experiences as a doctoral student writing this study provide a lens through which I interpret student interviews. During the interviews, I member checked with the participants repeatedly. Before transitioning to the next overarching topic, I repeated any themes or concepts noted during our conversation and adjusted my summary if needed based on the participants' feedback. In addition, I used multiple forms of journaling as described in chapter three. I peer de-briefed with colleagues throughout the analysis process. During the theory development phase I debriefed with additional colleagues, including peer doctoral students during a works-in-progress session. However, all unintentional biases portrayed in this study are mine and mine alone.

Recommendations for Future Research

Several opportunities for future research emerged during the data analysis. First, additional themes emerged from the data. However, due to time and scope limitations, I did not achieve theoretical saturation through repeated comparative analysis, theoretical recruitment, and adjusting the interview protocol. One such theme of interest emerged from the participants' use of business culture terms to refer to their lab environments. One participant referred to the lab as a small start-up, while another offered that running a lab was like running a business. The

“lab as a business” was an emerging concept. Future studies would benefit from increased time to widen the interview data pool and explore those themes.

Another example of a concept that emerged from the interview data, albeit less saliently, was that of the environmental footprint of translational work as a detractor from well-being. It would be valuable to explore further how the environmental impact of biomedical research shapes student experience and well-being.

Thirdly, it could be beneficial and exciting to expand this work by conducting similar interviews with biomedical science graduate students at higher education institutions with varying degrees of research designation. That would aid in a better understanding of the true reach of academic capitalism and its impact on students’ well-being.

Finally, an area of interest for future examination would be to dissect the emergent concepts further, considering student identities and affiliations. Some early concepts emerged about participant identification in a minoritized population, and it would be critical to understand the role that socioeconomic, racial, gender, and other underrepresented identities play in students’ actions and strategies toward maintaining their well-being while in graduate school.

Conclusion

Using constructivist qualitative methods, I developed a theory grounded in rich descriptive interview data that identifies relationships between LRU BIMS/BME doctoral students’ well-being and the academic capitalistic context within which the participants operate. LRU BIMS/BME students experienced the impacts of academic capitalism through the competitive and stressful nature of the academic job market and the intense pressure their advisors are under to publish in journals and receive external funding. Participants and their advisors have competing objectives–education and research–and students feel frustrated with their lack of guidance and clarity. Students chose to avoid jobs in academia, if possible, due to the low salaries as compared to other career opportunities, a stressful lifestyle, lack of work-life balance, and the highly competitive nature of the work. Regardless, they continued to be

energized and inspired by scientific engagement– particularly directly translational and fast-paced research.

They overwhelmingly like their advisors, even with their reservations primarily rooted in distrust over conflicting priorities. This complex and dualistic relationship with research and their advisors led LRU BIMS/BME students to become creative when approaching their career next steps. With one exception, participants did not intend to pursue academic research careers or had strong reservations about doing so. All participants except one also planned to stay in science, industry, biotech, or other avenues. They cited their motivations for better work-life balance, higher salaries, and scientific fulfillment.

Participants maintained their positive well-being by engaging in scientific research, remaining connected to the direct applicability of their work to better the human condition, and maintaining work-life balance and social connections. They liked their advisors and scientific inquiry and changed their career goals to find ways to stay in science but maintain positive well-being. They chose careers that allowed them to conduct fast-paced translational work that contributes to therapeutic development but does not require them to give up their happiness.

In conclusion, I hope that the results and culminating theory described serve as an inspiration to biomedical science doctoral programs at R1 institutions of higher education, such as the BIMS program at LRU, to consider the recommendations provided. Graduate programs have opportunity to work with departments, encompassing schools, and institutions at large to provide support mechanisms to alleviate the impacts of academic capitalism on their well-being during their time as doctoral students. These mechanisms may be through the restructuring of scientific labor in laboratories, providing mentorship and guidance to faculty and students, and expanding career preparation paths for graduate student trainees. In addition, institutions can influence the structure of federal grant funding mechanisms through involvement and engagement in public policy and decision making.

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Appendix A

Information Sheet

Please read this study information sheet carefully before you decide to participate in the study.

Study Title: Academic Capitalism and the Mental Health Crisis in Doctoral Biomedical Science Education

Protocol #: 6383

Purpose of the research study: The purpose of this study is to explore potential links between the well-being of biomedical science doctoral students, and the financially driven behaviors and culture at research-intensive universities.

What you will do in the study: You will be interviewed about your experiences as a doctoral student in the biomedical sciences. Interviews may be conducted using video conferencing tools or in-person, depending on your preference, and recorded for transcription. You are not required to answer all the questions and may choose at any time to stop the interviews. You would also be welcome to discuss any topics you might find relevant to the subject even if not directly asked in a question.

Some participants may be asked to do a brief follow-up interview if there are any additional questions that emerge during data analysis. You are not required to participate in any follow up interview.

Time required: This study should take no more than 90 minutes of your time. Most interviews will last 60 minutes and if there are any follow up questions those would last no longer than 30 minutes.

Risks: During participation in this study, you will be asked to share your experiences as a graduate student around your well-being. Sharing those experiences may lead to a wide range of emotions and may trigger memories and experiences. At any time, you may stop the interview. You will also be provided with a list of mental health support resources that can help you process those emotions.

Benefits: There are no direct benefits to you for participating in this research study. The study may help us understand how to better establish support systems and resources in graduate programs in the biomedical sciences.

Confidentiality: The information that you give in the study will be handled confidentially. The interviews will be audio-recorded and transcribed for data analysis. Each recording will be assigned a pseudonym in the recording file name. The list connecting your name to the pseudonym will be kept in a locked file.

Voluntary participation: Your participation in this study is voluntary. Your decision to participate will have no effect on your status as a student or school services.

Right to withdraw from the study: If you want to withdraw from the study, tell the interviewer to stop the interview. Withdrawing from the study will not have any impact on your standing as a graduate student or your relationship with any members or institutions affiliated with the study. If you withdraw from the study before data collection and analysis is completed your data will be destroyed. You will still receive full compensation for the study.

How to withdraw from the study: If you want to withdraw from the study, tell the interviewer to stop the interview. There is no penalty for withdrawing and withdrawing will not affect your grades or school services. If you would like to withdraw after your interview, please contact the Principal Investigator listed below.

Compensation: Participants will receive a $20 electronic gift card from Amazon OR a $20 contribution to a charity of their choice for each interview.

Using data beyond this study:
The researcher would like to make the information collected in this study available to other researchers after the study is completed. The researcher will remove any identifying information (such as your name, contact information, etc.) connected to the information you provide.

Using data beyond this study:
The researcher would like to make the information collected in this study available to other researchers after the study is completed. The researcher will remove any identifying information (such as your name, contact information, etc.) connected to the information you provide.

Please contact the researchers on the study team listed below to:

- **Obtain more information or ask a question about the study.**
- **Report an illness, injury, or other problem.**
- **Leave the study before it is finished.**

Principal Investigator, Affiliation and Contact Information:

Nadia Cempre
EdD Program, Higher Education
University of Virginia's School of Education and Human Development
Nab4g@virginia.edu
434-249-7833

Karen Inkelas, PhD
School of Education and Human Development
PO Box 40025
Charlottesville, VA 22903
kki5x@virginia.edu

You may also report a concern about a study or ask questions about your rights as a research subject by contacting the Institutional Review Board listed below.

Tonya R. Moon, Ph.D.
Chair, Institutional Review Board for the Social and Behavioral Sciences
One Morton Dr Suite 400
University of Virginia, P.O. Box 800392
Charlottesville, VA 22908-0392
Telephone:(434) 924-5999

Email: irbsbshelp@virginia.edu
Website: https://research.virginia.edu/irb-sbs
Website for Research Participants: https://research.virginia.edu/research-participants
UVA IRB-SBS #6383

UVA IRB-SBS # 6383
You may keep this copy for your records.

Appendix B

Recruitment Flier

The University of Virginia, School of Education and Human Development, Department of Education Leadership, Foundations, & Policy, **seeks doctoral students in their third or more year of study in the Biomedical Sciences or Biomedical Engineering degree programs** to participate in a research study.

*The purpose of this study is to explore potential links between the **well-being of biomedical science doctoral students**, and the **financially driven behaviors and culture** at research-intensive universities.*

WHAT?	If you choose to participate, you will be interviewed by a graduate student in the School of Education and Human Development about your experiences as a graduate student, with a focus on your well-being.
HOW?	The interviews will be conducted in person in Charlottesville, VA or over Zoom. Interviews will be audio recorded.
HOW LONG?	The interviews will take approximately 60 minutes. You may be asked to come back for a 30-minute follow up interview.
WHY?	Information learned from this research may help practitioners find ways to improve well-being and mental health conditions in science doctoral programs.

Compensation will be provided.

For more information, or to sign up, **scan the QR code above** or contact:

Principal Investigator
Nadia Cempre, EdD Candidate, University of Virginia
434-249-7833 (TEXTS WELCOME!)
nab4g@virginia.edu
IRB SBS # *6383*

Appendix C

Interview Protocol[4]

Interview Protocol:

Title:

Interviewer:

Interviewee:

Date and time:

Location:

Capstone Project Research Question:

How might biomedical science doctoral student well-being and academic capitalism be connected?

Consent:

- Thank you so much for agreeing to participate in this interview and capstone project. I'll review the consent form with you and then obtain you consent.
- Are there any questions that I can answer for you at this time?

Background/Introductory Questions

- Participant doctoral program (PhD program)
- Participant's stage in academic career
- Participant's research lab (PI/ Mentor)
- Quick overview of lab culture, size, make-up (how many grad students, post docs, etc.)

Capstone Research Questions

Academic Engagement & Progress & Preparation

Let's talk about your research in graduate school, and your dissertation research question(s).

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[4] This interview protocol will be duplicated for the interviews with alumni, changing the tenses to refer to the past during their time in graduate school. The career questions will stay in the same topic realm but be re-phrased to refer to how they felt right after graduation and then how they feel in their career now.

- Can you tell me about how and why you chose your research topic? What were the factors that you considered when thinking about your research questions?
- Was “publishibility” a factor that you considered when thinking about what to study?
- Did you know what you wanted to research when you started graduate school? Did that change and if so how and in what way?
- What are your feelings about the inquiry process in biomedical science? Is it different than what you expected when you were an undergraduate or before that?
- If interviewee is exploring an applied research question: How important was/is it to you to conduct scientific inquiry that is directly applicable to a cure or practice?
- If interviewee is exploring a basic science research question: Did you consider the idea that you are conducting “basic research”? Do you have any thoughts about that?
- Are there any external factors or people that might have guided your choice of research question? Like your mentor, or colleagues, or otherwise?

Advisor Relationship & Feeling Valued & Included

Tell me about your relationship with your advisor.

- How did you choose your advisor? What was the process like for you? How did you feel about it at the time? What are your feelings about the result of that process?
- What do you value in a graduate advisor? Do you have those qualities in your advisor now? What qualities do you admire/enjoy about your current advisor? What qualities do you wish they had more of?
- Do you receive recognition from your advisor? Is that important to you?
- Is your advisor in the lab/ at the bench often? Do you value that? How does your advisor spend most of their time, as far as you’re aware?
- I’d love to hear about anything else you’d like to share about your relationship with your advisor.

Career Prospects and Financial Confidence

Tell me how you feel about your future as a scientist.

- How do you feel about your professional future?
- What would you like to do after you graduate? What are your career hopes and dreams?
- What are you biggest concerns about your professional life after graduation?
- Do you ever worry about money? Do you have any concerns about your financial future?
- Do you feel prepared for life after graduate school?

Well-Being and the Academic Institution

- I’d love to hear anything you’d like to share about how you perceive your state of well-being. It can be how you feel right now, how you felt at other times as a graduate student, or how you perceive general well-being in your graduate program to be.
- What does well-being mean to you?
- Can you share more about how your life as a graduate student contributes to your state of well-being?
- How does your academic environment support your well-being? Detract from it?

Conclusion and Member Checking

- I noticed a few themes that emerged throughout this interview. Some of them are x,y,z. Do you agree? Did you notice any other themes?
- Do you have any additional thoughts or questions that you would like to add before we conclude?

Closing Remarks

- Thank you for participating in this interview. All recordings and transcriptions from the interview will be assigned a pseudonym and stored in a secure, password-protected location to protect your privacy.
- You will receive a follow up email that includes the information about how to receive your choice of compensation.
- Thank you again for your time. If you have any questions or thoughts that come up after this interview, you can reach me at nab4g@virginia.edu.