Interdisciplinary Writing Should Be Simple, But it Isn't: A Study of Meta-Genres in Interdisciplinary Life Sciences Doctoral Programs

Sara Doody

Department of Integrated Studies in Education

McGill University, Montreal

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Abstract

This dissertation explores the nature of doctoral writing in interdisciplinary life sciences programs and aims to understand how doctoral writers learn and navigate assumptions about writing, knowledge, and identity at disciplinary boundaries. With interdisciplinary programs and research becoming increasingly common in higher education – and with much doctoral education scholarship undertaken within siloed disciplines – this study aims to understand the explicit and unarticulated rules of writing at disciplinary boundaries. Specifically, this study seeks to explore both explicit and unarticulated rules governing writing in interdisciplinary life sciences doctoral programs, as well as the implications of such rules for how doctoral students learn to construct knowledge and develop and negotiate their scholarly identities. Drawing on rhetorical genre theory, I explore the meta-genres that make up the atmosphere of writing in interdisciplinary life sciences doctoral programs. Using a methodology informed by rhetorical genre theory and narrative inquiry, I conducted interviews, document analysis, and observations with five doctoral students. This study finds that while explicit and oft-repeated assertions claim interdisciplinary writing should be simple, it is actually a complex and fraught rhetorical process. The complexity of interdisciplinary writing is occluded by language positioning this practice as simple and complementary. Doctoral writers in interdisciplinary programs are faced with navigating contradictory assumptions about writing and knowledge, which create added demands and challenges in negotiating scholarly identities at disciplinary boundaries. For writing studies, contributions of this study offer insights into how genres interact at disciplinary boundaries and how interdisciplinary meta-genres may work to restrict innovation. This study also suggests that meta-genre may be useful as an empowering resource for doctoral students and in the training of new interdisciplinary faculty.

Résumé

Cette thèse explore la nature de l'écriture doctorale dans les programmes interdisciplinaires des sciences biologiques et vise à comprendre comment les rédacteurs de thèse acquièrent et gèrent leurs suppositions sur l'écriture, le savoir et l'identité à l'intersection de diverses disciplines. Les programmes et la recherche interdisciplinaires devenant de plus en plus communs en études supérieures – et le travail en éducation au troisième cycle s'effectuant dans des disciplines en silos – cette étude vise à comprendre les règles explicites et implicites de l'écriture au carrefour des disciplines. Plus particulièrement, cette étude cherche à explorer les règles explicites et implicites gouvernant l'écriture dans les programmes interdisciplinaires des sciences biologiques, ainsi que les implications de ces règles pour la manière dont les étudiants au doctorat apprennent à construire le savoir tout en développant et gérant leurs identités académiques. Pour accomplir ce but, je me fonde sur la théorie du genre rhétorique et le concept de *métagenre* afin d'explorer les conventions articulées et inarticulées régulant le contexte pour l'écriture dans les programmes interdisciplinaires des sciences biologiques au niveau doctoral. Utilisant une méthodologie informée par la théorie du genre rhétorique et l'enquête narrative, j'ai mené des entrevues, une analyse documentaire et des observations auprès de cinq étudiants de troisième cycle. Dans mon étude, je conclus que, bien qu'on ait prétendu en toutes lettres et à maintes reprises que l'écriture interdisciplinaire doive être simple, elle est en réalité un processus rhétorique complexe et difficile. Cette complexité de l'écriture interdisciplinaire est occultée par maints propos dépeignant cette pratique comme étant simple et complémentaire. En réalité, les rédacteurs de thèse dans des programmes interdisciplinaires doivent gérer des aprioris contradictoires sur l'écriture et le savoir, ce qui, pour ceux et celles qui veulent forger une identité académique à l'intersection des disciplines, crée des exigences et des défis

supplémentaires. Pour la rédactologie, la contribution de cette étude est de proposer de nouvelles perspectives sur la manière dont les genres interagissent aux frontières des disciplines et de montrer comment les métagenres interdisciplinaires peuvent avoir pour effet de restreindre l'innovation. Cette étude suggère néanmoins que le concept de métagenre peut s'avérer utile comme ressource conférant une certaine autonomie pour les étudiants du troisième cycle et aidant à la formation d'un nouveau corps professoral interdisciplinaire.

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Chapter 1: Introducing the Research

The research reported here focuses on the nature of writing, knowledge, and identity in interdisciplinary life sciences doctoral programs. My interest in this area developed from a broader interest in academic and professional writing (and sometimes a conflation of the two). In my experience, writing had always had been discussed as an *after* process, especially in academe: it is only after the *real* research work has happened that students and academics engage in a process commonly perceived as the straightforward task of *writing up* (Kamler & Thomson, 2014; Richardson, 1994). These assumptions about writing remain pervasive in higher education where scholarship is understood as empirical research or sustained intellectual work, and writing is just a record of this work. Indeed, it was my own experience participating in these discourses and reflecting on them that eventually led to this study. If writing was simply a transfer of thoughts from my head onto a page, why did it always seem so much like *work*?

This study developed out of questions about writing in natural and physical sciences. In these fields, writing is not typically discussed as playing just as large a role in the research process as experiments and studies (e.g., Latour & Woolgar, 1986). I became especially interested in questions about writing in interdisciplinary contexts, specifically interdisciplinary doctoral writing in the sciences. Did researching at disciplinary intersections affect how doctoral students needed to write? How might writing in interdisciplinary programs influence how students learned particular ways of doing and being? Guided by these interests, I set out to explore the nature of writing in interdisciplinary doctoral programs. I was motivated by an interest to understand how doctoral students engaged with writing and how this shaped the ways in which they produced knowledge and negotiated identity.

Before getting into the specific questions I address in this dissertation, I outline some of the scholarship that has provided a foundation for this study. I briefly discuss the nature of research about interdisciplinary programs and how these might introduce added demands for doctoral writers and outline some pertinent context and trends in doctoral writing research. I then present the aim of the study and the research questions that guided my inquiry, before outlining how the dissertation will be organized.

Interdisciplinary Doctoral Programs

Interdisciplinary programs have become increasingly common within higher education (Chettiparamb, 2007). These programs involve research that pushes or extends the boundaries of existing disciplines by bridging theories or methods to address complex questions that cannot be answered from within a single discipline (Klein, 2010; Newell, 2013). While interdisciplinary research is not a new phenomenon, recent years have seen colleges and universities creating and promoting interdisciplinary programs to attract students and faculty to tackle multifaceted issues (Williams, Crago, Driver, Maheu, & Renaud, 2011). In fact, enrolment of full-time doctoral students in Canadian interdisciplinary programs increased almost 145% between 2003 and 2013 (Looker, 2016).

Although discussed as an important feature in the future of higher education (Jacob, 2015), interdisciplinary research is different from research in traditional or siloed disciplines (i.e., disciplines with long-established and shared goals and practices). Since such research involves multiple disciplinary approaches to research, interdisciplinary research is accompanied by an added set of demands associated with working across diverse assumptions and practices (e.g., Brodin & Avery, 2020). Of particular interest to this study are the added demands of interdisciplinary research for doctoral students. Unlike in siloed disciplines, interdisciplinary

doctoral students are required to work across disciplinary boundaries and are often faced with synthesizing ways of knowing and doing from several established disciplines (Golde & Gallgher, 1999; Hibbert et al., 2014). In addition to navigating knowledge conventions, interdisciplinary students are also expected to learn how to navigate membership across disciplinary borders (Boden, Borrego, & Newswander, 2011; Brodin & Avery, 2020; Graybill et al., 2006).

Despite growing interest in interdisciplinary research, much of the work exploring doctoral students in interdisciplinary programs has been from the perspective of educators facilitating student success (Hibbert et al., 2014; Metz, 2001). The focus on student success stems from broader concerns about doctoral attrition rates and times to degree completion (Elgar, 2003; Tamburri, 2013). Echoing education and writing scholars' push to address these concerns, research aimed at improving interdisciplinary doctoral programs has explored ways to improve supervisory practices (Hibbert et al., 2014) and institutional policies (Boden et al., 2011). Largely absent from these discussions, however, is an activity universal to doctoral work: *writing*.

Doctoral Writing

Many higher education institutions, both in Canada and globally, have experienced steady growth in doctoral enrolments (Boud & Lee, 2009; Looker, 2018). With this growth, scholars have noted an increasing diversity of age, gender, race, and culture represented amongst doctoral students (Kamler & Thomson, 2014; McAlpine & Norton, 2006). Both the growth and diversification of the doctoral population have had significant effects on the availability of resources to support students. Of longstanding concern to doctoral education scholars have been issues of time to degree completion and rising rates of student attrition (Gardner, 2009; Pearson, 1999). In the face of what has been characterized as a "crisis" in higher education (Tennant,

2009, p. 232), scholars have attempted to address long times to degree completion and alarmingly high attrition rates (Bourke, Holbrook, Lovat, & Farley, 2004). Responding to these concerns, scholars identified an apparent absence of *pedagogy* in the doctorate (e.g., Green & Lee, 1995). Often, doctoral work focused on *research* rather than *education*, with scholars claiming that supervisors and coordinators perceived their roles as inducting students into academic communities, not as teachers of these fields (Brew & Peseta, 2009; Boud & Lee, 2009). Emerging from this research were calls to implement pedagogy into doctoral education, with particular emphasis on the role of supervisors as educators (Green, 2005). In exploring the role of supervision as an avenue for doctoral pedagogy, scholars began identifying writing as a key issue for doctoral education scholarship (Paré, 2011).

Even before writing became a key research issue in doctoral education, institutions seemed convinced that an important factor in student attrition was, in fact, writing (Torrance & Thomas, 1994). While writing was widely agreed to be a challenge for students, what was less clear was how to best address this issue. Finding ways to improve student writing was further complicated by dominant assumptions about writing as an individual problem; that is, students were seen as lacking writing skills and requiring a cure or intervention to become acceptable writers (Aitchison & Lee, 2006). These assumptions led to writing being perceived as an individual problem – the blame of failure was squarely placed on doctoral writers and their inability to write properly (Aitchison, Catterall, Ross, & Burgin, 2012; Starke-Meyerring, 2011). Characterizing doctoral students as skill-deficient sparked critique from writing scholars who argued that from an institutional standpoint, writing was constructed as being the same skill across all areas of higher education (e.g., Aitchison & Lee, 2006). Understanding writing as a skill positions all writing under the same umbrella – something students either can or cannot do –

no matter what discipline students are writing in. These assumptions are often echoed in institutional policies (e.g., university regulations about the dissertation, handbooks for supervisors and students) that frame writing as *simple*: as a process of making meaning clear and as being fairly easy to do since doctoral writers are expected to have mastered writing prior to the doctorate (Starke-Meyerring, 2011). As a result of consequences that emerge from skills-based assumptions about writing, doctoral writing scholars tended to advocate an approach that understands writing as a complex *social practice* (Aitchison & Lee, 2006; Kamler & Thomson, 2014; Lee & Aitchison, 2009).

By exploring writing as a social process, that is, as an activity that engages writers within specific communities, researchers were able to approach writing pedagogy from a perspective that unburdened student writers from taking sole responsibility for their so-called failures (Lee & Aitchison, 2009). Adopting a social view of writing led to approaches aiming to take the pressure off of students by making writing visible, communal, and collaborative (Kamler & Thomson, 2014; Lee & Boud, 2009). Much of the scholarship currently exploring doctoral writing does so from a social perspective (e.g., Aitchison & Guerin, 2014; Aitchison, Kamler, & Lee, 2010), which has proven beneficial in exploring how doctoral students may be better supported pedagogically while writing in the doctorate.

I would point out that while conceptualizing writing as social does a great deal to destigmatize doctoral student writing, it does tend to view the writing that goes on in the doctorate as *one* kind of writing. That is, there seems to be an assumption that doctoral writing can be taught in the same way regardless of discipline or program. Writing, though, is situated in particular contexts and as such norms for and expectations about writing manifest differently (Paré, Starke-Meyerring, & McAlpine, 2011). Doctoral writing research has illustrated that

writing requires different kinds of supports in, for instance, the sciences (Catterall, Ross, Aitchison, & Bergin, 2011; Cumming, 2009) than in visual and performing arts (e.g., Paltridge, Starfield, Ravelli, & Nicholson, 2012), but these delineations are not major foci within scholarship exploring doctoral writing pedagogy. When exploring writing that happens at the boundaries of disciplines, however, differences in expectations about writing become incredibly important.

As I pointed out, doctoral writing scholars have argued that writing is an important conduit for learning about and engaging in scholarly communities (Aitchison, Kamler, & Lee, 2010; Kamler & Thomson, 2014). Writing is in fact integral to how students learn to participate within their discipline of study (Paré et al., 2011). Learning to produce disciplinary writing, however, can often pose challenges for students because disciplinary norms embedded in such writing are largely tacit (Artemeva, 2009). That is, ideas about what constitutes *good* writing are perceived as being common sense, when in reality they are imbued with disciplinary beliefs and assumptions (Paré, 2002; Starke-Meyerring, 2011, 2014). Learning these tacit conventions are not only necessary for writers to make contributions to disciplinary knowledge, they also serve as a means for newcomers (i.e., doctoral students) to implicitly become acquainted with disciplinary practices and beliefs (Kamler & Thomson, 2014; Schryer & Spoel, 2005). In other words, learning how to produce particular kinds of disciplinary writing is important for students to learn how to negotiate disciplinary identities.

Research contributing to current insights in doctoral writing has largely emerged from disciplines with established writing practices, relatively homogenous audiences, and (again relatively) shared expectations about writing (Devitt, 1993). Thus, within fields like English literature (Paré et al., 2011) audiences have shared notions about what constitutes *good* writing

and about the practices and beliefs inherent to being a disciplinary insider. Interdisciplinary programs, however, introduce additional considerations for writers who must communicate across disciplinary audiences, each with their own beliefs about what constitutes acceptable writing (e.g., Blakeslee, 2001). Doctoral students in interdisciplinary programs are particularly susceptible to these demands because they must learn to integrate knowledge and identity practices from several different fields (Rademaekers, 2015) – fields that likely do not share the same assumptions about writing. Yet, writing in such programs remains situated—institutionally at least—under a single umbrella; that is, writing is assumed to be similar across doctoral programs. While writing like the dissertation might be viewed as an epistemic contribution to scholarship, the actual *processes* involved in writing these texts are go largely unrecognized—writing becomes conceptualized as existing separately from the research culture to which the writing contributes (Starke-Meyerring, Paré, Sun, & El-Bezre, 2014). The process of writing is, in other words, thought to be fairly simple. Thus, it becomes important to consider how these assumptions affect how interdisciplinary writers learn to produce writing that can transcend disciplinary boundaries.

Not only has research exploring doctoral writing largely emerged from siloed disciplines, but it has also focused on specific kinds of writing. Often, doctoral writing research has focused on integrating pedagogy to support the production of the dissertation (Kamler & Thomson, 2008, 2014; Paré, Starke-Meyerring, & McAlpine, 2009). To facilitate this, doctoral writing scholars have discussed how writing groups might contribute to supporting doctoral students' writing texts like the dissertation (Aitchison & Guerin, 2014; Boud & Lee, 2007; Paré, 2014; Starke-Meyerring, 2014), as well as how integrating publishing pedagogies into the doctorate might support doctoral writing practices (Kamler, 2008; Mantai, 2017; Paré, 2010). These explorations

of doctoral writing, however, focus on specific kinds of writing – on specific *genres*. Less often discussed are the collections of assumptions, practices, and values that control conditions surrounding how these genres are understood, produced, and regulated (cf., Starke-Meyerring, 2011; Starke-Meyerring et al., 2014).

Research Purpose and Questions

This study emerged from questions about doctoral writing at disciplinary borders. My purpose is to explore how doctoral students in interdisciplinary life sciences programs learn to produce and navigate assumptions about writing, knowledge, and identity. More specifically, I aim to inquire into both the nature and context of writing in interdisciplinary life sciences doctoral programs. Instead of exploring specific types of writing and tracing how students learn to produce, for example, a dissertation in an interdisciplinary program, my interest is in the assumptions influencing how interdisciplinary writers experience writing and the kinds of actions that are enabled and constrained by these assumptions. In other words, this study explores the assumptions about writing, research, and identity that are regulated by *meta-genres* and *meta-talk* in interdisciplinary life sciences programs and to understand their implications for interdisciplinary doctoral writers.

I discuss the concept of meta-genre in more detail in Chapter 2 but for the purposes of introduction, meta-genres are "situated language about situated language" (Giltrow, 2002b, p. 190). Essentially, meta-genres are implicit and explicit rules governing discourse that pervade our lives. These meta-genres dictate when we can speak, what we can (or cannot) say, what we are allowed to talk about, and how much we are allowed to say. Let me illustrate this with a fairly quotidian example: the dinner party. The rules of social interactions that govern the dinner party are sometimes explicit and these explicit rules can be found in books and columns that

codify the rules of dinner party etiquette. In North America, these rules usually advise guests not to arrive early, to bring a gift, and not to start eating until everyone has been served. But there are some dinner party rules we never read about and that are perhaps never said out loud. These are the subconscious dinner party rules that Emily Post may never have written about, but that we nevertheless learn through experience or osmosis. For example, we know it's probably not appropriate to show up a dinner party with a group of people who were *not* invited and we would expect our host to be serve dinner at a reasonable time. If we think about the dinner party as a kind of *genre*, or recurring and recognizable social action (Miller, 1984), we can think about the written and unwritten rules about how to behave at these parties as meta-genres. Dinner parties have well defined and pervasive conventions that result in guests and hosts acting in predictable ways: the rules encourage some kinds of actions (not arriving early) and discourage others (making your guests wait four hours for dinner). Like dinner parties, academic communities are patrolled by meta-genres governing what linguistic forms are available to members, when certain forms are to be used (i.e., when to deploy a research article or an opinion essay), and who is allowed to use them (i.e., established members may be allowed to write opinion pieces critiquing research, newcomers may not be extended the same right). In interdisciplinary life sciences doctoral programs, these conventions exert regulatory power over what writers can say and when, what language or forms are to be embraced or avoided, and what practices and beliefs mark them as members of interdisciplinary communities. Meta-genres, then, are the complex systems of assumptions, practices, and values that are deeply embedded in writing and that regulate individuals' participation in communities, inducing some actions and restricting others, and influencing how people understand what they are doing when they write.

With the aim of understanding meta-genres regulating writing, knowledge, and identity in interdisciplinary life sciences, I am guided by the following questions:

1. What is the nature of meta-genres and meta-talk in interdisciplinary life sciences doctoral programs? What are the explicit and unarticulated rules, regulations, allowances, and constraints that they regulate?

2. How do interdisciplinary meta-genres and meta-talk govern writing and research activities at disciplinary borders? What kinds of activities do they enable and constrain?

3. What implications do meta-genres in interdisciplinary life sciences have for doctoral students learning to develop and negotiate their scholarly identities?

How this Dissertation is Organized

This dissertation is organized into eight chapters. In this first chapter, I have outlined scholarship that has shaped my interest in doctoral writing, knowledge, and identity.

In Chapter 2, I describe the theory that I employ in this study and review relevant literature, which includes the evolution of writing as an object of study in higher education, and present how I understand writing from a rhetorical genre theory (RGT) perspective. In doing so, I trace how RGT emerged from rhetorical and phenomenological fields to view writing as a deeply social, situated, and non-neutral form of activity. I also outline how I conceptualize identity from an RGT lens, which allows me to foreground writing as a locus of identity development and negotiation. In other words, I illustrate how I see doctoral students *writing themselves into* interdisciplinary practices and beliefs. I also review the literature surrounding research into interdisciplinary programs and discuss how RGT complicates my understanding of interdisciplinary research practices.

In Chapter 3 I discuss the inquiry process by outlining the methodological approach and methods I used in this study. My methodological approach, in keeping with my theoretical and analytical framework, draws deeply from the well of RGT, so I begin this discussion by explicitly pointing to how a rhetorical perspective towards methodology shaped the research and writing processes. I also discuss how narrative inquiry was integrated into the study design and how this approach guided data generation and analysis. Employing a rhetorically informed narrative inquiry approach to conduct interviews, analyze writing samples, and generate insights allowed me to carefully and rigorously explore interdisciplinary writing, research and identity. After discussing the methodology and methods, I introduce the doctoral students who participated in this study: Aliya, Aster, Diana, Stefan, and Victor. I outline the programs they were enrolled in and detail some of their encounters with writing.

Chapters 4, 5, and 6 outline the study's findings[1]. In Chapter 4, I explore how writing is perceived and discussed in interdisciplinary life sciences programs. I trace the explicit and implicit meta-genres, and meta-talk, in interdisciplinary life sciences doctoral programs and discuss some of the assumptions about writing they regulate. I analyze institutional documents and interview data and tease out dominant assumptions about writing. I then contrast these assumptions with how participants' experiences writing in interdisciplinary programs.

Chapter 5 explores how meta-genres regulate assumptions about interdisciplinary research. Specifically, it addresses the question of how dominant meta-talk enables and constrains interdisciplinary research and knowledge work. I explore how participants talk about interdisciplinary work and contrast this with how they discuss their experiences.

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[1] For simplicity's sake, I am choosing to call the insights generated from my analysis *findings*. In doing so, I want to acknowledge that this term can be problematic in post-positivist research because it implies the existence of an objective and external reality (Sandelowski, 2008). Here, I use the term simply to identify insights generated when working with data.

Chapter 6 focuses on identity. It explores the implications of dominant meta-genres and meta-talk for interdisciplinary doctoral students' identity development and negotiation. Specifically, it explores how the dominant assumptions about writing and research enable and constrain interdisciplinary students from negotiating their identities across disciplinary boundaries.

Chapter 7 is a discussion of the findings. In this chapter, I discuss how the findings work together to indicate how meta-genres function at interdisciplinary boundaries, and the implications of these meta-genres for writing, knowledge, and identity of doctoral students.

Finally, Chapter 8 concludes this dissertation by reviewing the findings and suggesting possible implications for education, theory, and methodology. I also reflect on some of the challenges I encountered during the study and on my own experience as a doctoral student engaged in interdisciplinary research. I end by suggesting possible avenues for future research.

Chapter Summary

This chapter has established the importance of researching writing in interdisciplinary life sciences doctoral programs is worthwhile and detailed the specific questions I address in the dissertation.

Chapter 2: Theory and Literature Review

Questions about doctoral writing have been approached from several theoretical perspectives. A common approach has been to explore doctoral writing from a *social* perspective, particularly when researchers have explored integrating pedagogy into doctoral writing (e.g., Aitchison, Kamler, & Lee, 2010; Boud & Lee, 2009; McAlpine & Amundsen, 2011). These social approaches are, as I mentioned briefly in Chapter 1, largely concerned with understanding writing as a social practice that engages writers in specific academic communities. Doctoral writers, from this perspective, are not learning writing *skills*, but are instead learning how to engage in communication practices of larger academic communities. Much research emerging from this theoretical approach has pedagogical implications: its goal is to develop pedagogical practices that facilitate students' transitions into particular communicative practices (e.g., Aitchison & Guerin, 2014; Aitchison, Kamler, & Lee, 2010; Green, 2005).

More recently, the field of doctoral writing has responded to calls to re-think and re-imagine how doctoral writing is understood (Badenhorst, Amell, & Burford, in press). Such calls have led to doctoral writing scholars adopting more critical approaches to understanding and exploring the writing experiences of doctoral writers (e.g., Burford, 2017). Doctoral writing has also, increasingly, been approached from theoretical lenses that aim to understand writing from rhetorical approaches, including cultural rhetorics (Smith et al., in press) and rhetorical genre theory (e.g., Doody, in press; Paré et al., 2011; Starke-Meyerring, 2014). Significantly, each of these approaches – social, critical, or rhetorical – conceptualizes writing in (sometimes dramatically) different ways. This dissertation hinges on an understanding of writing as socially situated and recurring, recognizable actions (Miller, 1984). My aim is of course to understand

what interdisciplinary writing does, and how assumptions about writing enable and constrain certain kinds of social actions.

The purpose of this chapter is to establish a conceptual foundation; that is, the theoretical and analytical constructs that guide my understanding of the phenomena under investigation. I spend much of this chapter discussing rhetorical genre theory, an approach that understands writing as inherently social and foregrounds the connections between writing, social context, and identity.

Before going into detail about how I conceptualize writing, I briefly step back and trace how writing has been conceptualized historically within academe. Since the approach that I adopt has grown out of earlier traditions, it is useful to outline how these approaches have evolved. Tracing how conceptualizations of writing shifted from product, to process, to social approaches. I go on to spend the bulk of this chapter discussing how I conceptualize writing, identity, and interdisciplinarity from a rhetorical genre theory (RGT) perspective. In doing so, I also illustrate how RGT provides a useful means of exploring the interconnectedness of writing, social activities, and identity.

Writing in Academe

Before outlining how I conceptualize writing, identity, and interdisciplinarity, it helps to take a (brief) step back and outline the assumptions within which writing has been discussed. In doing so, I situate my approach within the history of writing and composition and illustrate how evolving approaches to conceptualizing writing have shaped current discussions about writing in higher education. This historical contextualization will illustrate how different approaches to doctoral writing research have developed and how some of these traditions still linger in higher

education. The traditions that I trace here are: the formalist tradition (also known as the current-traditional approach), the process tradition, and the social tradition.

To understand how writing became an object of study at all, it helps to understand the context in which assumptions about writing developed – namely, the structure of the university. During the late nineteenth century, as the university system in North America modernized and its population became more varied, the structure of the university became more specialized and led to the *professionalization* of academe (Russell, 2002). The move to more specialized degrees necessitated a shift away from traditional oral examination methods like debate and recitation and towards writing as the main communicative practice. Despite the specialization of academe, its members were still considered members of *one* community with *one* right way of writing. New students and, alarmingly, upper-level students were suddenly perceived as being unable to write, sparking the creation of what is now known as freshman composition programs in the United States (Berlin, 1984), the goal of which was teaching students how to write properly. At the time freshman composition programs were developed in the late 1800s, writing was a straightforward and mechanistic process (Nystrand, & Duffy, 2003). Writing was viewed a *brain-to-page transfer*: taking a thought in one's head and transferring it into grammatically correct and properly spelled words on a page (Rose, 1985; Russell, 2002).

This formalist tradition, also known as the current-traditional approach (Berlin, 1980; 1988), assumes that elements of writing are objective: anyone should be able to read and understand any piece of clear and concise writing (Nystrand, Greene, & Wiemelt, 1993, p. 277). Within this tradition, the teaching and production of writing focuses on grammar, spelling, structure and style (referring to writing being succinct and unambiguous) (Berlin, 1984; Nystrand, Greene, & Wiemelt, 1993). Significantly, formalist approaches view writing as

universal and as divorced from situation; that is, writing should be clear and comprehensible no matter who the writer or reader is. Freshman composition courses up until the 1960s were, unfortunately, not as successful as universities hoped – students were completing required writing courses, yet still appeared to struggle with writing (Berlin, 1984; Rose, 1984).

As writing continued to be perceived as problematic for students, the reliability of formalist approaches was questioned. A particularly forceful re-examination of formalist policies emerged during the 1960's and 1970's, a period of political and civil unrest. Before this time, universities still catered to a specific group of people – largely white middle to upper class men (Nystrand, Greene, & Wiemelt, 1993). University populations in the United States specifically underwent a dramatic shift during this time because of open admissions policies emerging from the discord and protest of the Vietnam War (Nystrand & Duffy, 2003, p. xx). The increasingly diverse population attending colleges and universities sparked a new wave of what has been called the "literacy crisis," with administrators being startled at students' inability to write (p. xxi). The perceived literacy crisis and diverse student body forced writing teachers to confront and question the utility of formalist approaches to writing pedagogy; pedagogy that was mainly inherited and not theorized. Up to this point, there had been no organized theorization or study exploring writing pedagogy (Nystrand, Greene, & Wiemelt, 1993), which resulted in writing instructors searching for research and theory to guide their teaching. Emerging in the 1970s was the influential work of Flower and Hayes (1977, 1981) who, inspired by cognitive approaches to psychology, adopted *think-aloud* protocols to understand the ways in which established and professional writers approached their craft. Based on their research findings, Flower and Hayes argued that writing was not the brain-to-page transfer formalist traditions assumed. Instead, writing was discovered to be an iterative and messy *process*. Process

approaches to writing marked a dramatic shift away from formalist assumptions and embraced a holistic writing pedagogy. Instead of approaching writing as an exercise in creating a final and clear product, writing teachers encouraged students to view writing as a process. Writing pedagogy began incorporating numerous rounds of revision, allowing teachers to scaffold and guide students through the writing process (Emig, 1977; Murray, 1978).

The process approach, however, was not immune to critique. Although the process approach did move towards an understanding of writing as iterative, much of the revision cycle continued to focus on editing for clarity. More significant for my purposes are the critiques of the process movement that pointed to how *good* writing was still understood to be one thing. Scholars critiquing the process movement began to question whether process approaches to writing sufficiently theorized writing practices (e.g., Bartholomae, 1986). Indeed, shifts towards conceptualizing writing from social constructionist perspectives in the 1980s complicated what are now seen as "easy generalizations about the 'composing process', the 'reading process', and 'cognitive processes'" (Nystrand, Greene, & Wiemelt, 1993, p. 286). Writing scholars began challenging the notion embedded within formalist and process approaches that writing was uniform (i.e., that there is one good way to write) and argued that the social context exerted a powerful influence on what was considered good writing (Bizzell, 1982; Zamel, 1982). Emerging from beliefs that social context must be taken into account to understand writing, scholars turned to the fields of rhetoric and phenomenology to theorize and explain the social context of writing. Borrowing from rhetorical and phenomenological traditions is an approach that views writing as inherently social, and one that I draw on here: rhetorical genre theory.

Rhetorical Genre Theory

Rhetorical genre theory (RGT) is an approach that expands on traditions that understand writing as a skill or process and conceptualizes writing as situated in social contexts. Writing is viewed as *situated social actions* that occur as *genres*, specific types of writing, or discourse, that are produced for a specific purpose, in a specific context, and for a specific audience (Bazerman, 1988; Freedman & Medway, 1994; Miller, 1984). To explain how RGT helps me understand doctoral writing, knowledge, and identity in interdisciplinary programs, I outline below foundational elements of RGT: social situation, exigence, and addressivity.

To understand how RGT defines the concept of social situation, it's useful to turn to how the concept emerged from rhetoric, specifically from discussions about how recurring situations habitualize rhetorical action (i.e., how we recognize situations and choose strategies to act within them) (Bawarshi & Reiff, 2010). Specifically, situation in RGT draws on Lloyd Bitzer's (1968) discussion of *rhetorical situation*. To define the rhetorical situation, it's helpful to first explain the concept of *exigence.* For Bitzer, an exigence is a problem or defect in a situation that requires some sort of response. Exigence is, in Bitzer's words, "something waiting to be done, a thing which is other than it should be" (p. 6). Key to this definition is that exigence is *rhetorical* – the thing waiting to be done (the problem) requires a discursive response. In other words, to respond to a rhetorical exigence people use language to *get something done.* Wildfires can be a problem, but they aren't a problem that can be solved discursively (we can't tell wildfires to stop burning). In the event of wildfires, however, language can be used to *do* things. During the destructive wildfires that occurred in Australia in late 2019, several online appeals were written requesting donations to help protect and foster injured wildlife. These appeals were responding to an exigence: overwhelmed and undersupplied, animal rescue foundations requested funds and

resources to fix a problem. The rhetorical situation, in this case, is created by calls for help. Note that for Bitzer, an exigence is a defect or problem in a rhetorical situation. Language responds to and attempts to address whatever the problem may be. Taking up the notions of the rhetorical situation and exigence, Carolyn Miller (1984) in her landmark paper "Genre as Social Action" points out that *all* situations require responses, not just problematic ones. Something as simple as wanting to remember what you need at the grocery store to make dinner creates a social situation where a grocery list responds to the exigence of needing a reminder of what to buy.

Rhetorical genre scholars have adapted the notion of the rhetorical situation to understand rhetoric not just as the solution to a perceived problem, but as the response demanded by *any* situation (Bawarshi, 2000; Miller, 1984; Paré & Smart, 1994). Instead of discussing rhetorical situations, RGT uses the term *social situation* to refer to "situations that are the construct not of 'perception', but of 'definition'" (Miller, 1984, p. 24). The social situation, and individuals' understanding of that situation, is a result of how the social situation has been constructed in the past and a shared interpretation of the kind of response it requires. The response required by the situation is determined by individuals drawing on their experiences with, and responses to, past similar situations. I've been grocery shopping enough to know that I need to bring a list with me, but I've also encountered new situations where a similar kind of response works. For example, when packing to go on a trip, I might create a packing checklist, which serves a similar function to the grocery list by reminding me to pack my toothbrush.

Particularly important to how RGT conceptualizes social situation is the notion of "definition." Understanding that social situations are defined by collectives, genres are produced within these collectives to "regularize writer/reader transactions in ways that allow for the creation of particular knowledge" (Paré & Smart, 1994, p. 122). How communities define a

social situation will determine the kinds of rhetorical resources individuals can use to respond to

this situation. Focus on the social situation is also where RGT breaks from other approaches to

genre. Following the work of rhetoricians Campbell and Jamieson (1978), who argue against

identifying and defining genres based on *a priori* categorizations, RGT understands genres based

on "the actions produced in recurrent situations" (Bawarshi & Reiff, 2010, p. 69). That is, RGT

explores and defines genres inductively, and situates genres within recurring, and socially

defined, situations.

Recognizing and defining a social situation, however, is not always easy and usually

requires some prior engagement with that situation, or at least some prior knowledge of it. This is

why the concept of *recurrence* is an important factor in responding to social situations. It is

through repeated engagement with a situation that communities develop shared (though often

implicit) definitions of that situation (Miller, 1984). As individuals engage with recurring

situations, they develop ways of responding to them. From an RGT standpoint, collectives that

engage in recurring, and defined, social situations develop genres to respond to these situations.

These genres, in turn, create new social situations and demand new responses (Freadman, 1994).

The call and response nature of genres and social situations can therefore be understood as

dialectical. When a social situation calls for a particular genre to be enacted, the genre responds

to and recreates the recurring social situation (Devitt, 1993). From an RGT perspective, social

situations are constructed from shared understandings of past similar events. Further, when

genres are called into action, they recreate the very social situation they were called to address.

For genres to be created in the first place, there must be something in the social situation

that calls for a response. To conceptualize absences or calls for response, RGT draws again on

Bitzer (1968), specifically his notion of exigence. As I mentioned above, for Bitzer exigence is

understood as a deficit in the rhetorical situation, a problem that can be objectively identified and must be addressed. While rhetorical genre theorists do acknowledge that there must be something in the social situation that calls for a response, it does not have to be a deficit. Furthermore, like the social situation, exigence is socially constructed. The way that individuals act within and understand a situation is a function of how they recognize the situation's exigence – in other words, how the recognize what genres they need to produce to address the exigence (Bawarshi & Reiff, 2010). Within RGT, exigence is understood as "social knowledge – a mutual construing of objects, events, interests and purposes that not only links them but makes them what they are: an objectified social need" (Miller, 1984, p. 30). Simply put, the way that someone responds to a social situation will depend on how they understand what kinds of actions that situation is calling for; that is, what actions the *exigence* is calling for. But, understanding exigence can be tricky if individuals are *not* familiar with a situation. Students in a first-year college English course might read an assignment sheet and respond to it with a five-paragraph essay, a kind of writing which may have successfully responded to past English assignments. Professors and teaching assistants, however, probably expect something quite different. The disparate expectations of what response the assignment sheet calls for is a function of how students and professors understand the social situation. Important to note is that I have written about exigence here as though it somehow exists outside of, or prior to, the social situation. This is not the case. As Paré (2014a) explains, a genre's exigence is "an essential part of the [social] situation itself" (p. A87). The genres that individuals produce to fulfill a social purpose are informed by their understanding of the social situation and exigence.

A genre's call to action – its exigence – is related to its purpose: a genre performs an action in order to respond to an exigence and social situation. Here, I want to draw attention to

the responsive nature of genres. In Bitzer's (1968) definition of the rhetorical situation, audience

is a key component but it refers only to those who might be influenced by a particular discourse.

It does not view all discourse as inherently directed. While the notion of audience is still a key

consideration in RGT, many genre scholars find it useful to draw on Bakhtin's (1981, 1986)

notions of addressivity and dialogism to describe the inherent directedness of genre. For Bakhtin

(1986), *all* discourse is directed towards someone or something and a communicative event will

always take "into account the possible responsive reactions, for whose sake, in essence, it is

actually created" (p. 94). Our definition of social situations, and the reasons why we are creating

a particular genre, shape both how we respond and the kinds of responses we *anticipate*

(Freadman, 1994). This understanding of discourse being addressed allows RGT to

conceptualize genres as being created for someone and having the potential to call for a response.

The call and response nature of genre can be further theorized with Bakhtin's (1981)

notion of *dialogism*. Bakhtin understands discourse as being dialogic, meaning that it is "directed

toward an answer and cannot escape the profound influence of the answering word that it

anticipates" (p. 280). Understanding genres as dialogic views these discourse types as being

created in response to a particular audience. It also suggests that genres respond to other genres.

When a genre is enacted, it is both answering a prior call and creating a rhetorical space for a

response. Understanding genres as both addressive and dialogic is useful for my purposes

because different communities will have different ways of calling for and responding to genres

(because of how different communities define social situations differently).

The assumptions that I have outlined above – social situation, exigence, and addressivity

– are foundational to how genre is conceptualized in RGT. RGT defines genre as "typified

rhetorical actions based in recurrent situations" (Miller, 1984, p. 159). Genres respond to and

(re)produce[2] social situations, respond to and (re)produce one or many exigencies, and are inherently social and addressed. By conceptualizing written genres from an RGT perspective, I am able to understand interdisciplinary doctoral students' writing as a conduit to participating within a larger social situation and as a form of social action, as a way of getting things done within a larger community.

Important to note is that genres (re)produce the social situations in which they are found. When people produce genres, they are *re*producing the same social structures that made the social action necessary, recognizable, and useful (Bawarshi & Reiff, 2010). Implicit in the social structures being reproduced are epistemological and ontological assumptions of people within that social situation. Such assumptions include beliefs about what can and cannot be said, what questions are worth asking, what issues are worth exploring, and conventions about who is allowed to produce the genre at all. Genre researchers exploring writing in education have illustrated how students gradually learn the implicit assumptions of disciplines and their values through learning to produce the discipline's genres (Artemeva, 2005; Schryer, 1994; Medway, 2002). Since genres (re)produce social structures, RGT scholars generally understand genres as being *non-neutral*. In performing social actions, genres reinforce beliefs, hierarchies, and practices of situated communities. This is especially notable for my purposes because when doctoral writers learn to produce genres, they are not just learning a form; they are also learning (and enacting) the beliefs of whatever community they are working in – or communities that they are working across.

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[2] I write "(re)produce" consciously: it is my way of getting around what I see as a "chicken-or-egg" question in rhetorical genre theory – which came first, the community or the community's genres? As the relationship between genres and its social situation is dialectical, I use parentheses around the *re* in reproduces to avoid suggesting one is more powerful than the other.

RGT scholars often argue that genre is inseparable from situation (Freedman & Medway, 1994), and as such can be viewed as discursive realizations of a community with a shared definition of social situation. Because of this, genres can be seen as inherited forms of human collectives that have been shaped by *and* shape these collectives over time (Starke-Meyerring, et al., 2014). As such, genres "evolve, develop, and decay" (Freedman & Medway, 1994, p. 8) along with their social situation. While genres may evolve, they remain rooted in the history of a particular community and reflect and reify that community's ways of knowing, doing, being, and arguing. Moreover, the historicity of genre and its stabilization, for now (Schryer, 1994), result from the repeated *drawings on* of a genre in a social situation. In this way, genre conventions are often taken-for-granted or viewed as common sense and become normalized (Paré, 2002).

When deeply situated and historically evolved genres are normalized, their value-laden nature becomes tacit. Newcomers learning genres are socialized into communities through trial and error, often without the benefit of discursive resources to interrogate or even see the implicit beliefs and practices the genre allows or discourages (Bazerman, 2009). Writing, in these contexts, is not viewed as rhetorical (i.e., as having evolved in communities and reproducing its values and practices). Indeed, writing is often perceived as being *arhetorical*: a universal skill divorced from context and situation. Those studying doctoral writing from a rhetorical perspective have argued that these arhetorical assumptions are common in doctoral education and create paradoxes that stifle students' learning, as well as their ability to participate in disciplinary communities (Starke-Meyerring, 2011, 2014; Starke-Meyerring et al., 2014). To aid in my understanding of these implicit assumptions in interdisciplinary doctoral writing, I turn to a concept emerging from RGT that traces the social dynamics of how genres are understood and interact, which I operationalize throughout the dissertation: meta-genre.

Meta-genre. The concept of meta-genre that I draw on here was developed by Janet Giltrow (2002b). Very simply, meta-genre is "situated language about situated language" (p. 190). Meta-genre consists of the ways that people understand, know, talk about, and perhaps question the kinds of genres they are routinely engaged in consuming and producing. Meta-genre, we could say, is talk or discourse about genre that serves to regulate and regularize genres themselves. Often, regulating discourse takes the form of guidelines or directives that serve as "a kind of pre-emptive feedback…ruling out some kinds of expression, endorsing others" (p. 190). For instance, the policies, guidelines, and manuals about doctoral dissertations construct a particular idea of how a dissertation should be written and the nature of the writing itself (Starke-Meyerring et al., 2014). Of course, written policies and guidelines are not the only meta-genres that regularize assumptions about writing. Situated language about situated language can extend to how people talk about genres. For instance, when professors or teaching assistants describe to their class what the components of a good essay are, they are producing talk regulating genre expectations (Giltrow, 2002b).

Meta-genres, then, can be understood as "atmospheres of wordings and activities…surrounding genres" (Giltrow, 2002b, p. 195). Writing and talk about precedents and expectations position genres in relation to specific activities, which consequently regularize genre norms and conventions. The atmospheres of language and activity that Giltrow discusses are not always explicit, nor are they always recorded. Expectations about genres can be tacit. If we consider the dinner party to be a kind of genre (as I did in Chapter 1), expectations that dinner party guests shouldn't show up with a large group of uninvited guests and that the host should not abandon the party to go to bed in the middle of dinner are not written down anywhere. Yet, we know that these are taboo actions. If, for instance, the host *does* leave in the middle of dinner,

guests are left confused and surprised as to why their host may have abandoned them. Similarly, meta-genres controlling written genres consist of unwritten rules and expectations that, while not discussed overtly, are nonetheless central to regulating genre conventions.

In looking at meta-genre as atmospheres of talk or discourse regulating genre, we may not only understand something about genres themselves, but also something about how people understand context. Meta-genre, Giltrow (2002b) writes, "helps us [understand] *talk* about writing as part of the *context* of writing" (emphases added, p. 198). Exploring the conventions and activities surrounding genres lets us "make more deliberate and sensitive estimates of situations in which writers learn to compose in a particular genre [or genres]" (p. 196). For my purposes, looking at meta-genres that exist in interdisciplinary life sciences doctoral programs provides a nuanced way of exploring the interdisciplinary contexts where writers learn and engage with different kinds of doctoral writing from how they talk about writing. Indeed, talk about meta-genres, or *meta-talk*, is a powerful entry point into understanding people's interactions with genres – in listening to meta-talk we are, as McNely (2017) suggests, "able to listen in on situated writing practices" (p. 450). Exploring meta-talk, along with guidelines and policies about writing, in doctoral interdisciplinary life sciences allows me to trace what actions meta-genres enable and constrain.

The regularizing function of meta-genre is important to highlight because it has consequences for what interdisciplinary writers can and cannot say and do. Indeed, Giltrow (2002b) argues that a meta-genre "that occludes or tactfully or timidly evades, or naturalizes highly contingent practices, may not be bad in itself, but, rather, a sign of unspoken negotiations among conflicting interests, a way of everybody getting on and going on despite hunches and suspicions" (p. 201). In other words, meta-genre may control what kinds of writing can happen

and how they happen in such a way as to sweep any evidence of discord or disagreement under the rug. This is an especially powerful tool that meta-genre offers for research in an interdisciplinary environment: the potential to tease out contingent practices that get occluded or naturalized. A meta-genre that occludes in an interdisciplinary context has implications for what doctoral writers can address in their writing, how they are allowed to write about it, the extent to which they are allowed to question or resist norms regulated by meta-genre conventions, and the kinds of researcher identities students can negotiate in their writing. Not only must students figure out how to navigate interdisciplinary writing, they tend to have to do so within a meta-genre that potentially "[denies] actual division, even when those divisions – or differences – are what student writers need to know about" (p. 188).

Meta-genre is a powerful lens for understanding the articulated and unarticulated rules of writing. I will note that its focus is on the power of *language and discourse* in controlling how genres are understood, written, and deployed. While the regulating power of meta-genre—and indeed *genre*—does have implications for individuals, my aim is to understand how *meta-genres* and writing function in interdisciplinary doctoral programs. This approach, then, serves to use individuals' encounters with writing as an entry point to understanding broader assumptions about interdisciplinary writing. As a result, my analytical gaze is focused on how assumptions about interdisciplinary writing regulate individuals' participation in genres and meta-genres. Its goal of exploring how doctoral writers are hooked into broad assumptions about writing thus restricts the degree to which I am able to explore questions of individual agency and power. Certainly, the experiences of individual doctoral writers is central to this study, but from an RGT and meta-genre perspective, these individual experiences serve more as entry points to understanding the regulatory discursive power of writing.

Meta-genre has proven to be a useful analytical concept for those aiming to explore how ways we talk about writing and how guidelines and proscriptions about rules, written as explicit guides and/or learned implicitly through advice or trial-and-error, reflect values and norms of communities. In her seminal work on meta-genre, Giltrow (2002b) uses the concept to unpack talk about writing overheard from writing research in professional contexts (e.g., tax accountants, economists), but focused largely on meta-genre in academic undergraduate contexts. This focus allowed Giltrow to understand how writing guidelines and requirements rationalize academic writing conventions and how these rationalized guidelines are communicated to students (p. 194). The concept of meta-genre has also been taken up in research that explores how different genres are taken up and produced. In her study exploring homeless blogs (i.e., blogs written by those experiencing or who have experienced homelessness), Elizabeth Maurer (2009) discusses how meta-genres regulate the generic activity of such blogs. She argues that the meta-genre of the homeless blog both stabilizes the genre by regulating who can author the blogs and how they can be written; that is, only those experiencing homelessness should be able to write these blogs and they should be written to counter common, often damaging, beliefs about homelessness. Berkenkotter (2001) suggests that in the field of psychiatry, the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* (DSM) constitutes a meta-genre that stabilizes and organizes the practices and activities of the psychiatric community by codifying what counts as a disorder. As a meta-genre, the DSM regulates what psychiatrists can and cannot diagnose and how they go about that diagnosis in the first place. Also in medical professions, Spoel and James (2003) argue that guidelines and regulations governing the College of Midwives of Ontario reveal an "uneasy trajectory of professionalization for midwifery" (p. 18) because they constitute a meta-genre relying on both biomedical and holistic discourses

to standardize the practice in ways that contradict midwives' professional role. More recently, in an exploration of transmedia writers (e.g., writers who distribute narratives across different kinds of media platforms, as well as performative and textual genres) McNely (2017) has suggested that meta-genres emerge as "nimble resources to serve important coordinative needs in multigenre writing projects" (p. 471). His research, undertaken with transmedia writers at London's Soho Theatre Writers Centre, illustrates how lists, narrative timelines, and a general story arc constituted meta-genres that shaped the creation of multiple genres (e.g., ebooks, character blogs) and stabilized and coordinated the social activities of the writing team.

Meta-genre has also been a useful analytical concept in graduate education, and it has been mobilized to great effect in doctoral writing. Starke-Meyerring, Paré, Sun, and El-Bezre (2014) draw on the concept of meta-genre to explore the policies, guidelines, descriptions, and tip-sheets regulating the doctoral dissertation at 11 Canadian graduate schools. They found that meta-genres surrounding the dissertation obscured its rhetorical nature and construed the dissertation as simply writing up knowledge produced elsewhere. In doing so, the findings of their work suggest that the meta-genre surrounding the dissertation contributes to how doctoral writing is so often conceptualized as an individualized problem. In a similar vein, Kate Pantelides (2015) traced how a series of threads posted to the Writing Program Administrators Listserv (WPA-L) created a meta-genre account of the dissertation. She explains how three related threads about the dissertation provided a sense of how the rhetorical community constitutes the dissertation; that is, the rules guiding the community's expectations of what a writing studies dissertation should be and do.

Meta-genre also offers a means of tracing the practices and beliefs of rhetorical communities. While meta-genre has generated insights into how assumptions about writing are

constructed within professional communities and academe (e.g., Maurer, 2009; Pantelides, 2015; Starke-Meyerring et al., 2014), it also has shown how tensions or shifts in communities may signal contradictions or innovations in meta-genre (Spoel & James, 2003; McNely, 2017). Since meta-genre has been used effectively in understanding assumptions about writing and how these assumptions may be prone to contradictions, frictions, and innovation from writers, this concept offers great potential for understanding doctoral writing, and identity, in interdisciplinary programs.

Identity

The connection between writing and identity is important to address due to the myriad ways that identity can be conceptualized. From a rhetorical perspective, writers negotiate and develop identities, at least in part, by learning to produce genres. The kinds of identities that genres make available to, in this case, interdisciplinary doctoral writers have significant consequences for their participation in the doctoral process. I begin my discussion of identity by outlining how doctoral writing research has grappled with questions of identity before turning how I conceptualize identity as a rhetorical construction.

Conceptualizations of identity in doctoral writing research. Within doctoral writing research, writing is often highlighted as a site where students develop scholarly identities (Aitchison et al., 2012; Green & Lee, 1995; Kamler & Thomson, 2014). A particularly widespread understanding of identity in doctoral writing research comes from Roz Ivanič (1998), who discusses identity from a social standpoint. In this approach to identity, scholars tend to explore how individuals draw on different facets of their identity when they write, which Aitchison and colleagues (2012) call a "writerly identity" (p. 437). This refers to how doctoral student identities are revealed through writing, ranging from autobiographical traces, how

students position themselves as experts, and how students convey disciplinary knowledge. The social approach to understanding identity has led to the creation of frameworks like "identity trajectory" (McAlpine & Amundsen, 2011, p. 39), which explores how students enact different kinds of identities. Identities that have come under investigation within this framework include, for instance, institutional identities (e.g., developing scholar) and personal identities (e.g., as a family member, employee, parent), and how these identities might create uncomfortable or challenging situations for student writers (Botelho de Magalhaes, Cotterall, & Mideros, 2019; Jazvac-Martin, Chen, McAlpine, 2011). These approaches have proven fruitful in answering questions about how doctoral students learn to participate in academe, but do not often delve into situated notions of identity (Aitchison & Lee, 2006); that is, the idea that identity is tied to particular communities and their practices.

Drawing on Wenger's (1998) notion of community of practice (i.e., like-minded peers working towards shared goals with shared discourses, tools, and social artifacts), Kamler & Thomson's (2014) notion of "textwork/identitywork" (p. 17) does explore writing as situated. For them, identity is plural (people enact several), constantly in flux, informed by participation in community, negotiated through interactions, and "patterned" (i.e., each community has its own norms and expectations new members must learn) (pp. 18-19). Essentially, as students learn to write in a disciplinary community, they are also learning a kind of disciplinary identity. While useful when exploring doctoral identity, approaches like textwork/identity work are most commonly used in pedagogical contexts for supervisors to support doctoral students in fostering academic identities. It does not generally address what happens when doctoral students negotiate identity *through* writing specifically, as is my focus here. Based on my understanding of writing, and what it does, I adopt a conceptualization of identity as rhetorical.

Understanding identity as rhetorical. For my purposes, the relationship between writing and identity is best conceptualized by returning to RGT. RGT's understanding of identity, and its connection to genres, is a powerful conceptual tool because it provides a way of exploring how writing is implicated in the process of constructing and negotiating interdisciplinary students' identities. A rhetorical approach to identity foregrounds how the confluence of different genres in interdisciplinary programs impacts the ways that doctoral students write or genre themselves into scholarly communities and scholarly identities. To explain identity as rhetorical, it helps to recall a few key points about genre.

Genres are situated within specific communities and oriented towards particular goals, meaning that as the communities where they exist develop and evolve, so do their genres (Devitt, 1993; Schryer, 1994). The close relationship between genre and community means that genres inherit epistemological and ontological beliefs of a community and are thus *non-neutral*: to learn a genre is to learn about specific practices, beliefs, and ways of being and arguing within a specific community. Thus, when learning to produce a genre, individuals learn – implicitly (Devitt, 1993) – how to enact particular ways of knowing, doing, and being. Learning to produce a particular genre is, in essence, learning to produce a particular kind of identity (Bawarshi & Reiff, 2010; Bazerman, 2002). In this case, when interdisciplinary doctoral writers engage in producing genres, they are essentially learning how to engage within a particular context and with a specific community.

Learning how to write, or genre, oneself into a community is not necessarily a straightforward process. When students learn to produce genres, they are also learning to enact ways of *being*, despite the fact that the histories and values from which these genres emerge can result in tensions when students must produce genres with unfamiliar or uncomfortable values

and beliefs. In his discussion of social work genres and identity, Paré (2002) outlines several instances where the institutional identities social work genres required were at odds with social work students' perceptions of what the situation called for. A particularly illustrative case Paré discusses is his experience working with Inuit social workers who resisted writing impersonal, detailed reports as was expected of them. They resisted genre expectations because they faced betraying vulnerable members of their community, while trying to remain a part of that very community. The social workers' resistance to genre conventions illustrates how the value-laden nature of genre impacts the kinds of identities that writers can negotiate. The conventionalizing power of genre is such that there are only select identities available to writers trying to work within a particular genre – identities that are regularized by a particular community (Bawarshi, 2003; Paré & Smart, 1994). Furthermore, because available identities are implicitly embedded in genre conventions they are often taken-for-granted, which has consequences for newcomers attempting to *genre themselves into* a particular community. Often, these consequences emerge as newcomers being perceived as unable to work within an established system (Paré, 2002) and affects how these newcomers construct their identities. A rhetorical understanding of identity, then, is useful because it looks past normalized assumptions about genre and explores how people adopt, and perhaps resist, the identities the genres make available.

Conceptualizing identity as rhetorical allows me to explore how students learning to produce the genres of their community are essentially learning about its practices, beliefs, and ways of being and arguing (Schryer, 1994). Since I view genres as spaces where identities are developed, enacted, and perhaps resisted, identity is not internal – it's *negotiated* (Bawarshi, 2003; Paré, 2002). The dialectical nature of genre means it is always addressed (Freadman,

1994), so when for example students learn to produce a new genre, they are co-constructing a genre-d identity with others (i.e., their readers and community).

That identity is co-constructed echoes the poststructuralist notion of positioning, whereby identities "come to be produced by socially and culturally available discourses" (Burr, 1995, p. 96). In brief, this idea posits that one way identity is developed is in interaction with others through discursive practices that "constitute the speakers and hearers in certain ways" (Davies & Harré, 1990, p. 62). While discourse is of course not the only way that identity is developed, positioning theory – like RGT – focuses explicitly on the role of language and discourse in identity development. According to theories of positionality, people are offered or allowed specific subject positions that they may take up, transform, or (with some difficulty) resist (e.g., Holland et al., 1998). What is useful about positioning, especially to this work, is the reinforcement that subject positions, or identities, are created through language and through interaction with others. Identity is not, as Holland and her colleagues (1998) argue, an individual enterprise (i.e., people can't decide to position themselves however they want without consequences), but a social one wherein people are identified, and identify themselves, through social interactions. Identity is seen as a negotiation within specific sets of discursive rules and expectations where individuals are positioned into specific identities, much like rhetorical conceptualizations of identity. Also noteworthy is positioning's concern with acknowledging that identity is not uncomplicated: people may resist or challenge how they are positioned in specific contexts (Davies & Harré, 1990) and try to negotiate new positions for themselves that may run contrary to established norms (Holland et al., 1998). Positioning theory further supports RGT's conceptualization that while identity is a negotiation it is not always simple and straightforward (e.g., Paré, 2002).

In the past, writing studies research has productively drawn on RGT to describe identity formation, particularly in education contexts. In their study of medical case presentations (i.e., presentations given by medical students and residents to communicate details of a patient's health to a physician), Schryer and colleagues (2003) observed that for student physicians to be acknowledged, they had to distinguish between patients' experiences and medical knowledge. In doing so, students were trained to see the world from the perspectives allowed by the genre of the case presentation and had to negotiate with doctors from these perspectives. They had to, in other words, *position* themselves in a particular way with doctors and patients and enact the values and beliefs inherent to the case presentation genre. Students in this case *genre-d* themselves into medical identities that enabled them to be recognized by doctors as a member of the medical community (or at least, a member-in-training). Similarly, Blakeslee (2001) discusses how a doctoral student in physics essentially learns how to become a member of the discipline through learning how to write journal manuscripts. In doing so, the student was learning the kinds of values, assumptions, and practices that identified him as a physicist. In his exploration of institutional social work genres, Paré (2002) powerfully illustrates genre's power to control and patrol identity. Discussing the power of genres as "collective and conservative forces operating to make sense 'common' and to locate individuals in identities and relationships" (p. 68), Paré discusses how institutional identities are conventionalized through genre, but also points to how these identities may be challenged and negotiated. In these studies, genres (particularly written genres) served as conduits for newcomers to negotiate their positions within a community. That is, in learning how to produce situated and value-laden genres, writers were also learning what kinds of identity positions they could and could not negotiate. The medical students discussed by Schryer and her colleagues (2003) were genre-d into very specific non-

neutral identity positions. Through learning how to produce the genre of the case presentation,

students were "learning how to see the world from the perspective of that genre's characteristic

structure, register and syntax… [classifying] the world in very specific ways" (p. 91). Yet, as

Paré (2002) illustrates, positions made available by a genre's inherent practices and values may

be resisted, and even transformed. As he pointed out, Inuit social workers resisted writing

themselves into values that ran counter to their positions within their communities, echoing how

genre-d identities may be resisted. Paré (2002), like Holland and colleagues (1998), further notes

that genre-d identities have potential to be transformed and challenged – sometimes leading to

innovative ways of operating within institutional contexts.

      Conceptualizing identity from a rhetorical perspective means that I understand identity as

a *situated, non-neutral, negotiation.* I view genres as shaping identity through influencing

intentions, expectations, goals, and actions (Bazerman, 2002). Instead of writing and identity

existing in separate, but related, spheres, using RGT to conceptualize identity as rhetorical

understands learning to produce genres as learning to produce, and negotiate, identities

(Bawarshi & Reiff, 2010; Schryer et al., 2003). For my purposes, this way of theorizing identity

lets me explore how interdisciplinary doctoral students learn to write meaningful genres and how

this process facilitates their (likely implicit) learning of values, beliefs, and roles of their

scholarly communities. A rhetorical understanding of identity also views this phenomenon as a

negotiation, which is significant because it allows me to account for the tensions and frictions

that may occur as students try to negotiate their identities across disciplinary boundaries.

Disciplines in academe are distinct academic communities with distinct beliefs about what

constitutes important knowledge and how to go about finding and constructing that knowledge

(Artemeva, 2009). In interdisciplinary programs, the boundaries between disciplinary

communities can become blurred or overlap (Lattuca, 2001). Understanding identity as rhetorical is a useful entry point to exploring how disciplinary conventions might push students to negotiate identities across communities where values, beliefs, and practices may not be totally complementary. From an RGT perspective "learning how to use a genre, means being genred [*sic*]" (Schryer et al., 2003, p. 91); thus, an understanding of identity as rhetorical traces how interdisciplinary doctoral students take up, transform, or perhaps resist identities and values (i.e., positions) afforded them by particular genres. As I mentioned above, however, interdisciplinary doctoral writers are likely to encounter a variety of genres with inherited values that may sit uncomfortably with each other. Conceptualizing identity as rhetorical allows me to explore what identity positions genres make available to students, while also letting me trace how these identity positions may be negotiated, transformed, and perhaps even challenged and resisted.

Interdisciplinarity and Interdisciplinary Knowledge

In my discussions of RGT and identity, I have emphasized the situated nature of genre in communities, specifically *disciplinary* communities. With few exceptions (cf. Blakeslee, 2001), genre research in education has largely focused on the disciplinary nature of writing in contexts that have evolved to share common knowledge-making goals, approaches, and ways of being and arguing (Artemeva, 2009; Artemeva & Fox, 2011; Medway, 2002). In contexts where disciplinary boundaries are blurred or distorted, questions of writing, research, and identity become more complex. Such questions are important here because, from an RGT standpoint, writing is a central knowledge-making practice: it is inherently epistemic (Dias & Paré, 2000). As Starke-Meyerring and Paré (2011) write, "participation in a community's knowledge-making practices does not just produce knowledge; it produces ways of knowing, ways of seeing, ways of believing, ways of being" (p. 14). To see writing as rhetorical is to see it as being inherently

epistemic. As such, important concerns arise about how research in contexts where distinct

disciplinary assumptions interact. These include considering how research and indeed *knowledge*

are rhetorically constructed and negotiated at disciplinary boundaries. Below, I outline how

interdisciplinary research has been conceptualized and explain how RGT impacts my

understanding of interdisciplinary writing and research.

What is interdisciplinarity? To discuss interdisciplinary research, it's useful to

understand the notion of *disciplinarity*. Within academe, disciplines have been characterized as

tribes (Becher & Trowler, 2001) with autonomous "areas of study which do not normally

cooperate or coordinate…across disciplinary boundaries" (Davies & Devlin, 2010, p. 8). That is,

disciplines are collectives with shared practices, knowledge, and methods of validation. While

Chettiparamb (2007) is careful to point out that disciplines are not static and constant, they "still

possess characteristics that make them identifiable as disciplines" (p. 7). For the purposes of this

dissertation, a discipline might be considered as a community of scholars with shared history and

inquiry traditions, as well as an agreed upon sense of what constitutes new knowledge and how

this knowledge should be communicated (Davies & Devlin, 2010). This definition acknowledges

an important characteristic of disciplines: shared history and tradition, resulting in shared

practices and beliefs. Disciplines, then, are defined not only by a shared history, but also by

differences that set them apart. English literature, then, can be understood as a discipline with

shared practices, beliefs, and histories that exists distinctly from the discipline of sociology.

Crossing disciplinary borders to bridge knowledge is not a novel practice, although it has

become more widely supported and discussed in post-secondary institutions (Klein, 1996, 2010;

Williams et al., 2011). The many ways in which disciplinary border crossing (or integrating)

have been carried out have led to many terms associated with this kind of research to become

muddy and take on multiple, sometimes competing, meanings (Lattuca, 2001; Pharo & Bridle, 2012). The three terms that tend to receive the most attention in higher education research are multidisciplinarity, interdisciplinarity, and transdisciplinarity (Spelt et al., 2009). While each of these terms refers how disciplines interact, each has a nuanced way of understanding how research and knowledge are integrated. The notion of multidisciplinarity, for instance, is additive: multiple perspectives from different disciplines are seen to coexist in ways that contribute new knowledge, without becoming integrated to provide new conceptual frames (Spelt et al., 2009).

More pertinent to my purposes is the notion of interdisciplinarity, which tends to be a catch-all phrase for referring to various disciplinary interactions. One of the earliest, and most commonly referred to, definitions describes interdisciplinarity as disciplines interacting and sharing methodological tools and theoretical concepts to construct a shared sense or understanding of a phenomenon (OECD, 1972, p. 25). This concept has been further dissected to explore how different fields interact and integrate (Klein, 1996; Lattuca, 2001). On a macro-level, interdisciplinary research is sometimes characterized as being methodologically integrative or theoretically integrative (Klein, 1996, 2010). Methodological integration refers to situations where methods or concepts from one discipline are integrated to test a hypothesis or develop a new theory (Klein, 2010, p. 19). For instance, the integration of mixed methods approaches, which combine quantitative methodological techniques (e.g., surveys, polls) with qualitative techniques (e.g., case studies, ethnography), is methodological interdisciplinarity that aims to improve the quality of results. Theoretical interdisciplinarity refers to a more comprehensive integration of epistemological assumptions "based on continuities between models and analogies" (p. 20); that is, theoretical interdisciplinarity aims to integrate disciplinary approaches

to understanding the world. In research exploring behaviour, theories from psychology, sociology, and communication might integrate with the aim of building a comprehensive framework with which to understand a behavioural phenomenon. I should point out that methodological and theoretical interdisciplinarity exist on a continuum. Some interdisciplines aim to *bridge* disciplines while maintaining traditional academic practices intact. Others aim to *restructure* disciplines by calling into question the traditional intellectual boundaries of disciplines and integrating previously siloed ways of doing research (Klein, 2010).

Even more integrative than interdisciplinarity is *transdisciplinary* research. The concept of transdisciplinarity has often been differentiated from multi- and interdisciplinarity by its integration of social purpose (Jantsch, 1972). Klein (2010) foregrounds the critical nature of transdisciplinarity and explains that a central characteristic of this work is shifting from reliable to robust ways of knowing by transcending disciplinary boundaries and questioning where knowledge is produced (p. 26). That is, transdisciplinary research dismantles the assumption that knowledge production happens only in academic institutions and involves collaboration between the academy and public. This approach to research has produced new methodological and theoretical frameworks for defining and analyzing the many social, economic, institutional, and political aspects of research through extending existing approaches (Stokols, Hall, Taylor, & Moser, 2008).

Before defining interdisciplinarity for my purposes, note that the various definitions presented above categorize interdisciplinary research based on how different fields merge or combine (Klein, 2010; OECD, 1972). Within these taxonomies, the consequences of interdisciplinary interactions (e.g., conflicts or tensions that might emerge when disciplines interact) are rarely discussed. When the possibility of conflict does emerge, it is often treated as a

language problem (e.g., the word *assumption* having different connotations in different disciplines). Because conflicts are often discussed as being rooted in language, interdisciplinary researchers have advocated for the development of new common languages for interdisciplinary research programs (Choi & Pak, 2007). Researchers exploring *critical interdisciplinarity*, however, do acknowledge that interdisciplinary research practices leave it vulnerable to conflicts, tensions, and disagreements (Rowland, 2004). Critical interdisciplinarity "interrogates the dominant structure of knowledge and education with the aim of transforming it" (Klein, 2010, p. 28). From this perspective, the interaction of different disciplinary approaches can raise questions and challenge assumptions underlying existing practices and beliefs (Rowland, 2002). Significantly, critical interdisciplinarity acknowledges the likelihood of tensions and conflict emerging when established and situated practices interact and it assumes that individuals will be "negotiating disciplinary boundaries, not removing them" (Rowland, 2004, para. 9). Research exploring writing and rhetoric in interdisciplinary environments suggest this is the case. Wilson and Herndl (2007) for instance discuss how understanding and negotiation are essential for an interdisciplinary group of scientists, engineers, and military specialists to cooperate. In their discussion of a multi-specialist (i.e., anaesthesiologists, chiropractors, acupuncturists, psychologists, etc.) pain management clinic, Graham and Herndl (2013) discuss how practitioners understand that differences exist between their fields, yet still find ways coexist and calibrate with each other. In both of these examples, however, one set of disciplinary assumptions and beliefs were not abandoned in favour of another; they were *negotiated*.

I find it useful to draw on critical interdisciplinarity, as well as Klein's (2010) and Newell's (2013) theorizations, to define interdisciplinary contexts as locales where previously siloed disciplinary ways of knowing and doing interact and are negotiated theoretically or

methodologically with the overall aim of addressing questions with interrelated or linked components (Newell, 2013, p. 31). I prefer to take a broad view of interdisciplinarity by conceptualizing it as a context where people with diverse approaches to knowledge and reality attempt to coordinate with each other to address a specific question. I employ this definition for two main reasons. First, it allows me to shift my focus from the kind of interdisciplinary research being carried out to the kinds of questions it attempts to answer (Robinson, 2008). Focusing on the questions interdisciplinary research attempts to answer allows me foreground what, in this case, doctoral students' goals are and consequently how they produce and deploy genres to address these goals (i.e., it aids exploring how genres function in these environments). Second, this definition sees interdisciplinary interactions as negotiations instead of as integrations. This is significant because it aligns with an important feature of how RGT conceptualizes writing: because the values, practices, and beliefs of communities become entrenched and taken-for-granted, they are not easily surrendered. Thus, it makes more sense to think about interdisciplinary research involving negotiations, rather than integrations, of genre conventions. Further, focusing on negotiations better accounts for how genres, which can be flexible (Schryer, 1994), interact and potentially in interdisciplinary settings.

Interdisciplinary programs and RGT. Scholarship exploring doctoral education in interdisciplinary programs is often concerned with the difficulties students encounter when navigating multiple disciplinary practices (Hibbert et al., 2014), accessing the tools and materials necessary for interdisciplinary work (Boden, Borrego, & Newswander, 2011), and accessing diverse intellectual communities (Golde & Gallagher, 1999). Scholars of interdisciplinary doctoral education also argue that many students are required to balance disciplinary and interdisciplinary knowledge bases (Graybill & Shandas, 2010). Though not often discussed,

writing is a central component of how doctoral students learn to engage in the communities they encounter. To understand doctoral writing in interdisciplinary programs, RGT is particularly conducive for teasing out how doctoral students interact, negotiate, and *write themselves into* interdisciplinary communities.

The interaction of disciplinary traditions has consequences for the kinds of writing that get produced in interdisciplinary environments, particularly from an RGT perspective. Genres develop in response to the goals and habitual activities of a situated community, while also shaping the community itself. The situated and dialectical nature of genre is especially useful for exploring writing in interdisciplinary programs. Interdisciplinary programs do not always share established sets of assumptions and practices (Haynes, 2004). Scholars of interdisciplinary research argue that the interaction of different disciplines requires students to "build expertise in their particular interdisciplinary area… and [branch] into related research topics and [publish] in related journals" (Pfirman & Martin, 2017, p. 594). The process of building expertise, and writing that expertise to related fields, is quite complex from an RGT perspective. The value-laden nature of genres, and the kinds of social actions they accomplish, cannot easily transfer to other disciplinary communities – genres are after all *situated* social actions. RGT, then, provides a valuable way of conceptualizing how genres may need to be improvised or evolve for students to work across, and write themselves into, interdisciplinary research communities (e.g., Artemeva, 2009; Schryer, 1994). RGT allows me to conceptualize how genres might evolve or shift in response to new exigencies that arise from boundary crossing research. Being able to understand the ways in which interdisciplinarity influences the goals and actions of particular genres, because of the relationship between genre and situation, also help locate indicate key rhetorical places where students negotiate and develop their scholarly identities. That is,

understanding how interdisciplinarity is deployed to address problems or research questions

helps me understand how genres are produced and deployed in these contexts and how these

boundary-crossing kinds of writing serve to connect students with various intellectual

communities that they are learning to write themselves into.

Positioning this Study in Relation to RGT and Composition Literature

In this chapter, I noted that RGT and meta-genre are suited to exploring questions of

doctoral writing, knowledge, and identity in interdisciplinary life sciences programs. The

theoretical power of genre and meta-genre is in their understanding of writing as situated, non-

neutral, and dialogic social actions (Miller, 1984; Paré, 2002). They also offer a means of

understanding writing in situations where genres of different fields interact; meta-genre,

specifically, is a theoretical concept that takes a macro view of genre by exploring how

established and at times unwritten and unspoken conventions regulate genre in interdisciplinary

academic contexts.

To understand how RGT contributes to this study exploring writing, knowledge, and

identity in interdisciplinary contexts, it helps to situate this work in relation to a rich canon of

research exploring disciplinary writing. RGT has proven particularly useful in the study of

disciplinary genres both within academe and outside of it. RGT's conceptualization of genre as

situated in specific communities has proven especially powerful in exploring how disciplinary

practices, beliefs, and ways of arguing are (re)produced in genre, textually or in some other

semiotic form (Artemeva, 2009; Carter, 2007; Devitt, 2004; Giltrow, 2002a; Hyland, 2008; Prior,

1998). Particularly notable is how this research illustrates the interconnectedness of genres to the

disciplinary environments where they exist. Bazerman (1988), for instance, traces the evolution

of the physics experimental article and notes how shifts in the genre were responses to shifts in

the physics community. For instance, when physics experiments stopped being publicly performed the written article became much more descriptive so that physicists would be able to reproduce an experiment without actually seeing it occur. Bazerman's work powerfully illustrates the dialectical relationship between writing and community – as scientific practices shifted, so too did physicists' writing practices and physicists' beliefs about how science should be communicated. In education contexts, Writing In the Disciplines (WID) scholarship has reinforced the notion that what constitutes good writing is deeply situated in disciplinary beliefs and practices (Carter, 2007; Russell, 2002). Good writing, in other words, is discipline specific.

        Understanding that conceptualizations of good writing will change across disciplines, writing scholars began exploring how writing in the disciplines might be applied to pedagogy. Writing scholars, particularly those aiming to integrate theory into pedagogy, recognized the potential of writing in the disciplines research to guide students to produce discipline-specific texts (e.g., Artemeva, 2009; Prior, 1998). Using established knowledge of disciplinary and professional genres, researchers have explored ways to teach discipline specific writing in programs like engineering (Artemeva, 2009) and social work (Paré, 2002; Smart & Brown, 2006), as well as fields with professional pathways like midwifery (Schryer & Spoel, 2003) and nursing (Parks & Maguire, 1999). Insights from this research have illustrated how students learn to produce disciplinary genres in classroom and apprenticeship settings, where established engineers, social workers, or nurses guide (often implicitly) newcomers in learning the genres of their discipline. Of course, insights into newcomers' learning of disciplinary genre conventions have focused largely on disciplines and professions with fairly stabilized (Schryer, 1994) ideas about what good writing looks like (cf. Blakeslee, 2001). Research into disciplinary writing offers valuable insights about the situated and value-laden nature of genres and how they are

learned by disciplinary newcomers; however, interdisciplinary programs present novel questions about how genres are learned and produced by newcomers – in this case doctoral students – working across several disciplinary ideas about what good writing looks like.

In doctoral writing research, RGT has been especially conducive to exploring questions surrounding how genres are learned and deployed by newcomers to academic communities (Paré, Starke-Meyerring, & McAlpine, 2009, 2011). In such research, RGT has enabled scholars to explore how genres that students produce in the doctorate (e.g., the dissertation) are key to participating in disciplinary communities (Paré, Starke-Meyerring, & McAlpine, 2009). Since genres are inherited and value-laden disciplinary forms, researchers have argued that learning how to produce genres is necessary for participation, and acceptance, in disciplines at large (Artemeva, 2009; Paré, 2011a; Starke-Meyerring, 2014). In producing genres, doctoral students are not only learning written forms, they are learning the inherent values, practices, and assumptions embedded in these forms. Drawing on RGT, doctoral writing research has discussed ways in which doctoral writers gradually and implicitly learn the genre conventions of their field. Researchers have traced how doctoral students implicitly learn disciplinary writing conventions through publishing (Paré, 2011a), writing groups (Aitchison & Guerin, 2014), and of course through writing the dissertation (Paré, Starke-Meyerring, & McAlpine, 2009). Much of this research also argues that engagement in disciplinary genres, particularly professional academic genres (e.g., manuscripts, conference talks), help shape how students negotiate their scholarly identities (e.g., Mantai, 2017; Paré, Starke-Meyerring, & McAlpine, 2009).

Of note to this study is how RGT and meta-genre have been operationalized to explore normalized assumptions about writing more generally in doctoral programs. Such research has aimed to tease out implicit assumptions about writing and understand how doctoral writers

experience writing in their everyday lives. Starke-Meyerring (2011), for instance, explores what she calls the "paradox of writing in doctoral education" (p. 75) referring to how normalized, often arhetorical, assumptions about writing (i.e., that it is a universal skill students acquire prior to the doctorate) stifle students' learning. She argues that normalized assumptions cut students off from engaging in meaningful conversations with disciplinary insiders about genres that they are supposed to be learning and producing. Similar work has drawn on the concept of meta-genre to explore institutional assumptions about the dissertation (Starke-Meyerring et al., 2014). Exploring dissertation policies from Canadian universities as meta-genres regulating the dissertation genre, Starke-Meyerring and her colleagues found meta-genres were often marginalized in institutional policies. That is, institutional meta-genres turned the dissertation "into the status-quo of inherited skills discourse…reproducing and extending…deep-seated, normalized, and inherited assumptions about writing" (p. A25). Explorations of taken-for-granted assumptions about doctoral writing have illustrated the complexity of learning deeply situated genres under the guise of normalcy and have documented the alarming implications they have for doctoral students. Significant amongst these implications are how normalized discourses about doctoral writing leave students to internalize writing failures (Starke-Meyerring, 2011) and prevent them from accessing discipline-specific guidance about high-stakes genres like the dissertation (Starke-Meyerring et al., 2014). Indeed, while the supervisor is meant to be a stand-in for the discipline-at-large (Green, 2005) and guide students' learning of disciplinary writing conventions, they often struggle to articulate their implicit knowledge (Paré, 2011). Often, therefore, doctoral students are left without chances to engage in vital dialogue about writing (Starke-Meyerring, 2014). The consequences this can have for doctoral students who are learning to develop their identities as doctoral scholars are significant. As Starke-Meyerring (2011)

argues, when students work under normalized assumptions about writing, they miss

opportunities to negotiate their "emerging research identities in their research cultures, being left

on their own to struggle with considerable ruptures and loss of confidence in their sense of

themselves as researchers in their field" (p. 85). Such research raises questions about how

doctoral students working across disciplines work within normalized assumptions about writing.

That is, navigating several research cultures under the guise of writing being a universal skill

likely presents doctoral students with several added demands to contend with, both in terms of

learning how to write for several research cultures and how to navigate their emerging research

identities at the intersection of several disciplines.

Chapter Summary

This chapter outlined the theoretical and analytical concepts that serve as the foundation

for this study. I began by outlining how theories of writing in academe evolved and how they

conceptualized writing as a product, a process, as social, and finally as rhetorical. Especially key

in this chapter is my discussion of rhetorical genre theory. RGT, which understands genre as

recurring, typified, non-neutral social actions is foundational to this dissertation. A concept

emerging from RGT that also recurs throughout the dissertation is that of meta-genre, which are

the rules and conventions that govern how genres are deployed and understood. RGT and meta-

genre serve as central concepts throughout the dissertation, guiding how I understand writing in

interdisciplinary doctoral programs and the practices and assumptions surrounding it. This is

especially conducive to exploring writing in contexts where it is still largely seen as *arhetorical:*

as divorced from situation and as a universal skill. Approaching writing from a rhetorical

perspective is instrumental in tracing the ways in which assumptions, practices, and beliefs are

negotiated (and perhaps challenged) across disciplinary borders. Further, RGT is instrumental to

my conceptualization of identity. I use RGT to understand identity as a situated, non-neutral, negotiation. In learning how to produce particular genres, students in this case learn how to produce particular kinds of identities. This approach allows me to identify how doctoral writers negotiate the identity positions genres make available, as well as how writers might contest, transform, or resist uncomfortable values inherent in interdisciplinary genres. Finally, this chapter outlined how I understand interdisciplinarity, focusing particularly on how critical interdisciplinarity acknowledges the tensions that may emerge from the interaction of previously siloed fields. I also point out that interdisciplinary environments present novel questions from an RGT perspective. From an RGT perspective, interdisciplinary programs are unique contexts in which to explore how genres, and consequently identities, must shift and evolve due to disciplinary boundary crossing.

The concepts of genre as social, situated, non-neutral actions and of meta-genres as the atmospheres of assumptions surrounding genres will be mobilized throughout the dissertation. They are core assumptions that influence my findings and the ways I went about undertaking this study. I return to these concepts and discuss them from a methodological standpoint in the following chapter. Specifically, I discuss how RGT and meta-genre inform not only how I approached this study theoretically, but also how it serves as the foundation for my inquiry approach.

Chapter 3: Methodology and Methods

In this chapter, I outline the methodological approach, study design and methods, and inquiry process (i.e., the analysis) that I designed for this study. I begin with presenting my rationale for the qualitative approach to inquiry that I adopt, specifically one that is explicitly guided by rhetorical principles.

Since methodology and methods are at times conflated, I distinguish between the two following Smart (2012), who suggests defining methods as "a set of procedures for collecting and analyzing research data, while a research methodology is a method *as well as* an implicit set of assumptions regarding the nature of reality (ontology) and knowledge (epistemology)" (p. 147). That is, research methods are the tools and approaches used to generate data (e.g., interviews as a procedure may be structured, semi-structured, etc.), whereas methodology is the procedure as well as the beliefs and assumptions underlying how that procedure is understood and enacted (e.g., what a semi-structured interview might reveal based on the researcher's questions and beliefs). To begin this chapter, I orient myself and this study within a methodology situated in rhetorical assumptions about research, reality, and knowledge (i.e., that knowledge is situated and largely socially constructed). These rhetorical assumptions about knowledge and reality inform my beliefs as a researcher and shape the kinds of insights I am able to generate.

Approaching Methodology from a Rhetorical Perspective

This study is designed on foundations that break with understandings of knowledge and reality as external, objective, and measurable; beliefs that are associated with positivist approaches (Paley, 2008). Instead, I view knowledge and reality as subjective and constructed. In doing so, I do not aim to deny the existence of objective and material realities. My interest, however, is not with these material realities but with how they are subjectively experienced and

constructed through language and discourse. The specific post-positivist beliefs from which this study emerges are situated in what is known as the *discursive* or *linguistic* turn in social research (e.g., Luke, 1997; Spiegel, 2005). Research following the discursive turn foregrounds the centrality of language and discourse to how people understand and interact with the world, focuses on *how* language makes meaning, and assumes that knowledge and reality are discursively constructed (Lemke, 1994). Language and discourse become central objects of study in this tradition because it assumes that people's beliefs and understandings of the world are products of language.

Within the discursive turn, there is a more specific perspective that informs my research approach: rhetorical genre theory. I approached designing this study from a *rhetorical* perspective, which understands discourse and writing as "historically evolved social and [non-neutral] practices that are regularized in *genres*" (Starke-Meyerring et al., 2014, p. A14), which are recurring and recognizable patterns emerging from social collectives (Bazerman, 1988; Miller, 1984). Discourse, in this case *written* discourse, is produced to accomplish the social goals of specific cultures, groups, or institutions (e.g., Dias, Freedman, Medway, & Paré, 1999). Consequently, when members of a specific community produce writing, they engage with the beliefs, assumptions, and ways of knowing, doing, and being embedded within it (Paré, 2002; Schryer & Spoel, 2005).

These underlying ontological and epistemological assumptions emerge from beliefs about knowledge and our perceptions of reality being discursively constructed and situated within particular contexts. Simply put, I operate under the assumption that knowledge is *rhetorical*. To approach research from a rhetorical perspective means to reflect on knowledge as being something that is *created by particular groups, in specific ways, and for established goals to*

serve established interests (e.g., Thieme & Makmillen, 2017). In approaching this study with a rhetorical perspective toward methodology, I do not view the knowledge that I generate as objective. Instead, it is affected by my perceptions of reality and created through a process of inquiry in a specific context and undertaken for a specific aim. Furthermore, this view approaches inquiry as a non-neutral process as insights are generated from within the researcher's agenda (i.e., research questions, conceptual approach). In addition to understanding knowledge as constructed, situated, and non-neutral, a rhetorically informed methodology understands knowledge as being created in response to a particular action, event, or audience (Bakhtin, 1986). I point this out because it suggests that knowledge is not created by the researcher on her own, but in conjunction and dialogue with other individuals.

Approaching the methodology and study design of this project from a rhetorical perspective also allows for reflection on how I use language to discuss the research process. Scholars have argued that even in qualitative research, discussions of methods and methodology can carry traces of positivist heritage, with researchers *collecting* data and *writing up* results (Richardson, 1994; Smith, 2005). To better align with underlying assumptions about research as constructed, situated, and non-neutral, throughout the dissertation I discuss data as being *generated in dialogue* rather than collected and view the writing process itself as generative, which I will discuss in more detail below (e.g., St.Pierre, 1997). Integrating rhetorical traditions and assumptions into the creation of my methodology helps me situate myself within the research and provides opportunities to discuss methods, and the insights that can emerge from them, rhetorically. Since I explore how interdisciplinary doctoral writers experience learning to produce genres that allow them to work across disciplinary boundaries and impact their development and negotiation of scholarly identities, my approach foregrounds doctoral writing.

Incorporating Narrative Inquiry

This study required an approach that could explore, discuss, and represent experiences, writing practices, and identities of interdisciplinary doctoral students in a way that acknowledged the situated, goal-oriented, and non-neutral ways in which data and insights would emerge. Narrative inquiry is an approach that meets these requirements as it aims to make sense of experiences. In this case, the experiences I to explore with participants how their experiences with writing, and exploring how these experiences might speak to larger questions of genre, knowledge, and identity in interdisciplinary programs.

Narrative inquiry involves "the reconstruction of a person's experience in relationship to both the other and to a social milieu" (Pinnegar & Daynes, 2007, p. 5; see also Clandinin & Connelly, 2000). That is, narrative inquiry tends to focus on how people experience life (Etherington, 2007). This approach has been particularly useful in exploring experience because, as Connelly and Clandinin (2006) write, "stories… are a portal through which a person enters the world and by which their experiences of the world is interpreted…. Narrative inquiry, the study of experience as story, then, is first and foremost a way of thinking about experience" (p. 375). The aim of narrative inquiry research – to understand the complexities and richness of experience – make it conducive to exploring questions of writing and identity development and negotiation. Indeed, many scholars have argued that narratives are a ubiquitous way of interacting with and understanding the world (e.g., Journet, 2012). A key assumption of narrative inquiry is that "telling stories is one of the significant ways individuals construct and express meaning" (Mishler, 1991, p. 67). The aim of research that incorporates narrative inquiry into its design is not to predict or control reality, but to attempt to understand experiences (Pinnegar & Daynes, 2007; Polkinghorne, 1995).

There are, as with anything, many ways of approaching and engaging in narrative inquiry based on the degree to which researchers immerse themselves in what Pinnegar & Daynes (2007) call *narrative turns*. The four turns that Pinnegar and Daynes identify mark shifts in approaches of designing and engaging with the inquiry process. The first shift is related to a change in relationship between the research and the *researched* to one of the researcher working with others to engage in a practice of co-constructing data and insights (p. 9). Narrative inquiry also prioritizes the importance of language in providing a portrait of experience and insight over numerical data (p. 21). Much like other post-positivist approaches focused on discourse, narrative inquiry focuses on how discourse and the creation and sharing of narratives construct life experiences. Related to the importance of sharing stories, narrative inquiry prizes the particularizable over the generalizable and understands data as being tentative and variable (p. 30). These turns are noteworthy first because they align closely with the rhetorical perspective I take towards inquiry in this study. Second, these features of narrative inquiry are useful in approaching research specifically focused on writing.

In writing research, there is a rich tradition of exploring stories and narratives (even though they are not always identified as such). This has included discussions of literacy narratives (i.e., reflections and explorations of experiences with language that inform writers' self-perceptions) (Wittman, 2016) and personal writing in education (Koerber, 2013). Far more common, especially amongst writing researchers engaged in ethnographic work, is conceptualizing data, especially interview data, narratively (e.g., Artemeva, 2009; Myers, 1985; Smart, 1998). A growing number of researchers in writing studies have begun integrating narrative inquiry into their research as a way of exploring representations of situated, meaningful, and non-neutral disciplinary knowledge (e.g., Journet, 2012). For these scholars,

narrative inquiry not only foregrounds experiences, it also allows an exploration of experience as situated within specific contexts. Writing scholars have increasingly recognized that the beliefs underlying the narrative turn are, in most cases and certainly in this case, compatible with their beliefs about what writing is and what it does.

Within writing research, narrative inquiry has proven generative in contexts where scholars explore the connections between writing and identity. In these cases, narrative inquiry has been used to interpret narratives emerging from textual and interview data about writing and identity from the perspective of researcher and participants, as Gesa Kirsch (1993) did in her exploration of women writing themselves into academe. This facet of narrative inquiry, along with its power to lessen (but not totally eliminate) power differentials between researcher and participants is one reason it has become more widely deployed in writing studies (Bell, 2002; Selfe & Hawisher, 2012). Narrative inquiry has allowed writing researchers to focus on writing as a key locus of identity development and negotiation, while acknowledging the researcher's role in how these stories are developed and interpreted.

Combining narrative inquiry with rhetorical traditions creates a useful methodological foundation for exploring the intersections of writing, knowledge, and identity. Locating identity and experiences with writing as narratives in data generated with participants provided a starting point to developing rich accounts informed by participants' experiences. This is crucial because writing remains largely hidden in academe and is often perceived as a secondary activity to so-called *real* research (Kamler & Thomson, 2014; Starke-Meyerring et al., 2014). Because of this, writing and its connection to research activities and identity are not easily discussed. Narrative inquiry provides a useful way of addressing this difficulty because it lets researchers weave together "tiny threads of evidence that [are] sprinkled across [a variety of data]" (Butler-Kisber,

2010, p. 72). This approach provides a way of making connections across different data sources to develop more profound insights into the nature of writing, knowledge, and identity in interdisciplinary programs that may not always be easily discussed in interviews, for example.

Thus, narrative inquiry provides an approach to exploring the experiences of participants and to understanding how these experiences speak to each other and inform how we currently understand doctoral writing in interdisciplinary programs. I also want to point out that my goal here is not to construct any grand narratives about doctoral students by finding similarities and differences between individual stories; instead, I am guided by narrative inquiry's goal of exploring how pieces of different stories make sense together (Etherington, 2007) and what they tell us about the nature of writing and identity in interdisciplinary doctoral programs.

Research Design

To probe my research questions and elicit the experiences of interdisciplinary doctoral writers, this study followed an emergent research design, which views data as being generated by the researcher and her participants, but also generative for future research stages. Such a design allowed for each stage of data generation to inform the next and/or shed new light on previous insights (Dörnyei, 2007). To allow for flexibility within the research, I also approached data generation and analysis recursively. Within qualitative research, recursivity refers to a repeated undertaking of inquiry procedures until a particular condition is met (e.g., data saturation) (Leech & Onwuegbuzie, 2008). This allowed me to make decisions about where to look for insights – while allowing me to follow unexpected trails and data sources – and how to make sense of data throughout the research process. By approaching the study emergently and recursively, I was able to align research methods with my beliefs about research being situated and dialogic.

To explore writing, knowledge, and identity in interdisciplinary doctoral programs, I employed a phased research design to give some structure to my process and to allow for flexibility in light of emerging insights. The study was designed with three phases. **First**, I located interdisciplinary life sciences doctoral programs and recruited doctoral students to share their experiences with writing. **Second,** I conducted a series of three individual interviews with each participant over the course of 6-9 months. **Third,** I collected samples of participants' writing and departmental and institutional documents about writing policies. I also engaged in two observations of one participant. I was invited to observe an hour-long journal club meeting and an hour-long lab meeting where a participant was presenting his research.

Locating interdisciplinary life sciences doctoral programs. I recruited five participants from interdisciplinary life sciences programs in a single institutional context ranging from biophysics to computational biology to evolutionary and developmental biology[3]. Four of these participants were in their first two years of their doctoral programs, and one had just graduated from the doctorate when he received my email over a graduate student society listserv. Participants were asked to choose pseudonyms, although some communicated that they were comfortable using their real names. In cases where participants did not provide a pseudonym, I chose one for them. The participants in this study are Aliya (studying computational biology), Aster (researching evolutionary and developmental biology), Diana, Stefan, and Victor (all in a biophysics program).

At the outset, my goal was to recruit students from a specific interdisciplinary program at different stages of the doctorate to perform a cross-sectional analysis (Menard, 2003) to see how

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[3] Recruitment only began after receiving my Certificate of Ethical Acceptability of Research Involving Humans from McGill's Research Ethics Board II in March 2018 and its subsequent renewal in February 2019. The Research Ethics Board Certificate can be found in Appendix A.

students experience writing at different stages in the doctoral process. As such, my recruitment began with what Cullinan (2015) termed "cold emailing," where I sent requests for students' participation to their publicly available university emails. While I received some responses, I did not recruit a sufficient number of participants through this approach alone. To add to my participant pool, I requested that emails containing a request for participation be sent over graduate student society listservs in science and engineering faculties. I asked any doctoral student in an interdisciplinary life sciences program (e.g., chemical physics, biochemistry, bioinformatics, bioengineering, systems biology) to contact me. I was, in other words, trying to sample by criteria: anyone who met the criteria of being a doctoral student in an interdisciplinary life sciences program was welcome to participate (Dörnyei, 2007). Again, I received emails from students expressing their interest in my work and their willingness to be participants within it. The third phase of recruitment was unexpected. A participant who I had met with had talked about my study with his lab mates, one of whom expressed interest in becoming a participant.

During the recruitment phase, I encountered challenges that altered my recruitment approach. After initially contacting students in a specific interdisciplinary program, I became uncomfortable recruiting from one program because of concerns with keeping participants' identities confidential. I worried that recruiting from a single program could inadvertently identify students or make them recognizable. Further, because doctoral research is very specific, I wanted to widen the participant pool so that research could be generalized outside of a single program.

Generating data. As I outlined above, this study was emergent and recursive, so while the procedures I followed to generate data and develop insights are described linearly, the process was much more circular. As a reminder, the questions I address in this study are:

1. What is the nature of meta-genres and meta-talk in interdisciplinary life sciences doctoral programs? What are the explicit and unarticulated rules, regulations, allowances, and constraints that they regulate?

2. How do interdisciplinary meta-genres and meta-talk govern writing and research activities at disciplinary borders? What kinds of activities do they enable and constrain?

3. What implications do meta-genres in interdisciplinary life sciences have for doctoral students learning to develop and negotiate their scholarly identities?

Below, I outline the procedures I employed to generate data, as well as the ways in which I approached working with the data to gain insights into questions of writing, knowledge, and identity in interdisciplinary programs. I begin by outlining the methods I used to generate data and go on to discuss how I analyzed these data. For ease of reference, a table outlining the data generated with each participant (see Table 1) can be found at the end of this chapter.

Interviews. The research interview is a procedure that writing studies researchers employ often and has been used to great effect in tracing connections between writing and identity (Artemeva, 2009; Schryer & Spoel, 2005). This is because writing tends to be a hidden activity and is often thought of as separate from the research process (Carter, 2007; Kamler & Thomson, 2014). Interviews, therefore, are useful procedures for probing experiences with writing. Interviews, though, are not neutral tools for extracting information from participants' heads; instead, interviewing is a procedure that engages the researcher in dialogue with participants within her established research goals (Mishler, 1991; Polkinghorne, 2007; van Enk, 2009). Instead of deriving objectively true insights from interviews, I see them as generating dialogic data that is situated within my research agenda (Gubrium & Holstein, 2002). Interviews served

as a valuable method of data generation for all three research questions as they provided an entry

point to participants' meta-talk about writing, insights into how participants' writing activities

were enabled and constrained at disciplinary boundaries, and how participants negotiated their

scholarly identities.

I conducted three rounds of in person, semi-structured interviews probing different

aspects of doctoral students' experiences with writing (DiCiccio-Bloom & Crabtree, 2006; van

Enk, 2009). Each interview was around an hour long and audio-recorded. I interviewed students

over the course of a year, beginning the interview process in April 2018 and ending it in March

2019. By interviewing participants longitudinally, I was able to learn how their writing

experiences were evolving, what they were learning (and how), and how they were *writing*

themselves into their field over time. This tactic produced copious amounts of data, with

participants returning to accounts they shared in previous interviews and discussing how their

beliefs and practices had changed because of new encounters with writing. Sometimes revisiting

accounts was prompted by my questions, at other times participants returned to discuss past

accounts without my prompting. The interview data I generated with participants was so rich that

it forms the foundation of my analysis. That is, all of the procedures I outline below were useful

in generating a sense of how writing is understood and addressed in interdisciplinary programs,

but the data I draw on in my inquiry is almost entirely interview data. This is because the

interviews served as specific points of entry into the experiences of students and the dialogue

generated was instrumental in tracing how participants' talk about writing was linked to

institutional and implicit practices and beliefs. The interviews provided what Dorothy Smith

(2005) might call a standpoint to beginning inquiry, where experience provides a starting point to

map how people are hooked into larger, and often invisible, institutional or academic discourses.

In this case, the interviews served as a starting point to explore how the participants' talk suggests how their writing assumptions and practices are regulated by powerful meta-genres.

Since I conducted semi-structured interviews, I developed a guide (see Appendix B) to help structure interviews, although this guide was sometimes totally disregarded as participants recounted their stories about writing in interdisciplinary programs. The three interviews were designed to probe different elements of my research questions, with interview one focusing on students' research activities and everyday routines, interview two on students' experiences with writing, and interview three on their positions and identities within their fields.

The first interview discussed participants' routines as doctoral students in interdisciplinary life sciences programs. Dominant understandings of writing as a brain-to-page transfer and not as a social and situated activity can lead to difficulties talking to participants about writing beyond grammar and style. Approaching the first interview, my goal was to understand the context in which participants were situated and to identify the kinds of writing implicated in their scholarly activities and identities. To do so, I began the first interview not by asking participants about writing directly, but by asking them about their routines and activities. Drawing on insights generated from the first round of interviews, as well as other data sources (e.g., documents), the goal of the second interview was to generate insights into participants' writing practices and beliefs. I talked to participants about the kinds of genres they produced and the conventions associated with writing in interdisciplinary programs. When students were given the opportunity to talk about their encounters with and the expectations surrounding writing, they shared many stories about their challenges and successes that did not necessarily conform to my interview guide. Happily, the semi-structured nature of the interviews gave participants space to share their encounters, all of which greatly enriched my own inquiry. Finally, the third round of

interviews focused on the connection between writing and identity negotiation. While

participants discussed questions of where they belonged and how they were positioned in

previous interviews, my final interview with students focused explicitly on teasing out the

connection between writing and identity in interdisciplinary contexts.

After each interview, I engaged in the process of transcription, which I view as a key part

of the inquiry process. Far from being a speech to text translation, the transcription process is

"interpretive work" (Poland, 2008, p. 885) and calls for the same careful reflexivity as any other

stage of the inquiry process. Because I transcribed the interviews, they are a reflection of how I

interpreted conversations with participants. For ease of reading, I removed verbal tics and

repetitions, except in cases where I felt they contributed to the story participants told (e.g., "um"s

or "hm"s in discussions about genre conventions, which I felt indicated hesitancy or a struggle to

articulate implicit knowledge). Identifying information, program details, and information about

students' research that may have identified them were all redacted. Sometimes I generalized

these details, other times I have redacted them entirely. All changes are marked with square

brackets. After transcribing the interviews, I sent them to participants to read and approve. Doing

so allowed participants to revise, redact, or add to our conversations and further helped me

safeguard their identities. All interviews were coded by participants' pseudonyms and the

interview number. For instance, insights from a participant I'm calling Aliya's first interview

appears as Al_INT1. A full list of interview codes is included in a table at the end of this chapter

(see Table 1).

Observations and field notes. Along with interviews, I originally intended to engage in

observations to see how writing enters into doctoral students' everyday lives in order to address

research question 2 (i.e., to understand the kinds of writing in which participants engaged and

how writing entered into their research practices). Observing doctoral students as they participate

in journal groups, attend lab meeting, and engage in their research is useful because, as Schutz

(2006) points out, they help inform how writing is deeply and often invisibly embedded in

individuals' daily activities. Observations, therefore, provide a way of seeing how writing enters

into the everyday activities of doctoral students in ways that students may not always

acknowledge. During the research process, however, I encountered obstacles to observations.

Some of these obstacles had to do with the nature of participants' research; for instance, one

student was doing her doctorate in a lab developing proprietary technology, so I was

uncomfortable asking if I could observe meetings and lab work. Another, as I discuss in more

detail in a following section introducing participants, seemed hesitant to agree to observations at

all, so I did not press her further. While the other three participants were happy to accommodate

my request, one was doing postdoctoral research which is not within the bounds of my interests

for this study. Two participants working in the same lab welcomed me into two of their lab

meetings, although one was not able to attend the meetings I observed. I attended two lab

meetings in November 2018, a journal club (where lab members discuss and critique the latest

research and how it applies to their work) and a meeting where a participant in the study (Stefan)

gave a research presentation. Observations of all participants would have provided more

opportunities to see how meta-genres were articulated in lab meetings, by supervisors, and by

collaborators. That is, they would have been chances to observe the kinds of informal and non-

institutional talk about writing that is a central part of learning how to engage in and produce

doctoral writing. However, my own discomfort with conducting observations in labs with

proprietary technology, as well as my hesitance to press participants to engage in an activity that

made them uncomfortable outweighed these benefits. Imposing further on participants would

also have affected the rapport I was in the process of building with participants, which I felt was necessary to foster and protect moving forward with the research. While it was useful to see one participant engage in lab meetings, but the lack of observations is adequately supplemented by other sources of data.

Field notes are often a companion to observations and are generally seen as records of people, places, things, and events, as well as reflections on the research process itself (Brodsky, 2008). Although field notes tend to accompany observations, I also employed them as I conducted interviews with participants since they serve as real time reflections and observations. Such field notes included observations of how participants talked about writing during interviews (e.g., emphasizing *translation* or *editing*) and detailed instances where participants appeared to struggle to articulate answers to my questions (e.g., long pauses, facial expressions, hesitancy). These notes also contained my own reflections of the interviews often in response to what participants were saying (e.g., notes to follow up on literature about translating science, notes that questions about tension and conflict should be added to subsequent interviews). While I predominantly used field notes to record questions and notes during interviews, I also recorded written field notes when I had the opportunity to observe lab meetings. These field notes, like the observations, helped generate a sense of the research activities and practices and recorded the ways in which writing tended to subtly find its way into conversations. For example, field notes taken at both the research presentation and journal club recorded talk about writing, especially publishing, being a common topic of conversation. These notes served as another source for refining interview guides. To use my previous example, on noticing the degree to which publishing was discussed (e.g., how not to write physics for an interdisciplinary audience, how to make data more convincing) I made sure to include questions about these discussions in

interviews (e.g., whether these conversations ever influenced students' writing, how much they helped, how much they perceived these meeting to be about writing).

Observations and field notes, in this case, served as important data sources for further refining my questions to participants. In understanding the kinds of activities some participants were engaged in, and in trying to notice the kinds of interview questions participants struggled with, I was able to refine my research direction to narrow in on how participants engaged with writing and research, and how these practices influenced how they positioned, or genre-d themselves into interdisciplinary scholarly identities.

Participant writing samples and policy documents. My research questions are concerned with writing, specifically with institutional assumptions surrounding interdisciplinary doctoral and the kinds of writing participants encountered. To explore these assumptions, I analyzed policy documents about writing in participants' programs and I asked that participants share some of their writing with me. Collecting and analyzing documents facilitated the exploration of research question 1 (i.e., locating and analyzing institutional policies revealed the articulated rules of interdisciplinary writing, while participants' writing was often an entry point to unarticulated rules, especially when their samples contained comments and revisions).

I began by asking participants to share writing samples with me. Ideally, these would be document-cycled drafts (i.e., sequential drafts, often with reviewer comments). After the first interview, participants sent me copies of proposals, manuscript drafts, drafts of dissertation chapters, and photocopies from their research notebooks (for a detailed summary of writing samples, see Table 1). These writing samples offered insights into the kinds of encounters participants had with writing, the kinds of feedback they received, and how their writing was implicated in the process of identity development and negotiation. Student writing samples also

provided an entry point to discussing participant writing beyond surface level features like grammar, structure, and technical language by me with specific examples that I could draw on during interviews. For instance, I often asked participants about how they interpreted comments on their writing and whether or not they affected how participants thought about or approached writing. I should note that I did not engage in a deep *textual* analysis of these samples; that is, I did not engage in close analysis to identify patterns in language. My goal was not to analyze examples of specific genres deployed in interdisciplinary programs, but to explore the assumptions surrounding writing (Giltrow, 2002b), their affordances and constraints, and their implications for doctoral students negotiating their identities. Writing samples, therefore, served as a starting point to engage participants in discussing their writing practices. I also want to note that my inquiry was *not* restricted to the dissertation. In fact, only one participant had written the dissertation, while the others were only beginning to approach this milestone. Expanding my analysis to genres beyond the dissertation, I was able to inquire into more diverse encounters with writing.

Participant writing samples, while helpful to understanding students' practices and experiences, did not provide direct insights into institutional ideas about writing. To trace how institutional ideas about writing filter into the everyday practices and experiences of doctoral students (Starke-Meyerring et al., 2014), I gathered examples of institutional policies and guidelines from programs in which students were enrolled. These included departmental policies about the dissertation (which ranged from one sentence directing students to university policies to three sentences, one of which directs students to university policies), departmental policies from two programs about written comprehensive exams, and a "Tips and Advice" guide written by faculty for students preparing to write a comprehensive exam. I also analyzed expectations set

out by the Faculty of Graduate Studies for the dissertation at the institution where participants were undertaking the doctorate. Although most of the policies I analyzed regulated the dissertation and comprehensive exams, they were still helpful in understanding institutional assumptions about writing.

The Inquiry Process: Working with the Data

As I discussed earlier in this chapter, RGT and narrative inquiry influenced my choice of research procedures (i.e., interviews, document analysis, field notes, observations) and shaped how I approached the inquiry process to work with data and generate insights into writing, knowledge, and identity in interdisciplinary life sciences doctoral programs. Here, I outline how I approached working with data using genre analysis and writing as a method of inquiry and illustrate how I enacted these approaches to generate insights into my research questions.

Genre analysis. There are several approaches to genre analysis, among them approaches emerging from linguistic traditions and focusing on text analysis (Halliday, 1978; Martin & Rose, 2008) and discourse analysis (Swales, 1990; Tardy, 2009). I, however, find it most useful to draw on genre analysis emerging from RGT: rhetorical genre analysis. While rhetorical genre analysis can, and does, engage in structural analysis of genres (e.g., in the case of written genres the tone of the author, style, lexicon), of greater concern are questions of why genres are produced, the assumptions and actions that made them necessary, and the larger social context in which they are embedded (e.g., Bawarshi & Reiff, 2010; Devitt, Reiff, & Bawarshi, 2004). Rhetorical genre analysis explores writing by investigating what genres *do* by employing an analytical framework that facilitates an exploration of the values and beliefs genres (re)produce. Such frameworks are designed to tease out the kinds of social actions that genres encourage or discourage and how genres reflect and shape habits, beliefs, and goals. Using a rhetorical genre

analysis framework allowed me to work with data to generate insights about how genres are implicated in the development and negotiation of identity and knowledge in interdisciplinary programs. In my inquiry, I employed genre analysis in two ways: first, to understand the social actions encouraged and discouraged by the institutional documents I collected, and second to explicate interview data through a rhetorical genre lens.

While rhetorical genre analysis does go beyond texts to explore the non-neutral, social actions of genres, it does provide tools to analyze texts as well. Understanding written documents was essential to this study; after all, I am interested in doctoral writing. I collected a variety of writing samples from students to inform interviews and gain a better understanding of the kinds of genres participants encountered. To draw on these samples in interviews, I wanted to first understand how the genres students were producing spoke to my questions of interdisciplinary writing, knowledge, and identity. Thus, I examined student writing samples using questions derived from rhetorical theory and adapted from Devitt, Reiff, and Bawarshi's (2004) guidelines for analyzing written genres:

- What do the purposes of this genre appear to be? What are some of the social actions it enables or discourages on the part of the writer?

- For whom does this genre appear to be written? What kinds of values and beliefs might this genre encourage/discourage? How does the genre take into account an interdisciplinary audience? Where might there be traces of writers taking into account a diverse disciplinary audience?

- How might this genre reflect/shape the goals, beliefs, and practices of its producers? Are there any indications within the genre of how goals, beliefs, and

practices of multiple disciplines might be integrated so the genre can function

within an interdisciplinary context?

- How does the genre contend with possible and subtle variations of practices and

    beliefs across disciplines? What traces of this exist in examples of the genre that

    students produce?

(Adapted from Devitt, Reiff, & Bawarshi, 2004, pp. 93-94)

Analyzing participants' writing using these questions generated a more contextualized

understanding of how writing works in interdisciplinary doctoral programs and its consequences

for knowledge and identity. This lens also shaped questions I asked students during semi-

structured interviews by providing concrete examples that we could discuss in detail. That is,

analyzing a participant's manuscript draft provided concrete entry points to talking about the

process of writing the manuscript and how participants contended with variations between

conventions in, for example, biology and physics.

During the inquiry process, I found that genre analysis could only contribute so much to

my research questions. To understand assumptions about interdisciplinary writing and their

implications for doctoral writers, I needed to move beyond genre analysis and employ an

approach that, instead of characterizing examples of individual genres (Devitt, Reiff, &

Bawarshi, 2004), could analyze assumptions inherent to a collection of genres. To accomplish

this, I employed meta-genre as an analytical device to explore both text and interview data for

evidence of assumptions about writing.

Employing meta-genre as an analytical device. Meta-genre (Giltrow, 2002b) provided a

means of analyzing both written policy and interview data to identify repeated and regulating

talk and text and about genres themselves. As I discussed in the previous chapter, meta-genres

are "situated language about situated language" (p. 190) that occur as "policies, directives, memos, procedures, manuals, tip sheets, guidelines, or other documents describing or regulating genres" (Starke-Meyerring et al., 2014, p. A-15). These directives are powerful forces that "[rule] out some kinds of expression [and endorse] others" (Giltrow, 2002b, p. 190) and "recruit writers to dominant interests, or impose discipline on diversity" (p. 191). Meta-genre is discourse that exerts power over what genres can and cannot do, should and should not look like, and *reproduces* normalized ways of thinking about and producing writing. Meta-genres, however, may also reveal "disparities or collusions" (p. 199). As Giltrow suggests, meta-genre "could have an equally valuable use as a critical instrument for investigating the sociopolitics of sites of writing and reading" (p. 199) and that:

> sharp disparities in the meta-generic expressions of users of the same genre…could be signs of context and domination… [but] the consensual solidarities of some meta-genres may signify a functional collusion of understandings, a deep socialization and isomorphism of practice and identity…. we could read meta-genres for evidence of dissent or acclamation in social locales. (p. 199)

That is, exploring data through an analytical lens tinted by meta-genre highlights not only the ways that situated and non-neutral writing practices are protected and regulated by meta-genre, it also helps identify evidence of dissent or disparities that indicate shifts, tensions, and contradictions may be occurring.

As an analytical device, meta-genre provides a means of exploring "atmospheres of wordings and activities" (Giltrow, 2002b, p. 195) that control and patrol the status quo surrounding doctoral writing in interdisciplinary programs. Meta-genre is useful for exploring how writing assumptions and practices interact at the boundaries of communities because they:

flourish…at the thresholds of communities of discourse, patrolling or controlling

individuals' participation in the collective, foreseeing or suspecting their involvements

elsewhere, differentiating, initiating, restricting, inducing forms of activity, rationalizing

and representing the relations of the genre to the community that uses it. (p. 203)

Using meta-genre as an analytical device highlighted how the genres that participants were

producing were regulated across disciplinary boundaries; boundaries which divide distinct

situated ways of understanding and engaging in science.

I approached the meta-genre analysis of data in two ways. First, I analyzed the policy

documents and departmental regulations about writing that I collected. In doing so, I aimed to

understand the "functional [collusions]" (Giltrow, 2002b, p. 199) that regulated assumptions

about writing in interdisciplinary programs. When analyzing these documents, I again used a

framework of questions to guide my analysis. I adapted Starke-Meyerring and colleagues' (2014)

framework for exploring meta-genres surrounding the dissertation, which guided my analysis of

the documents I collected:

- What kinds of writing are regulated by policies at the program, department, and

  institutional level? What policies and guides exist in interdisciplinary programs?

- How do these documents seem to conceive of writing? What are the kinds of

  assumptions and practices they endorse?

- How do these policies regulate the kinds of writing interdisciplinary doctoral

  students are engaged in? What kinds of actions do they enable or discourage?

- What kinds of rules or proscriptions are outlined by these documents? What

  kinds of implications might these have for interdisciplinary doctoral writers?

  (Adapted from Starke-Meyerring et al., 2014, p. A-16)

Analyzing the policy documents from these guidelines, I was able to gain a better understanding of what assumptions were regulated by these texts. Furthermore, language about writing in powerful meta-genres like institutional and departmental policies have a tendency to filter into the everyday lives of writers (Giltrow, 2002b), and by analyzing these textual meta-genres, I was able to understand the kinds of assumptions about writing that saturate the atmosphere around interdisciplinary students.

I also used meta-genre as an analytical device when working with interview data. While meta-genre may be traced textually (e.g., McNely, 2017; Pantelides, 2015), meta-genre can also be identified in how people talk about writing. As Giltrow (2002b) points out in her discussion of academic meta-genres, talk about writing can also indicate the rules enforced by meta-genres. Specifically, she writes "this talk is elicited by researchers' questions; sometimes by the traffic across community boundaries; sometimes by negotiations or struggles within those boundaries, or by disturbances at the threshold" (p. 187). When I analyzed interview data through a meta-genre lens, I found that much of the talk elicited by my questions *was* meta-genre talk, or as I call it throughout the dissertation, *meta-talk*. That is, interview data was rich with talk about conventions, proscriptions, and taken-for-granted rules about writing. To trace meta-talk in interview data, I used the following questions to guide my inquiry:

- How do students conceive of writing in interdisciplinary programs, specifically? That is, how do students talk about interdisciplinary writing and from what kinds of assumptions and practices might this talk emerge?

- How do students understand the conventions of interdisciplinary writing? What proscriptions, warnings, or advice might they have received that shape these understandings?

- How do students talk about the activities surrounding interdisciplinary writing? How do they contend with possible variations of practices and beliefs across disciplines?

- What regularities and contradictions exist in students meta-talk about interdisciplinary writing? That is, how does student meta-talk reinforce some practices and assumptions, while discouraging others? How might meta-talk reveal frictions, tensions, or contradictions about interdisciplinary writing?

When analyzing transcripts, I saw many examples of students reproducing ideas embedded in policy documents, and I also saw students struggling to articulate how they worked across community boundaries and the attendant challenges that seemed to contradict dominant meta-genre regulations.

Writing as a method of inquiry. Genre analysis and meta-genre analysis were key insight-generating devices, but I also relied on a process that sometimes is relegated to the margins of methods: the writing process itself. Writing tends not to be discussed as a method of research, save for when research memos are a part of the inquiry process. Memos, though, are often discussed as a secondary document, albeit one that engages in important work like reflecting on questions, locating patterns, and locating the researcher's role in the process (Butler-Kisber, 2010). Research memos are useful research tools, but they often serve as simply another source of data. Approaching the inquiry process from a rhetorical perspective, however, I engaged in writing as a central component of the inquiry process. Writing, after all, is inherently *generative* (Bazerman, 1988; Dias & Paré, 2000). When we write, as RGT tells us, we are not simply transferring ideas onto a page – we are generating knowledge. From this perspective, writing is more than a record of insights and reflections. Instead, the process of writing is a way

of finding something out that we didn't know before (Richardson, 1994; St.Pierre, 1997). The findings I discuss in this dissertation emerged out of writing through data and my interpretation of that data. I point this out not to make an argument about writing as heuristic, but to further situate how the findings and discussion of this study emerged.

Foregrounding writing as a part of the inquiry process is also important to maintaining trustworthiness throughout the study. The epistemological foundations of writing as inquiry are the same as those that view writing as non-neutral ways of constructing experience. When I employ writing as a method of inquiry, I do not claim to be creating a reflection of external realities; I am, however, imposing my "(socially constructed) view of reality through the writing process" (Kamler & Thomson, 2014, p. 11). Essentially, this means that the insights I generate reflect my goals and beliefs as a researcher. Despite being coloured by my assumptions and beliefs, writing as inquiry provided me with a way to make discoveries about the data generated throughout the inquiry process. Yes, these insights were guided by my assumptions. But they were also informed by a variety of data sources (e.g., interviews, text analysis) and situated within particular goals. Writing as inquiry provided an important way of engaging with data sources, my own questions, and my own assumptions. While writing the dissertation was, of course, part of this discovery process, much of the insights generated emerged from what I am calling participant accounts and formed the backbone of my analysis.

Accounting for experiences: writing through the data and generating insights. While the inquiry process was iterative, many insights revealed themselves during the writing process. To pull together all the pieces of evidence scattered over documents, transcripts, field notes, and writing samples, I approached the inquiry by writing participants' encounters and experiences with writing into narratives, or as I prefer to call them *accounts*. Following Butler-Kisber (2010),

I identified significant excerpts in the data – excerpts revolving around a central research question, theme, or "dilemma" (p. 70). In my case, this involved repeated readings of interview transcripts to identify excerpts that resonated with my research questions, theoretical approach, and with previous research investigating doctoral writing. For instance, in response to research question one (what are the assumptions about writing that meta-genres regulate?), a significant excerpt might be a participant explaining how she communicates concepts across disciplinary boundaries. When I asked one participant, Aliya, about how she communicated concepts across disciplines, she replied with the following significant statement, "I think there is a lot of trying to translate across disciplines and communicate our computational strategies and why they're legit to the oncologist who's gonna use this to design a mouse model or whatever" (Al_INT3). This statement is significant because, read through a meta-genre lens, this statement reveals some of Aliya's assumptions about interdisciplinary writing (i.e., it is translating concepts to convince others that they are "legit").

To begin weaving together participant accounts, I first outlined the contexts in which participants found themselves. This included information about their program (which I supplemented with my policy and document analysis), their encounters with writing, and how they experienced these encounters. In writing the biographical information about participants, I did not perceive myself *ghostwriting* or generating stories or memoirs from research data (Butler-Kisber, 2010; Kirsch, 1993; Mishler, 1991). Instead, the accounts served to develop a sense of how participants were situated in their programs, institutions, and broader research communities. When writing the accounts, I began documenting what kinds of writing participants' programs required them to produce, the supports available to them, and – importantly – how participants talked about their experiences with writing. Aside from

establishing contextual information about participants, the accounts were useful in organizing

their encounters and experiences with writing.

Instead of being fully formed stories to share in this dissertation, the participant accounts

served as a means of making sense of events (Gubrium & Holstein, 2002), of knitting together

disparate data sources to gain a fuller understanding of writing in interdisciplinary doctoral

programs. After writing a participant account, I read carefully through the narrative from a

rhetorical genre and meta-genre lens, again guided by the analytical questions outlined above.

The purpose of re-reading the accounts from a rhetorical and meta-genre lens was to theorize

participants' experiences. I did this by tracing the language used by participants when they talked

about writing (e.g., translating, explaining, clarifying) and documenting the language they used

to describe interdisciplinary writing specifically (e.g., bridging, transposing, merging). When I

theorized participants' talk about interdisciplinary writing, I noted that they often talked about

interdisciplinary writing in contradictory ways (e.g., writing was in one sentence "just writing,"

and in another "really hard"). I also noted instances where participants appeared to struggle to

articulate their experiences and beliefs about interdisciplinary writing. The theorizing process

often resulted in surprising trends; for instance, it was reading through participant accounts from

a meta-genre lens that I began to notice tensions between writing assumptions simmering

throughout the data. Reading accounts though a rhetorical genre and meta-genre lens led to

several reorganizations of the accounts. That is, accounts became organized according to how

participant experiences resonated with trends emerging from the data. Eventually, participant

accounts became organized around ideas like "translation versus transformation," "science as

complementary versus science as contradictory," and "identity and tension."

Some of the excerpts from participant accounts recur across Chapters 4, 5, and 6. The recurrence of these narratives is a function of how powerfully they illustrate the ways in which writing, interdisciplinary research, and identity are deeply connected. A single narrative from participants often richly illustrated how writing was a pivotal site of identity and knowledge work and so recur across several chapters.

Ethical Considerations and Questions of Trustworthiness and Reflexivity

As this study aims to explore assumptions about writing in interdisciplinary doctoral programs and their implications for knowledge and identity, I approached questions of ethics and trustworthiness very carefully. My goals at the outset of this project were to maintain a focus on ethics and to ensure that I designed a study that maintained internal harmony; that is, to design a study that, within my theoretical and methodological approaches, produced insights that could be justified from within my genre-coloured lenses (e.g., Devitt, 1993). I want to start here with my first consideration: my ethical responsibilities as a doctoral researcher working with doctoral students.

Ethical considerations and the ethics of representation. Working with doctoral students presented some particular considerations in regards to keeping all participants' confidentiality protected. One consideration I grappled with was the nature of doctoral students' research. Each participant was engaged in fascinating but very *specific* research questions. This research will eventually be written into a dissertation that, as Kamler and Thomson (2014) suggest, is often discussed as being a unique contribution to scholarship. In this case, this issue was not limited to the dissertation. All the genres that participants produced were of course about their very specific research questions. In my inquiry process, I was faced with the question of how to ensure participants' confidentiality when writing about work that has the potential to

identify them. I was guided by previous studies exploring doctoral research where participants'

identities were protected by generalizing information about their research and academic

programs and omitting non-generalizable information (e.g., Aitchison et al., 2012; Gonsalves,

2010; Paré, Starke-Meyerring, & McAlpine, 2011). There is somewhat of a trade-off when

purposely generalizing, obscuring, or omitting specifics of participants' research and their

programs. By not delving into specifics, there are fewer nuances in participants' accounts;

however, it is important to maintain their confidentiality, especially because participants spoke in

detail about the demands they encountered with writing and the effects of these demands on their

identities.

On a more theoretical level, it was important for me to pay careful attention to how I was

Having never been a life sciences researcher, I was concerned that despite my best efforts

I would not have enough content knowledge to know when and when not to generalize detail of

participants' research. To address this, I sent interview transcripts to participants to revise and

approve. This gave participants opportunities to respond to my interpretation of our discussions

and let participants have a more active role in the research process.

On a more theoretical level, it was important for me to pay careful attention to how I was

representing participants. As I wrote participant accounts, which organized their encounters and

experiences with writing, I carefully considered how I was using their words to support my

analysis. In her discussion of methodological challenges in writing research, Gesa Kirsch (2012)

argues "ethics and representation…play a key role when researchers study people, places, or

programs whose beliefs, values, and worldviews they may find at odds with their own" (p. xiv).

In this case, I needed to acknowledge that I was reading and analyzing participants' voices from

a very particular lens, one with which participants were unlikely to be familiar. Because I am

drawing on narrative inquiry and using interviews as a primary source of data, I had to contend

with ethical considerations stemming from a reliance on participants' words and accounts. In her

discussion of narrative inquiry, Butler-Kisber (2010) writes, "the issue of voice in inquiry is

multifaceted and fraught with tensions…. [and] requires vigilant and ethical attention to power

and appropriation while attending to ownership, advocacy, and protection of participants on the

inquiry continuum" (p. 21). Further, while research interviews in relativist paradigms are often

discussed as conversations between participants and researcher, this can minimize the inherent

power differentials in interview research. As van Enk (2009) has pointed out, "approaching the

interview as an alliance with the interviewee mans gaps in relative power and differences in

perspectives and purposes risk being ignored" (p. 1269). Similarly, Tuck and Yang (2014) warn

that the act of simply building participant involvement into a research study does not necessarily

eliminate ethical issues of voice and representation (p. 230). In this dissertation, my answer to

these concerns is to acknowledge that my interpretation of participants' experiences may not

match their own; after all, I am interpreting their words as a researcher from a very specific lens.

Addressing expectations of rigorous and valid research. While the assumptions and

practices involved in undertaking inquiry from a rhetorical perspective are at odds with positivist

beliefs about research validity (e.g. Paley, 2008), I did not want to ignore questions about *quality*

control in post-positivist research. To ensure intellectual rigour, while acknowledging that my

beliefs and goals as a researcher shaped the inquiry, I turned to the concepts of trustworthiness

and reflexivity.

Trustworthiness. For many qualitative researchers, a trustworthy project includes

showing how researchers are situated in the work, how they account for situational and

contextual influences, and how they adhere to reflection and reflexivity (Butler-Kisber, 2010).

The concept of trustworthiness is especially useful in this study since it is situated within a

hermeneutic and interpretive framework. These approaches are at times critiqued because of their subjective nature and lack of *real evidence*. But, as Denzin (2009) writes, qualitative approaches can be likened to performances where we "invite audiences to experience these performances, to live their way into the scenes, moments and lives we are writing, and talking about…. [These stories] can't be fudged, mis-represented [*sic*], altered, or distorted because they are life experiences" (p. 151). To invite audiences into this performance and illustrate its trustworthiness, I crafted a research narrative with internal harmony. As such, I did not *get at* any kind of objective truth – this was not my goal. Instead, the findings and insights I generated emerged from careful and rigorous theorizing and inquiry.

Indeed, from a rhetorical perspective the best way to ensure trustworthiness is not necessarily to worry about not getting it right. Instead, during the inquiry process I maintained what Thieme and Makmillen (2017) call a "principled uncertainty" (p. 486). This idea refers to how different ways of knowing and doing may result in unexpected responses to established practices and beliefs – responses that may challenge entrenched research practices. Maintaining a principled uncertainty, in my case, allowed me to remain a critical relationship with data and insights by challenging my own taken-for-granted assumptions.

Reflexivity. As part of the practice of maintaining trustworthiness, many qualitative researchers advocate for researcher reflexivity. Reflexivity is often discussed as a process of researchers engaging in constant reflection on the research process (Dowling, 2008) and on how meaning is being generated from data (Butler-Kisber, 2010). Often, reflexivity is practiced through the process of memo writing as a way to "keep the researcher embedded in…empirical reality and contribute to the trustworthiness of qualitative research" (Groenewald, 2008, p. 506). While one way that trustworthiness is maintained, reflexivity has been critiqued by scholars who

argue that, beyond methods, reflexivity is commonly omitted from any discussion of the research

process. Writing specifically about interview data and reflexivity, Clegg and Stevenson (2013)

argue, "rarely…are our data simply the 'interview', but we contrive to pretend they are by

making our knowledge of the field invisible" (p. 8). In other words, although researchers may

work reflexively and critically with data during the research process, connections between this

reflexive work and the insights generated are not often discussed in great detail. This lack of

discussion creates the illusion that data were interpreted in an unbiased and objective manner.

Employing writing as a method of inquiry was key to maintaining a reflexive research

stance. As other writing researchers have argued, reflexivity is a way of accounting for changes

in how researchers interpret and react to data (Eubanks, 2008; Kirsch, 2008). While writing

participant accounts, and engaging in the process of generating insights from these accounts, I

confronted questions of how the data I was working with were shifting my beliefs and

assumptions about writing in interdisciplinary doctoral programs. Through the writing process, I

reflected on how the assumptions I brought to the research shaped my reactions to participants

and their stories and found that throughout the process these reactions tended to shift throughout

the inquiry process and had implications for the kinds of insights that emerged from these

accounts.

Introducing the Participants

This study positions *writing* as the main object of study, but it does so through the lens of

how writing is brought into human action. Interviews generate valuable insights into individuals'

writing practices and are a technique often found in writing research (e.g. Artemeva, 2009;

Starke-Meyerring, 2014). Since my research asks questions about interdisciplinary students'

experiences with writing, their ideas are incorporated into and analyzed throughout the findings.

In addition, from a rhetorical perspective, an understanding of how genres *work* is only possible

through an understanding of context (e.g., Paré, 2010). For the purposes of this investigation,

therefore, it's necessary to provide some context on the individuals who shared their experiences.

I do want to point out that while I have tried to make present participants' narratives as

faithfully as possible, I have removed or generalized details of participants' research that I felt

had the potential to identify students. While I regret the loss of nuance and specificity this

generalization causes, my first responsibility is to the safety and confidentiality of participants.

Therefore, using my best judgement and the advice of the participants themselves, I have

redacted potentially identifying information about participants and their research by inserting

"[X]" where these statements would have occurred. I have also generalized some features of the

programs in which they are enrolled. I'll reiterate here that all participants were enrolled in

doctoral programs in a single institutional context (i.e., the same university). All names assigned

to participants are pseudonyms, most of which were chosen by participants. Some participants

were happy to have their own names assigned to their data, but I was hesitant to do this because

of the potential for students to be identified. In these cases, I chose pseudonyms for participants.

The participants that I introduce below are Aliya, Aster, Diana, Stefan, and Victor.

Aliya

When I first met Aliya in May 2018, she was a first year Ph.D. student in an

interdisciplinary rotation program. At the time of our final interview in February 2019, she had

started her second year of her program. Aliya offered to participate in this study during the

second round of recruitment after seeing my request for participation on a graduate listserv. I

wasn't able to observe lab meetings, partly because of the rotational nature of Aliya's program,

and partly because of the highly competitive and sensitive nature of her research. I also got the

sense that while Aliya was more than happy to talk with me one-on-one about her work, she wasn't entirely comfortable having me observe lab meetings and journal clubs. Indeed, at our first meeting when I discussed the content of the informed consent documents and asked to record interviews and observe meetings, she asked if she could decline visits and change her mind later. Sensing Aliya was uncomfortable with the prospect of observations, I decided against requesting them. Despite not observing Aliya at work, her interviews were saturated with rich insights and discussions about writing, insights that I believe made up for the lack of observation. Aliya also shared a collection of lab book entries and drafts of a manuscript she worked on with her supervisor. Because Aliya wrote this manuscript during her bachelor's degree, I was more interested in her other experiences with writing; however, the paper was written with the woman who would become her PhD advisor and influenced Aliya's direction in her doctorate. Thus, while these samples were not writing she was doing during her doctorate, they were related to writing she was engaged in at the time of this study.

Aliya is part of a fairly new doctoral program that aims to be truly interdisciplinary. Students participate in three lab rotations in their first year of the program. They choose three different labs that resonate with their interests and spend three months with these labs. The rotations are meant to provide students opportunities to see how research is undertaken in different life sciences and to learn about different facets of life science research (e.g., neuroscience, cancer, genomics, physics, cell biology, biophysics) that may enhance their doctoral work. During rotations, students are sometimes offered chances to contribute to research projects and publications. In the middle of each rotation, students are required to give presentations about the work they are undertaking to their peers in the rotation program. The presentations are usually five to ten minutes long and are, as Aliya said, supposed to be prepared

for "someone with no background on your subject because most probably nobody in the room has the subject background because we're just *that* all over the place in terms of what we're working on" (Al_INT1). The presentations are meant to provide students with opportunities to practice talking about interdisciplinary research to people working in other disciplines. It is, in other words, meant to emphasize how students have to think about language, specifically jargon, when trying to communicate within and navigate interdisciplinary spaces. I should also point out that this program allows exceptional students, who a committee deems qualified, to enrol directly from their undergraduate degrees, which is what Aliya did.

Aliya's research is in the area of computational biology and involves exploring cancer using big data and computational approaches. More specifically, she uses computational-based approaches to understand how tumours develop, so her work spans disciplines like cancer biology, computational biology, and developmental biology. While her work does span several disciplinary boundaries, she tends to emphasise that her main interest is in computational biology and, as she often put it, "translating"(Al_INT1) these methods to other fields.

During the first year of her Ph.D., Aliya participated in lab rotations like her colleagues. Aliya's rotations took place in two different computational biology labs and one biology lab. During these rotations, Aliya had opportunities to contribute to manuscripts that were being prepared for submission to fairly high-impact journals. One manuscript Aliya co-wrote, which was discussed often in interviews, was produced during her rotation in a biology-oriented lab. In fact, Aliya expressed interest in spending three months in this lab to learn more about the biology and the lab, serendipitously, was looking for a student or collaborator with a computational background to help analyze their data. Aliya spoke at length about her experiences contributing to this manuscript and what the process entailed. A second writing experience that she discussed

at length was situated in the computational biology lab where Aliya chose to carry out her doctoral research. She contributed to the writing, editing, and submission of a manuscript to a high-impact journal. This manuscript emerged from research carried out by an interdisciplinary team of life scientists whose specializations come from fairly different spheres of life sciences research. Much like Aliya's research interests, this team included members from computational biology, cancer research, and developmental biology.

Aster

At the time of writing, Aster was the only participant to have completed his doctorate in evolutionary and developmental biology. Aster, like Aliya, was recruited during the second round of recruitment after seeing a participation request over a graduate student listserv. Aster informed me that he was doing post-doctoral research at another institution and was eager to discuss his experiences with writing during the doctorate.

Aster's research background prior to the doctorate was in evolution and biology, specifically evolutionary and developmental genetics. His doctoral research, generally, explored how genes turn into observable anatomy. Because of this, much of Aster's work was done in fossil labs specializing in evolutionary biology. In interviews, Aster mentioned several disciplines related to his research: evolutionary biology, developmental biology, embryology, systems biology, and palaeontology. Despite the range of disciplines implicated in Aster's research, he seemed at times uncomfortable with his work being labelled interdisciplinary, saying one point that, "part of me hates the term interdisciplinary because it's not, we're all talking about developmental biology" (As_INT2). Other times, however, Aster discussed the tensions that he experienced because of shifting expectations about the implications his of work,

Aster spent seven years completing his doctorate and talked about writing as a significant hurdle to graduating. Throughout interviews, Aster spoke about writing as a difficult, but very important, part of the doctorate and expressed disillusionment with how writing was approached in science, as well as his own experiences and frustrations. Possibly because it was still a fairly recent experience, Aster often spoke about his experiences writing the dissertation during interviews. Aster, as is increasingly common in the sciences, produced a dissertation by manuscript. Aster's dissertation consisted of five chapters that should be publishable, not necessarily published, papers. Aster's first attempt to pass the dissertation in 2017 was unsuccessful. I point this out to provide context for Aster's complicated relationship to writing. Within the dissertation, there was a particular chapter that Aster felt contributed the most to how he "learned how to write" (Aster, personal communication, 2018). This chapter was a literature review manuscript that Aster often called "the vignette." We spoke a great deal about the evolution of this chapter, from earlier attempts using the metaphor of vignettes (which was rejected by many of his readers), to a version included in his first version of the dissertation, to the final manuscript he sent for publication.

Diana

Diana is a doctoral student in a biophysics program. Diana was recruited during the first round of recruitment, when I emailed potential participants directly using their publicly available university emails. When I first met Diana in March 2018, she was finishing her second semester of her first year of the Ph.D. At our last meeting, in January 2019, Diana was halfway through her second year and, she hoped, halfway through her doctorate. Diana agreed to participate in observations, but because of the proprietary research being conducted by Diana's supervisor and colleagues, I was hesitant to ask to observe meetings. However, I do not feel that my decision

against observing Diana at work was detrimental. Diana's interviews provided rich context and

insights into her work, as did her notes and comments on the interview transcripts she reviewed.

Several times, Diana responded to notes or questions I included in the transcripts and gently

clarified points that I had misheard or misunderstood. While I wasn't able to sit in on lab

meetings, as will be clear from Diana's interviews, she was very careful and thoughtful in

describing her day-to-day as a biophysics student. Diana also provided document-cycled drafts

of a grant application she submitted, and was successful in earning, to a federal granting agency

(see Table 1).

The biophysics doctoral program in which Diana is enrolled is the same program that the

two other biophysicists, Stefan and Victor, are a part of. This is an interdisciplinary program

housed in the physics department of the university's science faculty. Students entering into the

program are expected to come from physics or biology and the program is designed to include

interdisciplinary course work. Students must enrol in physics courses, but they are also

encouraged to take courses in chemistry, biology, physiology, engineering, and computer

science. At the doctoral level, students are only expected to take two courses and at the end of

their first year must write the department's comprehensive exam. This is a two-day exam that

students must pass to continue in the program. Subsequent to passing the comprehensive exam

(which Diana, Stefan, and Victor did), the only official document they must produce is the

dissertation. Since biophysics is an interdisciplinary program, it is not uncommon to find

students being co-supervised by a biology faculty member and a member of the biophysics

program. Although none of the participants in this study were co-supervised, there were students

in their labs who were, and there were also students from the rotation program periodically in the

labs. I mention this because, although the biophysicists sometimes questioned how

interdisciplinary the program was, its description in the university course calendar, as well as the clear cross-disciplinary collaboration, speaks to the interdisciplinary community in biophysics.

Diana's doctoral research uses physics as a way to understand the mechanics of cells. Using novel imaging techniques, Diana's research explores cellular structures. Some of the implications of this work are related to cancer research, so Diana's lab has some collaboration with cancer institutes.

Diana discussed several different encounters with writing during interviews. These included her experiences writing proposals to federal and provincial scholarship programs, writing conference presentations, and her experiences with publishing. As a fairly new doctoral student, Diana's experiences with publishing were limited to a paper she co-authored with another doctoral student, their supervisor, and a group of collaborators outside of biophysics. By her own admission, Diana's experience with the publication was largely restricted to editing, although she did help write a section of the paper that resonated with her research questions. Diana spoke to more extent about the conference papers and poster she created and presented and the funding proposals. Diana discussed her experiences at two conferences: an imaging conference where she presented a poster and a medical biology conference where she wrote and presented part of a conference talk and where she presented a poster. Finally, Diana discussed her (successful) experiences crafting proposals for federal and provincial agencies that support doctoral student research.

Stefan

Stefan is a doctoral student in a biophysics program. Stefan offered to participate during the first round of recruitment, in March 2018. While he seemed enthusiastic to participate in the study, he requested that we delay our first meeting as he was writing a manuscript with his

supervisor and hoped this experience would give him more examples to share. Our first interview was conducted in June 2018, at which point he was finishing his first year in the biophysics program. I also had the opportunity to observe Stefan at two lab meetings: one where he gave a presentation about his research, and one journal club meeting where a student presented an article and the lab group discussed the science behind it. Stefan also sent me samples of his writing, which included a journal article he co-authored with his advisor and a colleague, and a grant that he submitted to a physics research-funding agency (see Table 1).

Stefan's background is in physics. He obtained an undergraduate degree in applied physics at a European institution (English is not his first language), but he switched to a more research-oriented degree in theoretical particle physics for his master's. Stefan's doctoral research explores the relationship between machine learning and biology and draws on machine learning, computer science, physics, and quantitative biology. During our interviews, Stefan discussed some of his encounters with writing in some detail. One such encounter was Stefan's experience writing a manuscript for publication with his supervisor. Although Stefan was supposed to take a lead role in writing the manuscript, his supervisor ended up writing a large portion of the paper himself, and Stefan worked more on editing and the section "supplementary materials" (a section with more details on methods, programs, controls, and extra experiments not in the main paper). As Stefan said:

> I thought initially, when you emailed me, I thought oh this is a great time if we wait a little bit because I am going to write part of the manuscript, and that was the initial idea of the prof, too. But then one Monday afternoon, no, no, one Monday evening I received a message like, oh I turned my notes into a whole paper, I started writing at 3:00 and I'm done at 10:00, look here it is! I was like, oh. [….] That's pretty, that's some hard work.

And he definitely has this teaching aspect in mind that it is good for us students to learn

how to write stuff. (S_INT1)

Despite Stefan not having as large of a role in the paper as he had imagined, the paper went

through a critical peer-review process that generated a great deal of discussion about writing in

an interdisciplinary program. Stefan also discussed his encounters writing grant proposals to

funding agencies, particularly to a provincial funding body.

Victor

The final participant is Victor, a first-year doctoral student in a biophysics program.

Victor was the last participant to join the study and heard about the project from a colleague

(Stefan). Victor contacted me and expressed an interest in this study. Since Victor entered the

program in the winter semester, he was just starting his second year at the time of our final

interview.

Victor's research aims to, in his words, apply physics to biological problems and

hopefully make "life simpler for biologists" (V_INT1). Victor's research aims to reduce large

biological models, which Victor as a physicist characterizes as being often too large and

complicated to communicate results. In other words, Victor's research aims to reduce models to

find basic physical principles responsible for biological principles. In doing so, Victor does a

great deal of coding to develop and test physics algorithms. Victor also said that while his work

was interdisciplinary and did have implications for medical, biological, neuroscience fields, he

felt most aligned with the physics research community.

At the time of our meeting, Victor had successfully passed the required physics

comprehensive exam. Victor talked about his experiences writing a manuscript with his

colleague and supervisor for a biophysics journal, and he also discussed his experiences writing

federal and provincial funding grants. Much of our discussions, however, were about Victor's experiences writing conference papers and posters, and creating presentations to share in biology labs.

Chapter Summary

This chapter has served as an illustration of how I approached this research, from the set of beliefs underlying my methods, to what methods I used, to how they were used. Because my research questions aim to explore the assumptions about writing in interdisciplinary life sciences doctoral programs, and the implications of these assumptions for how doctoral writers experience writing and for how the negotiate identity, I approached the study design using rhetorical genre theory and narrative inquiry. These approaches enabled me to explore my questions from a perspective that understands research itself as situated and dialogic (Josselson, 2007; Mishler, 1991). Insights were generated largely through the process of writing as inquiry (Richardson, 1994; St.Pierre, 1997) and the iterative process of data generation was crucial to maintaining trustworthiness and reflexivity. The chapter also introduced the five participants whose experiences serve as data in this study.

In writing through the data, I generated three story lines that speak powerfully to the nature of writing in interdisciplinary life sciences, how students experience writing in these programs, and the implications for their identities. I explore these story lines in more detail in the following chapters: Translating and transformation (chapter 4), knowledge in interdisciplinary programs (chapter 5), and identity negotiation and tension (chapter 6).

Table 1. *Participant Data.*

Participant (Data Tag)	Date, Interview Number (Duration Minutes:Seconds)	Observations/Field Notes	Writing Samples (When Collected)
Aliya (Al)	May 2018, INT1 (54:18) July 2018, INT2 (58:07) February 2019, INT3 (65:37)	No (Declined)/ 4 Handwritten pages during interviews	**Evolution of Manuscript** (After INT2) • Early manuscript outline (with supervisor comments) • Manuscript draft 2 (with edits) • Manuscript draft 3 (with comments and software tutorial) • Notebook pages, 6 total ("planning/ 'talking to myself' writing through ideas, challenges, next steps, etc related to this paper" [Al_Samples])
Aster (As)	July 2018, INT1 (58:01) October 2018, INT2 (70:40) March 2019, INT3 (67:38)	No (N/A)/ 5 Handwritten pages during interviews	**Evolution of Manuscript (Dissertation Chapter)** (After INT1) • Initial review article • Manuscript in preparation for high impact journal • Chapter rewrite after first attempt to pass dissertation (with own comments) • Second dissertation version • Submitted manuscript
Diana (D)	April 2018, INT1 (58:22) July 2018, INT2 (65:04) January 2019, INT3 (62:00)	No (Proprietary Research)/ 4 Handwritten pages during interviews	**Evolution of Grant Proposal** (After INT1) • 5 drafts of proposal to federal agency • Draft 2 with supervisor comments • Final submission
Stefan (S)	June 2018, INT1 (76:08) October 2018, INT2 (68:59) January 2019, INT3 (68:57)	Yes, one lab presentation, one journal club (both in November 2018)/ 10 Handwritten pages at observations, 3 during interviews	**Miscellaneous Samples** (After INT1) • Proposal for grant (2 drafts, plus final submission and two rounds of supervisor comments, one of peer comments) • Proposal for entry into doctoral studies (with peer comments)
Victor (V)	July 2018, INT1 (56:26) October 2018, INT2 (61:03) February 2019, INT3 (63:39)	No (not present at meetings I attended)/ 4 Handwritten pages during interviews	**Miscellaneous Samples** (After INT1) • Conference poster (award winning) • Manuscript (contributed with supervisor and colleague • Supplementary information (wrote with colleague)

Chapter 4: Meta-Genres, and Meta-Talk, in Interdisciplinary Life Sciences Doctoral

Programs

This chapter explores the assumptions that shape writing beliefs and practices in interdisciplinary doctoral life science programs. My overarching aim is to understand the implications of meta-genres for interdisciplinary doctoral writing, research and identity. To aid in this endeavour, this chapter begins by tracing meta-genres and meta-talk about interdisciplinary writing. I begin with a brief conceptual reminder about meta-genre and outline how I traced meta-genre and meta-genre talk in data. I go on to trace assumptions about writing through institutional texts like dissertation policy documents before illustrating how doctoral students talk about interdisciplinary writing. The chapter ends by discussing the conflicting nature of meta-talk in interdisciplinary doctoral life sciences and suggests possible consequences emerging from this talk.

The findings and insights generated and discussed below also serve as a foundation for the analysis found in Chapters 5 and 6. That is, to understand the implications of meta-genre and meta-talk for interdisciplinary doctoral students' writing, research, and identities, I must first illustrate the assumptions regulating writing in interdisciplinary life sciences doctoral programs. Before discussing the meta-genres I located, I emphasize here that my analysis is not an attempt to analyze individual genres; that is, I do not engage in any close analysis of genre structures or features (e.g., tone, style). Instead, my goal is to trace how interdisciplinary writing practices are understood more broadly and how these practices influence the ways in which writers experience and encounter writing.

Meta-Genre as an Analytical Guide

Before detailing the meta-genres and meta-talk that shape writing assumptions and practices in interdisciplinary doctoral programs, I summarize how I mobilized the concept of *meta-genre*, which I discussed in Chapters 2 and 3. As discourse regulating genres, meta-genres often occur as guidelines or directives that serve as "a kind of pre-emptive feedback…ruling out some kinds of expression, endorsing others" (Giltrow, 2002b, p. 190). For instance, the policies, guidelines, manuals, and regulations about doctoral dissertations construct a particular idea of how a dissertation should be written, how it should be read, and the nature of the writing itself (Starke-Meyerring et al., 2014). These regulations not only direct writers to produce the dissertation in a certain way, they also hint at assumptions about writing and research itself (Giltrow, 2002b).

Conceptualizing meta-genre as atmospheres of talk or writing about genre "helps us [understand] *talk* about writing as part of the *context* of writing" (emphasis added, Giltrow, 2002b, p. 198). Exploring the meta-talk students reproduce and the documented guidelines and policies about writing in doctoral interdisciplinary life sciences provide clues to the rhetorical work meta-genres enable or constrain. Indeed, not only must interdisciplinary doctoral writers figure out how to navigate interdisciplinary genres, they tend to have to do so within meta-genres that potentially "[deny] actual division, even when those divisions – or differences – are what student writers need to know about" (p. 188). By denying division and difference, writers become complicit in the very assumptions that control the kinds of connections, collaborations, and identities they are able to negotiate (Myers, 1990). Thus, by exploring meta-genres and meta-talk, I am also exploring the nature of interdisciplinary doctoral programs themselves.

In tracing meta-genres in interdisciplinary life sciences doctoral programs, many of my insights emerge from meta-talk that was elicited during interviews with participants. Meta-genre, though, is also textual; that is, there are also written guidelines and directives that control how writing happens and how it is understood (e.g., Maurer, 2009; McNely, 2017). In an effort to understand regulatory texts that normalize assumptions and practices about writing, I first explore some examples of institutional meta-genres that regulated participants' experiences with writing (knowingly or not).

Institutional Meta-Genres

While much of the data I discuss in this dissertation will be meta-talk (i.e., talk I elicit about writing and genre from participants), this talk comes from somewhere (Giltrow, 2002b; McNely, 2017). Since I am exploring doctoral writing, institutional discourses and documents are sites of particular interest. Institutional discourses, often concretized textually (Smith, 2005), shape how institutions define writing and how individuals get *caught up* in these discourses (Percy, 2011). I gathered institutional documents (i.e., program requirements, dissertation requirements, comprehension exam requirements) regulating expectations about writing. This analysis enabled me to explore institutional and program-sanctioned expectations and regulations about writing. While I report on the content of these documents, I don't include direct links and I make slight modifications to quotations I include, none of which change the essential meaning and content of the quote. For example, a program policy containing something like "students are encouraged to make their proposal clear and concise" might be modified to "proposals should be clear and concise." Since the directives, guidelines, and policies I analyzed are widely available online, word-for-word extracts could lead to participants' programs and identities being recognized. Using the rhetorical genre analysis framework outlined in Chapter 3, I report on the

writing policies encountered by participants at the institutional, departmental, and program level (i.e., dissertation policies, comprehensive exam policies, and documents detailing program requirements).

Analyzing institutional texts about writing. Searching for texts about doctoral program policies and requirements on departmental and program webpages, I found that writing merited little attention. Most of the participants (four out of five) were enrolled in interdisciplinary programs where degree requirements were mandated at the departmental level. That is, although participants may have been enrolled in a biophysics doctoral program, the degree requirements were controlled by the physics department. The rotation program had its own requirements, which I describe in more detail below. Each departmental webpage had a list of requirements for students (i.e., coursework, yearly progress reports, graduation requirements), and part of this list often had a subheading for the dissertation.

Physics policies. The physics page informs students that information on the layout and style of the dissertation can be found on the university's Faculty of Graduate Studies page, and goes on to emphasize the importance of being aware of submission dates, deadlines and fees. In the three-sentence statement, one sentence (around a third of the statement) refers students to university policies on the dissertation, two-thirds warn students of deadlines and fees.

Biology policies. There are very few references to writing on the biology program page apart from a small section about dissertation requirements. Again, students are directed to the university policy, located on the university's Faculty of Graduate Studies webpage, for detailed information about the dissertation. The biology page informs students that the dissertation is a part of a doctoral research degree. The content of the dissertation, therefore, must be specialized and exemplify independent and original research. This information is delivered in three

sentences: one refers students to university policy, one emphasizes the importance of the dissertation being an original contribution, and one informs students of the importance of research to their degree. Unlike the physics program, the biology doctoral program has a secondary writing component built into the program: a comprehensive exam.

In the requirements for this exam, students are asked to produce a 10-page dissertation proposal in advance of an oral presentation and examination. Of the 1530 words in a document stipulating the regulations and guidelines for the comprehensive exam, 297 words are spent outlining the expectations for the written proposal. The expectations detail a timeline for providing examiners with their proposal, what the proposal should contain (i.e., relevant background information, research questions and their significance, methods, results, and the students' timeline), as well as information about the length of the proposal (10 pages). With information about the length of the proposal is a warning that the examining committee is under no obligation to read over the 10-page limit. Finally, the comprehensive exam document informs students of the proposal's two purposes: first, to define the research area of the dissertation and second, as an evaluative component of the comprehensive exam. The last sentence of this document points students to a document on the Biology Graduate Students' Society website for tips and advice on the comprehensive exam. Writing appears again in the comprehensive exam document under a heading called, "In the Event of Failure," where the written proposal and oral defense are identified as likely reasons for failure. In the event students do fail the comprehensive exam, they are asked to repeat the oral exam and at least one other component of the written portion. If students demonstrate "weakness in limited areas," the examining committee can request an essay on this area or a revised dissertation proposal.

Since the comprehensive exam requirements make explicit reference to a document containing tips and advice, I reviewed this document as well. Although this is not a policy text like the comprehensive exam regulations, this is a meta-genre that helps create a specific "atmosphere" of writing (Giltrow, 2002b, p. 195) because it was created by faculty to directly respond to and enforce guidelines set in place by departmental policies. These proscriptive guidelines from disciplinary experts (i.e., faculty) make the tips and advice document a rich site for locating dominant expectations about writing. The advice document starts by informing students that their dissertation will be "the largest, most independent research project they ever undertake" and part of this includes the "communication of results." The advice document is 1516 words long and about a third of the document is given to advice about the proposal (529 words), more than any other section of the document. The section starts by reminding students of the length and content already documented in the official regulations. It goes on to advise students to approach writing the proposal as though it were a grant proposal and encourages students to use subheadings and "*clear* writing to help the reader." The document then presents a list of what the proposal should contain. This advice states that the proposal should be "top-quality," go through multiple phases of drafting and revision, and end up as a "finely honed document that shows *clarity* of thought by using *concise* and *exact* statements." It advises students to make sure they have "*precise* statements," "*detailed* descriptions," "*clear* explanations of the approach used," and have "provided *detailed* descriptions of novel techniques." I italicized particular words and phrases in these excerpts because they will reappear later in students' own talk about writing.

Rotation program policies. On the rotation program's main degree requirement page, students are informed that the comprehensive exam has a written component (i.e., the

dissertation proposal), as well as an oral presentation and exam. The program also has a policy page outlining the required components of the comprehensive exam. Most of this page is taken up by the timeline and milestones students are expected to achieve (e.g., when students should schedule the exam, when to submit their proposal), but it also informs students of the objectives of the exam. The exam is meant to evaluate the depth of students' research projects and the breadth of knowledge they demonstrate in designing their dissertation. The detailed instructions inform students that the proposal must include "*specific* objectives," a review of the literature, new findings and how these findings will advance science and health, a detailed timeline for the remainder of the dissertation, and preliminary findings and results to support the proposed dissertation.

Like the other departments, under a heading about the dissertation, students are informed that this document should "demonstrate a mastery of research and be an original contribution to knowledge." However, students are directed to the university's Faculty of Graduate Studies page for details on the dissertation.

Institutional policy on the dissertation. The policy on doctoral dissertations to which every program directs students is housed within the Faculty of Graduate Studies. I outline how this policy discusses writing because of its institutional power: it is *the* document to which all dissertations must adhere, no matter in which department the dissertation is being written. As Starke-Meyerring and her colleagues (2014) argued in their exploration of institutional discourses about dissertation writing, these kinds of institutional texts often serve to reinforce common sense assumptions about writing (cf. Rose, 1985). The dissertation policy and guide that students were directed towards does much the same thing.

The policy begins with a disclaimer that individual programs and departments are encouraged to provide detailed expectations for the dissertation. The requirements inform students that their dissertation must "constitute original scholarship," "demonstrate an ability to plan and carry out research", "organize results", "defend the approach and conclusions in a scholarly manner," "meet disciplinary standards and clearly demonstrate how knowledge is advanced," and finally be "written in compliance with norms of scholarly and academic expression." In an accompanying page detailing how dissertations should be prepared, students are given a list of components that must appear in the dissertation. These include an introduction that "clearly states the research rationale and objective," a "comprehensive" review of literature and a "comprehensive" discussion of research findings.

Outcomes of policy analysis. My analysis of institutional and departmental documents suggests several meaningful insights into how writing is understood institutionally and departmentally. First, the amount of language in the documents that I analyzed indicates that writing is not seen as a major component of the doctoral degree institutionally, despite it being the medium through which progress is communicated and assessed. That is, institutionally what counts as writing are comprehensive exams and the dissertation – both of which tend to be relegated to a few sentences at the end of a larger document. Second, my analysis suggests that in these interdisciplinary programs the only institutionally recognized kind of writing doctoral students are expected to produce is the dissertation and, in some cases, a dissertation proposal. Third, these policies indicate that writing in interdisciplinary programs is *the same thing*: every department directs students towards a single university policy about the dissertation. This policy, as I wrote, applies to doctoral students across the university, no matter if they are producing a dissertation in an education program or in biophysics program. Finally, I want to draw attention

to the language in these documents. According to writing policies, writing should be "clear," "concise," "comprehensive," "specific," and "exact." While these clear writing policies are not new (e.g., Kamler & Thomson, 2014; Starke-Meyerring et al., 2014), they have the potential to present added demands for interdisciplinary students grappling with several different disciplinary assumptions about what specific and exact writing looks like. The control that institutional meta-genres exert over how writing is perceived, practiced, and mentored has significant implications for doctoral writers who are expected to work across disciplinary boundaries, but within expectations that writing should be fairly stable so long as they stay within sciences. To better understand how institutional meta-genres regulate and regularize interdisciplinary doctoral students' assumptions about writing, I explore and discuss the ways in which participants *talked* about writing, and the kinds of explicit and implicit ideas that emerged about writing.

Locating Meta-Talk

Having analyzed textual policies and guidelines about writing in interdisciplinary programs, I turned to exploring *meta-talk*; that is, talk about genre. Eliciting meta-talk from participants was a way to better understand how interdisciplinary doctoral students perceived and experienced writing. By locating meta-talk in interview data, I traced both how students talked about writing (i.e., explicit meta-talk) and how students talked about their research: what they did, how they did it, and why (i.e., rhetorical talk). I do this because writing is often assumed to be little more than organization, grammar, spelling, and syntax (Berlin, 1984; Nystrand, Geene, & Wiemelt, 1993) and fails to account for writing as a deeply social and situated practice. Thus, by highlighting where participants talk about what they *do* I'm able to see participants actually go about navigating the writing practices and beliefs of multiple disciplines. To begin this analysis, I first highlight participants' *explicit* meta-talk before going on to trace what I

characterize as *indirect* meta-talk. I characterize explicit meta-talk as instances when participants speak about writing overtly, often using language that can be found in dominant meta-genres regulating writing at the doctoral level (e.g., describing writing as being *clear* or *concise*, echoing language concretized in institutional policies). Indirect meta-talk, however, is talk about writing produced in response to questions about writers' research activities or probing questions meant to elicit implicit rhetorical knowledge (e.g., talk about writing as epistemic, making logical leaps and justifying them in the writing process).

       Tracing meta-talk about interdisciplinary writing. To begin locating meta-talk, I traced how participants talked explicitly about the kinds of writing they encountered and how they learned the conventions of how to produce this writing in an interdisciplinary program. Often, my questions were met with responses that suggested a very particular understanding of interdisciplinary writing, one that viewed writing across disciplines as a matter of *explaining, translating, clarifying, simplifying,* and *specifying*. Below, I outline how students used these processes to talk about interdisciplinary writing and what this meta-talk suggests about how interdisciplinary writing is understood.

       When participants discussed their experiences with interdisciplinary writing, they often talked about having to *explain* their research to members of other disciplines. Aliya, for example, spoke about her experience contributing to a biology manuscript during one of her rotations. The biologists wanted to apply computational methods to their data and asked Aliya to contribute to the manuscript since she is familiar with computational analysis. When discussing this experience, Aliya mentioned that it was very collaborative, with the biologists "**explaining** biology things to me and me trying to **explain** statistics to [them]" (emphasis added, Al_INT1). Aliya, in this example, is characterizing interdisciplinary communication more generally. While

she is talking about explaining in discussion with biologists, the strategy of explaining bleeds into how Aliya talks about interdisciplinary writing specifically. Often, Aliya uses the process of explaining to characterize what she did when she was writing with biologists. In fact, when Aliya and other participants talked about their encounters with interdisciplinary writing, they often talked about the importance of explaining their research clearly and simply (see Table 2). In the following table, I have collected instances of participants' using the process of explaining to describe how they approached interdisciplinary writing. When referencing data from this table in the dissertation, I use column and row numbers to indicate particular excerpts. For instance, to refer to Aliya's excerpt about explaining in "two directions," I'll use the notation Table 2 C1R1 to indicate the excerpt is located in Table 2, in column one, in row one. Also note that all bolded text in Table 2 was added for emphasis.

Table 2. *Meta-Talk about "explaining" in interdisciplinary life sciences writing.*

	Aliya (C1)	Aster (C2)	Diana (C3)	Stefan (C4)	Victor (C5)
R1	I think when we're **explaining**- I think there are kind of two directions. One big direction that's been important and more close to us is **explaining** the computational analysis we do to the biologists. And I think that just comes with understanding, what's the key information and trying to figure out clear ways of **explaining** it and analogies and so on. (Al_INT3)	I guess, there are certain things I would **explain** more or less. […] It's like what do you say, who do you think you're trying to **explain** this to. And I guess for the more interdisciplinary or a broader audience, you just kind of- the thing you're telling is robust against those ignorances […] or narrow your journal and **explain** things a different way. [….] And I think at that point it's just a function of **explanation**. (As_INT1)	In a *presentation* on the other hand, or a poster presentation, something a lot more informal where you're just trying to **explain** the gist of the research to someone, depending on the audience I'll either **explain** the math as intuitively as I can, or maybe just skip over it all together and just show, here are the results. (D_INT2)	In the previous project we did **explain** it to biologists and it was a big a algorithm to do something complicated and it would be quite hard to first understand and get why it is important to do so and we didn't want to **explain** all of that to the biologist who'd be quickly lost, not because he's dumb but because it's not his type of thinking and he wouldn't see the point of why we're doing all this. (S_INT1)	As a scientist, I really want to **explain** things well, in the clearest way possible and… I think through good figures, clear figures you can actually manage to **explain** something that could be very complicated, very abstract, perhaps for biologists or computer scientists. [….] things need to be tidy and clean and well **explained**, well built, I dunno. (V_INT2)
R2	I think a lot of the, not disagreements, but the parts where it really needed a lot of changes in terms of the writing were A) **explaining** things clearly which I think I was learning how to do and was very close to the research. (Al_INT1)	Just exposition and developing, how do I explain this? And what am I not **explaining**? I'd look at something and […] didn't know what to do to make it better (As_INT1)	If you're talking to a biologist, half the time you don't even need to show any equations, you just need to **explain** this is what the general trend is. (D_INT3)	The reviewers, the committee, may not necessarily understand the things you talk about but if you're able to **explain** it reasonably well and at least make it seem like you have an idea of what's going on, it is much better. (S_INT2)	They can understand what you're saying if you **explain** well, but you can't- they don't know the jargon that is specific for whatever you're working on, or you have to describe. I couldn't just write [X] without describing it first. (V_INT1)
R3	I think it goes back to the idea	I do have a lot of	I can't think of a polite	This specific paper	[I]f you can **explain** it

	of having to figure out how to **explain** the analyses and doing it in a way that's, *accessible* to them so that they also understand A) what's being done to their data but also can point out if there's something that, in a biologically motivated way doesn't make sense? (Al_INT1)	problems with grappling with those implicit expectations. I have a very- I *don't* have a very good way, or at least the way people get expectations and get that implicit, oh, this is what I'm supposed to **explain** my things against, is something I've had a really hard time with. (As_INT3)	term, but how some scientists might look down upon using too many metaphors, but the truth of the matter is, when you're trying to **explain** it to an audience that knows nothing about it, the fastest way to get your point across is to compare it something they *do* know. (D_INT3)	wasn't as difficult to write it was mainly just following the figures- we just had to **explain** the figures and that was the result. (S_INT1)	well, then it's a good idea. (V_INT2)
R4	I really worked on the text that they had so it wasn't a totally unrecognizable thing, but there were ways of **explaining** things that I modified [….] I don't know if that's not like, this field likes to do this and my field likes to do that. Maybe it's just not fully understanding what the algorithm is doing or what the conclusions are. But those are the kinds of changes I had to make. Things that I thought were obvious to me I really had to **explain** to my collaborators while writing with them. (Al_INT2)	I guess I naively thought that science was about **explaining** reality. (As_INT2)		So that's perhaps it was too technical for them, partly because we would have had to do a better **explanation** both in the written part as in the figures. Like in the figures really focus on the main message. Yeah, that was the main point. There were other points they found that, them being [medical biologists] they knew about the [medical biology] models. (S_INT2)	I think by **explaining** it that way and saying it's only for modelling purposes or describing purposes to understand the system, people get it. They understand we're not claiming biology is wrong and this stuff doesn't exist, that's not true. So, no it's okay. Once we **explain** it, usually people get it. (V_INT3)

In these examples, note how participants draw on the process of explanation to describe writing in an interdisciplinary program. Participants talk about "explaining things clearly" (Table 1 C1R2), trying to "explain the gist of the research" (Table1 C3R1), having to "explain…something quite complicated…to a biologist who would be quickly lost" (Table 1 C4R1) they are describing how they would take a complex and situated approach or idea and make it accessible to other fields. Furthermore, the process of explanation is often discussed as being simple. Stefan, for instance, spoke about writing a section of a manuscript with his supervisor as not being "as difficult to write… we just had to explain the figures and that was the result" (Table 1 C4R3). Victor spoke about using and explaining figures to make a complicated and abstract idea easy to understand (Table 1 C5R1). When Aster talked about how he approached writing in an interdisciplinary program, he spoke about addressing different ways of understanding biology as "just a function of explanation" (Table 1 C2R1). That is, to ensure his work could be understood across disciplinary lines, all Aster had to do was explain his research carefully. The process of explanation is largely discussed as being a straightforward process; for instance, Aliya and Diana suggest that the process of explanation is the easiest way to make research accessible to many fields (Table 1 C1R3, C3R3). Of course, there are excerpts that suggest that explaining concepts across disciplines is not a simple process. When Aster, for instance, talked about writing his dissertation, he talked about struggling to explain his ideas and asking himself, "how do I explain this? And what am I not explaining?" (Table 1 C2R2). Aster also spoke about how he "naively thought that science was about explaining reality" (Table 1 C2R4). Notable about this excerpt is Aster's discovery that perhaps approaching science writing as explaining was naïve. Although the process of explanation is often used to describe what

interdisciplinary does, the process of explanation often fails to adequately account for the complex work doctoral writers are engaged in, as I discuss in more detail below.

Explanation, though, is only one way that participants talked about writing. Another process that students often used to describe interdisciplinary writing was *translation*. Aliya often discussed interdisciplinary writing as translating, although Aster also talked about interdisciplinary writing using this process (see Table 3). The following table contains examples of participants characterizing interdisciplinary writing as a process of translation. As with Table 2, I use the table, column, and row numbers to point to examples references in the analysis. In this case, to refer to Aliya's excerpt about the lack of overlapping vocabularies in biology and computational biology, in use the notation Table 3 C1R1. As in Table 2, all bolded words have been added to emphasize where and how participants talk about translation.

Table 3. *Meta-Talk about "translating" in interdisciplinary life sciences writing.*

	Aliya (C1)	Aster (C2)
R1	The big challenge for me is I'm finding myself doing a lot of learning, but also trying to **translate** all these ideas that I know are, like we were talking about earlier about having to… there's like two entirely not necessarily overlapping vocabularies in these two areas so, it's been a lot of practice in learning how to communicate things I know and have used in my analysis in ways they will understand and also trying to incorporate the fact that they have a ton of biological knowledge that I am not coming in with. (Al_INT1)	Mostly because I was in speech and debate, I was always able to talk about the stuff I do very well, so this frustration of the inability to **translate** that to effective writing is something that really, really troubled me. (As_INT1)
R2	Okay, I think I'm using [the word '**translate**'] in two ways. I think what I am finding myself doing a lot in this lab is having to apply quantitative methods, where I wanna explain to them what I'm doing, but I also, it probably took me a couple years of math classes to understand what this is and so I think when I **translate** in that sense I mean thinking out a way to explain what the analysis is… in an intuitive and accessible way given that they may not have the same math or computer science background. (Al_INT1)	I never really believed math was… I guess I always thought that thought that there was a separation was BS. This math stands for something and you should be able to **translate** it. [….] And not only that, if it's useless, that act of **translating** shouldn't provide any additional insight than just gazing upon the equations. The fact that it does help you I think speaks to the fact that this effort of **translating** what's going on in the math to the real world, and that same language we use to communicate science, like biology science, aids in our ability to more deeply and tease apart, what is this math doing? (As_INT3)
R3	And there's a lot of new technology that's coming out right now […] that offer a lot of different ways of looking at biological data and so, I think for me my interest is in using my computational background to figure out if there are methods from that field that we could **translate** and could be useful to help us answer our question on the cancer side. (Al_INT1)	I think the barriers [to good writing] are kind of like when you read a developmental biology paper and, I mean some of them are really good, other ones are just crap. So especially if you read the crap ones, you're like this is impenetrable and of course you need some sort of **translation**. (As_INT3)
R4	I think there is a lot of trying to **translate** across disciplines and communicate our computational strategies and why they're legit to the oncologist who's gonna use this to design a mouse model or whatever. (Al_INT3)	I guess, if you're talking about- if you're trying to communicate this paper to someone else or something else, it's about- **translation's** just that communication. I want to say, colloquially it might be dumbing down? But I would also say it's cutting out the crap. (As_INT3)
R5	So within the team, it's mostly in the other direction of **translating** the computational stuff. (Al_INT3)	
R6	I don't know if I envision myself developing these tools necessarily, but being able to understand them well enough to apply them correctly or possibly **translating** new tools from computer science literature to be able to use them in life sciences. (Al_INT1)	

First, notice how Aliya spoke about interdisciplinary writing as translating. Aliya described interdisciplinary writing as involving some degree of translation often when discussing the manuscript she co-wrote during her rotation in a biology lab. In re-writing the biologists' discussion of the computational analytical approach, Aliya talked about having to *translate* computational biology into vocabulary biologists could understand. Translating her computational biology was Aliya's way of re-writing ideas to make them "intuitive" and "accessible" to people who don't share her background in computational approaches and statistics (Table 3 C1R2). Aster, too, used the notion of translation to describe making disciplinary concepts accessible to members of different fields. He talked about translation as a way of "dumbing things down" and ensuring good, clear writing by "cutting out the crap" (Table 3 C2R4). Indeed, Aster said that disciplinary jargon was often a barrier to interdisciplinary communication and translating this jargon not only made claims more accessible, it also cut out what Aster described as superfluous descriptions of disciplinary concepts (Table 3 C2R2). Like the process of explanation, participants use translation to describe how they simplify ideas so that they may be understood across disciplines. Aliya and Aster both talked about taking something complex and discipline-specific, like a computational method or mathematical model, and translating it into language that let them communicate what the method (Table 3 C1R2, C1R6) or the math (Table 3 C2R2) was doing. As with the process of *explanation*, Aliya and Aster spoke about translation as though they were taking concepts or approaches from one discipline and downloading them into another. That translation actually is a matter of transferring a concept from disciplinary language into another (or from disciplinary language to clear language) is debatable. Were it that simple, Aster would not have experienced the same degree of frustration with an "inability" to translate his knowledge into writing (Table 3 C2R1). Aliya,

too, characterized translation as important to communicating why and how her computational

approaches worked to members of other disciplines (Table 3 C1R4). Keeping her work *legit* to

scientists outside of computational biology suggests that what participants call translation

involves more than transferring ideas into clear language – it suggests a much more complex and

epistemically involved process is at work (Myers, 1985).

    Before expanding on what participants' direct meta-talk suggests about how writing is

understood in interdisciplinary programs, I want to illustrate some of the other processes that

commonly occurred in participants' explicit meta-talk about interdisciplinary writing. These

examples all illustrate how, for participants, interdisciplinary writing must be easy to read,

worded carefully and free of jargon, and precise and specific (see Table 4). Table 4 collects more

examples of explicit meta-talk about writing from participant interviews. Like the previous two

data tables, the examples included below illustrate how participants' talk about interdisciplinary

writing characterizes it as *clear*, *precise*, *careful*, and *simple.* Again, when referring to excerpts

included in this table, I specify the table, column, and row number to point to specific interview

extracts. For instance, to refer to Aster's comment about his writing having to be efficient and

clear, I indicate that the comment is in Table 4, Column 1, Row 1 using the following: Table 4

C1R1. Once again, all bold emphases were added to foreground how participants described

interdisciplinary writing.

Table 4. *Meta-Talk about "clear", "precise", "careful", "simple" interdisciplinary writing.*

	Aster (C1)	Diana (C2)	Stefan (C3)	Victor (C4)
R1	If it [Aster's writing] were efficient and **clear**, then it'd be easy to read. But since it's not done it's *not* easy to read. (As_INT1)	What does really come into play is, you have to word your- you have to word what you're writing very **carefully**. One of the first applications I wrote was for physics funding and I sent it to my prof to edit it and she sent it back changed- like, I had written it as if I was writing to a biology person so she sent it back changing… *so* many of the words I chose just so it sounds more physics than bio. (D_INT1)	But then we've pointed this out more **clearly** in the introduction and we've been very, we've now structured the paper very piece-wise. [….] So we're very **precise** and very **detailed**, but only on the basic stuff. (S_INT3)	We would've done things a bit differently, a bit **simpler**, more easy to use for someone that's not used to MATLAB software's coding in general. But I think that's pretty much it, well, at least that I can think of for this very specific case. (V_INT2)
R2	At the end of the day scientific papers have to be somewhat **simple**. (As_INT1)	It's very important in science writing to be very **precise**, very **honest**, have all the facts presented. (D_INT3)	Be **specific**. Not say vaguely we want to advance our understanding in this topic, but then… say very well then that the way that it'll be advanced and… what specific parts of that topic would be advanced. So make it as **focused** as you can even though it's written for people who are not familiar with the work, or not specialized. I find that the most complicated part. (S_INT1)	The journal was [X]. So it was really what we did! And as I said, they had published others, very similar algorithms in the past and we couldn't understand why we got rejected. Maybe we didn't write our objective **clearly**, how it was useful? (V_INT2)
R3	I just think that a lot of the terms and a lot of the form that people use in science to write to their	We'll give tours to biophysics professors when	One tricky part, in machine learning, they have a very	In my case, in this *very specific* case, my supervisor

	group are little more than just short cuts because they don't really – **they haven't organized these ideas in their own heads terribly well** and they don't understand what is the point of what I'm doing. [….] And I think the difficulty of reading a lot of scientific articles is not jargon or a purposeful or useful inscrutability, **it's just a standard of poor writing and poor mental organization** that people have just accepted. (As_INT2)	they come. And when we give them the tour of the lab, the first thing I'll always ask them is, 'how much do you know about [X]?' If they know a lot about [X] I can jump into all the biology jargon and talk about everything super in-depth. [….] If they know absolutely nothing about [X] then I use very **simplistic** language that I hope they can understand […]. Same goes for when you're trying to write to your audience. (D_INT2)	specific way, in computer science, they have a very specific way of writing papers, which is like short, one result per paper. [….] That sounds normal, but the kind of specific way, also the tables and how your accuracy has improved with given algorithms, these are things you can pick up on and it seems like it would be a bit simpler to write such papers because the structure, the format is **clear**. (S_INT2)	asked me, 'okay. I want one section that describes this. Just write this.' So we did. We didn't really think about a set of rules of where we should lay out things in this way or that way. It was more like, my supervisor asking me about this. Write a section about how to define [X], which is one of the important things about our algorithm. We wanted people to understand it was different from other work and really important, and we had to write it as **clearly** as possible. (V_INT2)
R4	I'd say the best you can hope for is maybe a complete motivated reading [of your work with your supervisor] and so you just end up discussing ideas and not necessarily- you don't have an appreciation for 'oh this is what you tried to say, this is what it seems like you're trying to say, and you're not quite saying that.' Or, 'this point isn't quite clear.' There is an awful lot of reading to try and make what seems to be there **more clear**. (As_INT2)	I didn't realize this while I was writing, that sometimes you can never figure out why it's off so the best you can do is circle it and say this is off and pass it back to the author and hope they can figure out why it's off. I think the thing I look for most is when things don't make sense as opposed to things… For some of the weaker writers in the lab, like the undergrads, I have no problems about 'be more specific here, include more examples here', but I try to be, not to overuse the word specific, but I try to be very	Then knowing the target audience we've had to change many ways of saying things in the paper and we had to make it more consistent because some of the critiques were justified, that we would be using too much jargon. So we removed a whole portion that was kind of jargonic and moved it into the supplement. […] So we agreed and… we had to be very **specific** to the computer scientists on their thinking about inputs and outputs and the interaction between inputs. So, what is	Something complicated and I want to make it **simpler**, and perhaps that's what I do when I try to explain something to someone else. Try to make it as **simple** as possible. (V_INT2)

		specific writing [what I think] (D_INT2)	the input? Make it **clear**, what is the input? (S_INT3)	
R5				The questions that my colleague had when he presented the same work to cancer biologists, it was the same kind of questions where people try to apply to their field, right? To **transpose** it to their field and they had questions and thoughts that we never even had in the first place. (V_INT3)

This talk forms a pattern of how participants explicitly articulate their understandings of interdisciplinary writing. Aster found himself "making things simple" (Table 4 C1R2); Diana discussed having to be "careful," "precise," and "specific" while also ensuring that her writing is "simple" enough for a diverse disciplinary audience (Table 4 C2R1, C2R2, C2R4, C2R3); Stefan talked about having to make sure that his writing is "specific," "precise," and "clear" (Table 4 C3R4, C3R1, C3R3) so that people who were not familiar with his work, or not as familiar with specialized ideas, could understand; and for Victor, making things "simple" and "clear" was very important for him to be able to "*transpose"* his work to other fields (Table 4 C4R4, C2R3, C2R5). Like in earlier examples where students discussed writing as explaining and translating, Table 4 illustrates meta-talk that constructs interdisciplinary writing as fairly simple: so long as students are precise and clear, so long as their explanations translate concepts well, so long as they clearly articulate their ideas, interdisciplinary writing should not be much different from any other kind of writing (cf. Nystrand, Greene, & Wiemelt, 1993; Russell, 2002). This language, in fact, suggests a very specific set of assumptions about what interdisciplinary writing is and does.

What direct meta-talk suggests interdisciplinary writing should be. Direct meta-talk about writing elicited from participants suggests that interdisciplinary writing should be simple – all students have to do is *explain clearly and simply, be specific* and *translate*. The way that participants talk about interdisciplinary writing harkens back to formalist assumptions about clear writing: so long as writing is clear and free of jargon, anyone should be able to understand it (Rose, 1985). This understanding of writing, one that views it as separated from a social situation, audience, and inherited assumptions is *arhetorical.* That is not to say that interdisciplinary writing is arhetorical – as I illustrate below, it isn't – but that the assumptions surrounding writing mean that students *perceive* writing arhetorically.

Participants' direct meta-talk illustrates how dominant, arhetorical ideas about writing are reproduced by interdisciplinary doctoral students. The processes of *explaining* and *translating* are common when participants talk about taking concepts from one field and applying them to another. The practice of interdisciplinary writing, based on meta-talk students produce, involves writing *clearly* so that members of other disciplines can understand unfamiliar concepts. It involves *simplifying* language so that approaches and ideas are not hidden by incomprehensible technical language. Like I discussed above, this meta-talk reinforces assumptions that writing is just a matter of being clear and simple (Berlin, 1984), leading this arhetorical talk to paint the genres interdisciplinary students produce as being uncomplicated. Furthermore, this meta-talk *directly echoes* the language used in departmental, program, and university guidelines about writing at the doctoral level: it should be "clear," "specific," and "precise" (e.g., Table 4 C3R3, C2R4, C2R2). Interestingly, participants seemed to paradoxically embrace these assumptions *and* struggle against them.

Although participants articulated ideas about writing using arhetorical meta-talk, there were also instances where they resisted arhetorical assumptions. In fact, Aliya expressed a desire to talk about writing as more than just an end product:

> I think it's- one of the reasons I wish there was more- or like that's one of the reasons I was really interested when I got your email, is I feel there is not so much talk about what other writing there is than before the manuscript or before even the mini-publications like posters and stuff. And I find I tend to take really copious notes just on a daily basis and I think that helps clarify my thinking, but I don't- I have tried to ask, how do you do this? How do think about your project? What's your process? And people don't give good answers! (*laughs*) (Al_INT2)

Aliya's desire to talk about writing and her inability to get "good answers" points to the possibility of a contradiction within interdisciplinary writing: explicit meta-talk writing makes it seem like it should be a final step in the scientific process. The dominant assumption is that writing should be easy when the research is finished and there is something to write *about* – at this point, all writers should have to do is *translate* or *explain* their findings. Because of such assumptions, Aliya was left to try and find her own resources to navigate writing. Aliya repeated this sentiment at the end of her final interview, when she explained why she was motivated to volunteer as a participant for this study and how she felt she benefitted from talking about her writing:

> I think talking about the writing process and how it relates to research is a bit different than just offering writing courses for example, because I feel like it's not necessarily more practice, I have a lot of opportunities to write and practice my writing and so on. But it's like the meta, you know, the meta-cognitive aspects and how does- what's your process like and what parts do you spend time on and what parts are difficult? So I think that has been super helpful. (Al_INT3)

These passages contrast the predominant way of talking about writing in an interdisciplinary environment as *translating* and *explaining things clearly*. Explicit, arhetorical meta-talk, in fact, limits the kinds of conversations about writing that can happen. If writing across disciplines is just explaining clearly, there should not be a need for *rhetorical* meta-talk – talk that can address the "meta" aspects of interdisciplinary writing.

Aliya is not the only one who encountered the contrast between common arhetorical talk and underlying – and often unspoken – expectations about writing. Aster also discussed sensing a contradiction between explicit assumptions about writing and the experiences he went through

as a doctoral writer. At one point, Aster expressed his disillusionment with writing because, as he said, "I do feel like there should be a consciousness about participating in these discussions and the fact that you are making these types of points, but yeah. I don't know" (As_INT2). Aster *wanted* to have, as Aliya might call them, "meta-cognitive" (Al_INT3) conversations about the writing expected of him, but said repeatedly that he had little to no opportunities to engage in such conversations. In fact, during his final interview, Aster articulated astutely the conversations he felt he missed during the doctorate:

> *Aster:* [Hiring people to read my writing] really helped me- because really my biggest
>
> problem is- a lot of my problem was just exposition and developing, how do I explain
>
> this? And what am I not explaining? I'd look at something and it would be done, but I
>
> didn't know what to do to make it better.
>
> *Researcher*: So would that idea of knowing that the specific point *there*, the specific point
>
> where you would be, meh, was that something that you had a sense of?
>
> *As*: Oh yeah. I mean that was a lot of my frustration. This isn't there, but I don't know
>
> how to make it. (As_INT1)

Aster talked about writing in the above excerpt as being more complex than dominant arhetorical meta-talk can account for. In Aster's experience, understanding what various disciplinary insiders expected of him was not simple. These tiny cracks in the meta-talk surrounding interdisciplinary writing suggests that, far from being simple, clear, and concise, writing in interdisciplinary life sciences programs is *complicated*. When participants described what they actually *did* during their encounters with writing (i.e., how they collaborated, how they constructed particular genres, how they worked with other scientists) quite a different picture of writing started to emerge. When contrasting participants' talk about writing and their meta-talk

about the activities surrounding writing, contradictions began to emerge. Interdisciplinary

writing is at once *simple* within the frame of arhetorical meta-talk, and incredibly *complex*. In the

following paragraphs, I trace the indirect meta-talk participants produced when explaining the

activities surrounding writing and suggest that this talk exists in opposition to assumptions

regulated by arhetorical meta-talk.

Tracing rhetorical talk about writing. As I documented above, participants' direct

meta-talk is consistent with how meta-genres (i.e., policy documents and university sanctioned

guidelines) regulate assumptions about writing. Interdisciplinary writing is assumed to be

arhetorical: simple, clear, and concise. But, participants also described writing as complicated,

made even more so by the lack of meaningful talk about what it means to produce genres in an

interdisciplinary program. As I repeatedly returned to interviews during my analysis, an

interesting trend began to appear: in trying to understand how meta-talk about writing revealed

assumptions surrounding writing in interdisciplinary doctoral programs, I began noticing that

when participants talked about writing arhetorically, they would qualify this talk with stories

about experiences that were certainly *not* arhetorical.

A striking example of this comes from Aliya, who talked about translating as a way of

explaining foreign disciplinary knowledge to interdisciplinary collaborators (Table 2 R1, R2,

R4). In the example below, Aliya is speaking about her experience contributing to a manuscript

written with her doctoral supervisor for a high-impact journal. This manuscript emerged from

research undertaken by an interdisciplinary team of biologists, cancer researchers, developmental

biologists, and computational biologists. Aliya said that during this project translating ideas was

important because, as computational biologists, she and her supervisor needed "to translate

across disciplines and communicate our computational strategies and why they're legit to the

oncologist who's gonna use this" (Al_INT3). When asked how she would actually do that

translating, she said:

> I don't know (*laughs*). I think… I have no idea! I think my [supervisor is] really good at
>
> it. I think she's really good at sitting at the interdisciplinary- and I think she's respected
>
> for it too. [….] I went to a talk by her the other day. She was giving a seminar at another
>
> university on this project so [….] it was really interesting to hear her give it to other
>
> people. I think when we're explaining- I think there are kind of two directions. One big
>
> direction that's been important and more close to us is explaining the computational
>
> analysis we do to the biologists. And I think that just comes with understanding, what's
>
> the key information and trying to figure out clear ways of explaining it and analogies and
>
> so on. So I think that's one way. But the *other* way I didn't think of that much until I was
>
> at this talk last week was explaining to the *non*-cancer people our whole logic for the
>
> model. **She had a one-hour talk and she spent twenty minutes setting up *why* there is**
>
> **a case for a developmental link for these tumours**. And that's actually where I was
>
> learning a lot because after she presented our work, which I know. And so in *that*
>
> direction, **I think it's more about explaining the logic about why we even think this.**
>
> **What is all the evidence over the many years, and there is a lot, that this is even a**
>
> **valid thing to pursue**. Does that make sense? (bold emphasis added, Al_INT3)

Note that while some of this excerpt uses language recorded in Table 2 about explaining

(C1R1), I've bolded segments of meta-talk that suggest what Aliya and her supervisor are doing

is *arguing* computational ways of knowing and doing to a developmental biology audience.

Indeed, Aliya emphasized what she called a second "big direction" of explaining: spending time

carefully setting up the evidence and logic for why her research is valid so that other disciplines

can perceive its value. From a rhetorical genre perspective, this involves more than just explaining things clearly. Students have to know how to orient their work to interdisciplinary groups. As Blakeslee (2001) demonstrated in her investigation of physicists interacting with biology audiences, this orientation and argumentation involves having an understanding of the audience's assumptions and practices. Indeed, Aliya points out that her supervisor spent a quarter of her talk *justifying* the link between their research and the developmental biologists. This signals the necessity of reframing their research into a framework to which the developmental biologists would respond. In reframing the research, Aliya's supervisor was doing more than just explaining by taking out jargon and technical language, she was arguing the research into a different disciplinary lens.

Aliya referred to another example from the same paper about feedback she and her supervisor received from their collaborators on early drafts of the manuscript. When detailing the revision process, Aliya started by characterizing re-writing the paper as an uncomplicated process; all she was doing was explaining the results clearly. Yet, this statement was followed by a lengthy explanation of what the explaining involved. When detailing how the paper was supposed to teach and explain results across disciplines, it became clear that what Aliya was really doing was anything *but* uncomplicated. When speaking about her responsibilities during the process, there was a contrast between how Aliya talked about writing and how she talked about what she actually did when revising the manuscript:

> *Aliya*: I really felt the hardest part was saying how interpreted our results, like pinpointing we saw this in the data and therefore we think this about the tumour and how it originates.

> *Researcher*: Why would that have been the tricky part?

Al: Maybe part of it is because our data, or I guess our logic was, we would study the

normal [X] and try and use different computational strategies to match the tumour to the

normal [X]. So there's no real… I think there was a lot, what is the word I'm looking for?

There's a lot of precise pieces of information and logic to hold in your head and to follow

why the results at the end, this matching, implies that this tumour starts *here*, for

example. It's not quite an experiment where we did an experiment on this cell and

generated a tumour in a mouse, which lots of papers do. So maybe it was, part of it was, I

don't want to say correlational in nature because I don't think that's quite fair, but I think

maybe it just takes some background to interpret the results. So figuring out how to

communicate that to the reader was hard. [….] I guess to go a little bit further, the idea of

the project is we have these different [X] tumours and we think they start in specific cell

types [X] and each tumour type probably starts in a different type of cell and the idea is to

identify those cells. So, yeah, I guess it was making the leap from we say this match of

this tumour type to this type of cell to this implies that this tumour starts in *this* cell type

at *this* age and so on. I don't know if that makes sense, I think that's where I felt… yeah.

(Al_INT3)

Again, Aliya begins her story by reproducing arhetorical meta-talk about writing: it's

harmonizing and explaining the data and theory clearly. But when pressed for more detail, she

tries to explain her way through why the most difficult part was not translating but arguing for a

specific interpretation of results. Instead of talking about translating and explaining things

clearly, Aliya starts referring to the "logic" of how she understands cells. When Aliya discusses

the background knowledge necessary to understanding her results, she speaks about "making the

leap" from one kind of logic to another. In doing so, she is not simply explaining a concept to

another discipline, but *arguing* a particular way of understanding how tumours develop. In other words, Aliya is engaged in a process of arguing her research into a specific kind of logic that may be unfamiliar to developmental biologists or cancer biologists. This links to the previous expert from watching her supervisor's presentation: Aliya's supervisor *did* make that ontological leap to orient herself to a developmental audience. Clearly, this had to happen in the paper as well, yet it was only after probing questions that Aliya started articulating the complex nature of arguing knowledge across disciplines. Note too that even when Aliya did try to explain the process of arguing knowledge into different disciplinary logics, she seemed to struggle. She was unsure if what she was saying made sense and she struggled to find the right words to describe what she was actually *doing*. It appears that dominant and arhetorical meta-generic assumptions blocked, or at least prevented, Aliya from making this ontological shift in her writing.

Similar conflicts emerged in other participants' meta-talk: they seemed to struggle to reconcile dominant assumptions about interdisciplinary writing as translating and explaining with hidden rhetorical demands that arhetorical meta-talk simply cannot account for. Especially notable was how participants seemed to take a great deal of time trying to explain allegedly simple processes of translation and explanation. Stefan exhibited some of this struggle when discussing the manuscript he wrote with his advisor that was rejected by biology reviewers. When describing changes he and his supervisor would make before sending the article to a friendlier journal, Stefan alluded to how he and his supervisor would have to do more than just simplify and explain their research:

> [Physics people] do analogies all the time. Like, you can say you can study how some phase transition takes place, how ice turns into water at different pressures. But [it's] actually *very* tough to build a computational model let alone an analytical model of this

process. [….] But, as [biologists], you never mind it, okay how do I learn more about my

[cell], about how my [X] system [works], versus just science. [….] And then it would go

in that direction toward medicine. Yeah, it's closely tied to this. And for machine learning

it would be close to practical data science projects. There wouldn't be the triangle with

physics. Or the physics part in between. They'd be looking in opposite directions and

physics is in the middle of the triangle saying, hey! Look at us! [….] So then, actually,

the challenge is then, here I am describing why it is physics, and the challenge is bringing

it in in such a way for scholarship, like, look it *is* physics. And I'm not sure it worked.

Well in the field- well, no. I guess in the manuscript it would be easier because you

describe results and they are familiar for them to make previous connections to systems

that seem related and have much to with them but actually do not. (S_INT2)

While Stefan did seem to rely largely on arhetorical meta-talk to talk specifically about

writing (see Table 1 C2, Table 3 C3), he also talked about the complex activities that surround

this writing. Stefan spoke about how it was challenging to *argue* how physics could be applied to

biological and machine learning fields; a result, as Stefan said, of being "in the middle of the

triangle." Talking about "bringing in the physics," Stefan seemed to be trying to articulate that

writing in interdisciplinary contexts is an inherently transformative process as opposed to one

that simply translates physics to medical biologists or machine learning scientists.

During a conversation about the rejected article, I told Stefan I assumed it must be quite

difficult trying to please so many different people. Stefan replied with an account of how he had

begun to understand what he was doing as a writer:

Well, there was first the realization that we had [biology], physics [biology] people, but

mainly [biology] who didn't like what we were doing. So then we said, okay, that means

our work is meant for different people than [biologists] with physics backgrounds. So

who is it? Machine learning scientists, they appreciate it, they have for some reason a

more accepting view. [….] So we're very precise and very detailed, but only on the basic

stuff. To get everyone at the right level and perhaps I think beforehand we'd been

assuming some knowledge was common knowledge when it wasn't. It was common

knowledge to us, but us being reasonably knowledgeable in all three fields makes us very

specialized because there is not that many who'd be reasonably knowledgeable. [….] The

work itself is not very complicated, but writing it up has been quite complicated I think.

(S_INT3)

Although there are segments of this excerpt where Stefan speaks about writing as being

precise, clear, and specific, these are surrounded by large segments of text where Stefan is

describing something very complex. Instead of *translating* physics to a specific biology group,

Stefan is engaged in an inherently *transformative* process (see Myers, 1990). Stefan is trying to

articulate that he needs to transform the physics for it to resonate with and be understood by

biologists and machine learning scientists. He talks about having to modify his approach to

writing based on what his audience will and will not know (see Blakeslee, 2001). Particularly

notable in this excerpt is Stefan saying, "the work itself is not very complicated, but writing it up

has been quite complicated" (S_INT3). Although Stefan talked about the writing process as

"writing up" (a phrase that has been critiqued in writing research [e.g., Kamler & Thomson,

2014]), he describes the writing process as complex. For Stefan, the complicated part of the

process was the writing: he was faced with figuring out how to write for a specific cross-section

of scientists and how to argue his work specifically for this group. Of course, the rhetorical work

that Stefan was doing tends to be hidden by dominant arhetorical assumptions of "writing up"

the research after it has been done and of having to simply translate jargon and physics processes into clear language.

Diana's accounts of writing exhibited similar characteristics. At the beginning of our final interview, Diana spoke about a conference talk she prepared and presented for a medical biology meeting. While, as I documented above, much of Diana's explicit talk about writing was rooting in arhetorical assumptions (e.g., simplicity, clarify, specificity), her discussion of the conference talk was quite different. As she said, much of the work that went into preparing the script and presentation for this talk went beyond simply trying to figure out how to "translate" biophysics for medical biologists:

It was mostly – there were a lot of talks about going through clinical trials for a new sort of diagnostic tool. [….] And everything was always focused in that sort of treatment point of view. As opposed to if I'm talking to a biophysics audience, it's like hey look [X]! [X]'s cool, here's how it behaves, here's how I can use the tools in the lab to study it better. [….] It's like, I want to preserve the actual part of my research which came further on in the talk, but the introduction got completely revamped to be something applicable to this audience where they would actually care about – yeah, in essence we framed it such that we were talking about, hey look here are some current diagnostic models and tools on the market, here's where our technology fits with that, and hey look here's an example. My research was more, here's an example of what we've done with it as opposed to the main focus. (D_INT3)

Diana spoke about crafting the conference talk so that it would be applicable to an audience with whom she was not familiar and who would respond to her research differently than biophysicists. Significant in this excerpt is when Diana talked about having to *frame* the

technology and research being developed in her supervisor's lab in a specific way for the medical biologists. In this case, Diana's emphasis on how to frame the research for medical biologists suggests that producing a genre for an interdisciplinary audience goes beyond simplifying.

Victor, too, seemed to struggle with the conflicting meta-talk about interdisciplinary writing. He also tended to use arhetorical meta-talk when talking directly about writing as, for instance, transposing (Table 3 C4R5) and simplifying (Table 3 C4R4). Yet after using this arhetorical meta-talk, he would describe the processes of transposing and simplifying as being quite complex. At one point, when Victor was speaking about a presentation he had prepared for a biology group (the group supervisor being a member of his doctoral committee), he talked about kinds of responses and questions the group had for him:

> The questions that my colleague had when he presented the same work to cancer
>
> biologists, it was the same kind of questions where people try to apply to their field,
>
> right? To transpose it to their field and they had questions and thoughts that we never
>
> even had in the first place. [….] Yeah. So they were trying to say, 'okay, but how can we
>
> account for this kind of heterogeneity in the population for example, you know? You
>
> model one thing, but in reality, everyone's different. Everyone is a little more like this or
>
> like that and so, yeah, it was those kinds of questions. More like, how can we apply this?
>
> I get it, I really understand but I want to apply it to my research, how do I do that?'
>
> (V_INT3)

Although Victor reproduced arhetorical meta-talk about transposing physics, this talk shifted when (in a section of this account that I cut for clarity) I asked Victor about why he thought he was getting questions about applying his models to biology. Victor began by talking

about how the biologists he was working with wanted to apply his research in ways that had not

occurred to Victor or his fellow biophysicists. Then, however, he transitioned into talking about

the *thinking* of the biologists – how for them, acknowledging the details, differences, and

subtleties in individuals is integral to how they undertake biological research. Victor said that for

his research in parameter reduction to be useful and applicable to the biologists, it had to be

presented and argued so that it conformed to the epistemic assumptions and research practices of

the biologists. Victor further qualified the process of transposing physics research for biologists

by saying:

> I think it's always a question of scope, right? Us physicists, we're good at modelling
>
> something, we're good at abstracting a lot of stuff and saying, 'okay this could work like
>
> this, this I know how to handle.' I'd say there's this, like, I don't know… this *idea* in
>
> biology and systems biology that if you describe *everything*, everything, then naturally
>
> the science will emerge. […] But in physics, a lot of the models, we know that's not
>
> possible. As a matter of fact, the air in the room, right? I don't need to model every
>
> molecule to know the pressure or the temperature, right? I don't need all of this detail. So
>
> that's an idea in biology that is not well grasped, I feel. [It's okay if the model] doesn't
>
> explain *everything*, it's not supposed to. It's just, I'm trying to explain this little thing
>
> over here and, yeah, that's kind of the ideology that we're trying to transmit to those
>
> people. Sometimes being too descriptive or too exhaustive is more detrimental than
>
> anything. [….] And that's something I *need* to make sure to put in my presentations when
>
> I talk about my work because this stuff really exists. I'm not denying it's actually there in
>
> our bodies or whatever, but for modelling purposes, for understanding purposes
>
> sometimes you don't need all of those little details. **(V_INT3)**

Detailing what this transposing entails, Victor again took a great deal of time to detail how he had to communicate an "ideology" of physics to a group of biologists. He stressed that when communicating across disciplines he had to acknowledge the way things were done in biology. In doing so, he also needed to ensure that he was able to make an argument for why, as Aliya might say, his biophysical logic works for biologists. In transposing biophysics research, Victor was really speaking about how he must carefully argue to biologists how and why his model would work for them, despite epistemic differences (i.e., generalizing for modelling purposes in physics versus specifying individual details in biology).

The conflicting nature of meta-talk about interdisciplinary writing was most pronounced in Aster's interviews. Like the other participants, while Aster did talk about writing arhetorically, he also tried on several occasions to articulate why he found interdisciplinary so demanding. At one point, Aster seemed to articulate an added demand of interdisciplinary writing, saying that by the end of his doctorate he had started to get the sense that the "intuitive" values embedded in science writing might be part of a larger issue:

> I guess because I think these conventions just come- or at least they're taught- I also had
> an advisor who didn't really impress any of these conventions. I mean had a very poor
> idea of how developmental biology works, but also there's kind of a definite society that-
> there's a socialization in science that comes with- that is separate from what's written on
> the page and I certainly didn't really get a whole lot of that. So that's, I feel like what you
> get when you, again, do a typical project and go through conferences and stuff like that.
> You intuitively start to value or perceive the types of narratives and mental algorithms
> and I just never- again people read these types of things with a whole loaded knowledge
> or bias that I think eases the fact that the writing is bad. And I think that it's relied upon

in scientific writing. But if you're just relying on scientific writing, you don't have to

realize what's there. But also I think in order to find issues or find where things are gonna

be you have to have a good understanding of the writing because a lot of being an expert

is knowing what's not being written as it is what's being published. (As_INT2)

Here, Aster crystallizes the contradiction in interdisciplinary writing: it simply cannot be

as simple and straightforward as so much of the explicit meta-talk surrounding it suggests.

Instead, he talked about beginning to see writing as "loaded" with particular kinds of biases:

interdisciplinary writing is, in other words, a complex process of arguing across situated and

inherited beliefs about what writing should be and do. Even more interesting is Aster's assertion

that the socialization he felt he lacked, and which impacted his understanding of conventions,

was separate from writing. In line with existing understandings of paradoxes in doctoral writing

(Starke-Meyerring, 2011) is that while Aster talks about different ways of being socialized into

biology, writing is *not* one of the ways the status quo is learned. This illustrates the powerful

regularizing nature of meta-genres that appear to occlude the rhetorical nature of writing: Aster

can see that different areas of biology have different ways of doing things and that there is

ideally a socialization students engage in to participate in these different areas. Writing, however,

is not one of them. For Aster, writing is more a symptom of differences than a way of engaging

in specific ways of knowing, doing, being, and arguing (Bawarshi & Reiff, 2010). In the above

excerpt, Aster appears to be trying to untangle how this socialization happens; that is, how

developmental and evolutionary biology doctoral students learn the conventions of the field.

Understanding deeply socialized conventions, however, is not easy and becomes even more

challenging when Aster's exposure to meta-genres and meta-talk position writing as static,

translating, and explaining. Meta-talk, and explicit meta-genres, that characterize scientific

writing arhetorically make it difficult for Aster to learn the practices of different biology fields.

      The difficulty Aster experienced writing from within arhetorical assumptions was echoed

during our last interview. In this excerpt, Aster spoke about why he contacted me to participate

in this study:

> I'm really interested in this type of stuff [writing]. It's something I've always thought
>
> about. [….] It's requiring people to look at how we do these things, and I think some of
>
> the better insights and arguments about why systems biology is useful is through an
>
> interrogation of what do we know and how do we know it? [….] And you can't really do
>
> that without talking about the forms, without talking about the quality of what we're
>
> doing and really going into what the ideas that we're talking about are and looking into
>
> what are we communicating? (As_INT3)

      In the above excerpt, Aster is implying that there is more to writing in interdisciplinary

programs than just making things clear and specific. To write well in interdisciplinary programs,

according to Aster, necessitates an understanding of how writing privileges certain insights and

arguments. Again, the contradiction in meta-talk about interdisciplinary writing rears its head: it

should be simple, but students do not experience it as such. As a final example, I want to

document an excerpt from a discussion about Aster's experience writing his dissertation. His first

attempt was failed, and in talking about how he dealt with this setback, Aster first spoke about

how he felt writing was *his* problem, before talking about writing conventions themselves:

> When I started writing up […] I didn't know myself how to do that. So I kind of had to
>
> teach myself how to write to the level because you can't write about these ideas without
>
> trying- basically, if I wanted to be more conventional in my writing, then I should have

chosen projects that are amenable to that. This isn't about purely writing, it's also about

how you do your science in the first place and so those conventions are embedded not

only just with writing, but also with thinking about the science, for instance, and choosing

a project or system or choosing a thing to talk about that conforms to that kind of

simplicity of thought and ease of obviousness of directionality. (As_INT2)

Once more, Aster positioned writing in interdisciplinary doctoral programs as being more

than simplifying and translating. Instead, he talked about writing as inherently connected to how

science is done. While this has significant implications for how interdisciplinary students

navigate their research and identities across disciplinary borders (as I discuss in following

chapters), it also points to frictions in the accepted explicit and implicit meta-genres surrounding

writing in interdisciplinary doctoral programs.

When participants' experiences with interdisciplinary writing are far from the simple

processes of explaining and translating that direct meta-talk suggests. When participants were

pressed about the conventions surrounding writing in interdisciplinary programs, they described

a complex and deeply situated process. Aster spoke about writing as not just writing but "how

you do your science in the first place" (As_INT2) and Stefan outlined the careful line of

questioning that influenced how he and his advisor rewrote and resubmitted a manuscript. The

tacit rhetorical knowledge students attempt to verbalize has several implications for how

interdisciplinary writing is understood, as well as consequences for knowledge and identity. I

take up the latter two implications in the following chapter, but first, I want to focus on the

contradictory nature of the meta-talk I've traced and discuss what this talk suggests about meta-

genres patrolling interdisciplinary writing.

Meta-Genre: It Should Be Simple. But it Isn't.

Tracing participants' meta-talk provided a starting place to understand the meta-genres regulating assumptions and practices surrounding writing in interdisciplinary life sciences doctoral programs. Findings emerging from this analysis suggest that:

a) Interdisciplinary writing is perceived *arhetorically*: participants' meta-talk and institutional meta-genres suggest that writing is a simple matter of translating, explaining, or clarifying ideas from one discipline into another;

b) Although interdisciplinary writing is supposed to be easy, participants struggle to reconcile the process of explaining and translating with the complex, *rhetorical* demands they encounter.

As discussed above, much of the explicit meta-talk that participants produce indicates an arhetorical understanding of writing: students should, according to this talk, be able to translate or explain concepts regardless of disciplinary associations and beliefs. Institutional policies, too, echo formalist assumptions about writing with regulations stipulating that writing should be *clear*, *concise*, and *exact*, suggesting that conciseness and clarity – or as Aster might say, "cutting out the crap" (As_INT3) – is the key to acceptable writing in interdisciplinary programs. However, when participants talked about the activities surrounding writing (e.g., why images had to be described in particular ways, why care must to be taken to acknowledge different ways of understanding a research object), they took a great deal of time and effort to articulate the conventions and expectations associated with writing in and across disciplines. The meta-talk that participants produced is, in other words contradictory.

The contradictory nature of this meta-talk is important to acknowledge because it highlights an important feature of the context in which interdisciplinary writing happens

(Giltrow, 2002b, p. 198). When the meta-talk surrounding writing is largely arhetorical, writing cannot be understood as non-neutral, situated, or social and so student writers are restricted from accessing implicit rhetorical knowledge and transforming "tacit know-how into discursive knowledge" (p. 190). That is, implicit rhetorical knowledge gets stuck in students' minds because arhetorical meta-talk normalizes the idea that writing across disciplinary boundaries should be no more difficult than translating research into clear and jargon-free language (Starke-Meyerring, 2011). When participants tried to articulate the rhetorical demands and expectations they encountered, the arhetorical meta-talk they had access to was not adequate to do so. This resulted in halting, questioning, and lengthy talk about the activities surrounding. Further, the rhetorical knowledge participants struggle to articulate suggests that interdisciplinary writing is an incredibly complex process. Writing across disciplines, or to audiences with different ways of understanding the world, requires writers not to translate but *transform* their claims (Blakeslee, 2001; Myers, 1990, 2003). In his discussions about popularizations of science, Myers (1990, 2003) argues that the concept of translation obscures how popularizations create different kinds of knowledge by being transformed into different genres. While not popularizations, interdisciplinary doctoral students writing across disciplinary boundaries face the same sorts of "challenges to the boundaries of [a] field" (Myers, 2003, p. 267). Not only must doctoral writers navigate audiences who share different assumptions, they are also faced with arguing, and transforming, knowledge in ways that may be totally unfamiliar to them. This process is, of course, inherently rhetorical: it involves interdisciplinary writers arguing a phenomenon into a particular epistemic and ontological frame that will enable their interdisciplinary research. Of course, students struggle with this transformation because it remains hidden by dominant assumptions of interdisciplinary writing as *translating* and *explaining*.

The assumptions regulated by dominant, and largely arhetorical, meta-talk have significant consequences for students. Students should be able to simply explain concepts or approaches, but are faced with reconciling demands of competing disciplinary conventions and practices. In the absence of any other kind of talk about writing, these arhetorical assumptions are reinforced, leaving students struggling to reconcile implicit knowledge with the status quo regulated by dominant meta-talk. Reconciling these demands are further complicated by the deeply inherent rhetorical nature of writing expectations. Rarely are established members of disciplinary or professional communities able to articulate deeply situated and historical genre conventions; often they left trying to do so by critiquing grammar and organization (Giltrow & Valiquette, 1994; Paré, 2011b; Rose, 1985). For newcomers, in this case doctoral students, to interdisciplinary communities arhetorical meta-talk "reinforces insiders' mutual understandings while estranging newcomers from this consensus. And this may be especially so when students hear the same workings in different disciplinary contexts" (Giltrow, 2002b, p. 196). Indeed, the interdisciplinary students whose experiences are detailed above all speak about writing the same way, despite being situated in different interdisciplinary fields. This suggests the existence of a meta-genre regulating interdisciplinary writing so that the possibilities of contradictions or tensions remain unavailable; instead, meta-genres reinforce the idea of one status quo in writing by obfuscating rhetorical work happening "behind the scenes." And therein lies the crux of this contradiction: the meta-talk and the meta-genres regulating this talk suggests writing across disciplines *should* be simple. But in disentangling arhetorical meta-talk from participants' talk about their experiences with writing, it becomes clear that interdisciplinary writing is not simple at all. The complex nature, indeed the *rhetorical* nature, of interdisciplinary writing gets hidden

by arhetorical talk and, based on data outlined above, students are left without productive ways of engaging with what appear from data to be multiple status quos.

Chapter Summary

In this chapter, I used a meta-genre lens to explore the assumptions and talk surrounding writing in interdisciplinary life sciences doctoral programs. Examining policy documents from a meta-genre lens revealed how interdisciplinary writing was constructed institutionally as *clear*, *concise*, *comprehensive*, and *specific.* These documents also indicated that writing is rooted in traditions that understand and normalize writing as a universal skill, assuming that interdisciplinary writing is a matter of being specific and clear. In other words, the policy documents reinforced *arhetorical* understandings of writing; that is, the idea that writing is separate from social situations. Also revealing arhetorical perceptions of interdisciplinary writing was participants' explicit meta-talk about writing, which echoed assumptions codified in institutional documents. When talking about clear writing and concept translation, participants struggled to articulate the complex and rhetorical activities in which they were engaged. For this reason, I have argued that the meta-talk that participants encountered is contradictory: it at once provides a linguistic framework to talk about writing as simple and straightforward and prevents them from reconciling this meta-talk with the implicit rhetorical demands that they encounter. The meta-talk, and policy texts, indicate the existence of meta-genres that regulate particular assumptions about interdisciplinary writing: it *should* be simple and arhetorical meta-talk occludes the complex rhetorical work required of students to write across, and at the intersections of, disciplinary boundaries.

My discussion of the meta-talk and meta-genre assumptions provide a foundation for understanding how these assumptions shape how interdisciplinary doctoral students genre their

way into research communities and interdisciplinary scholarly identities. In the next two chapters, I explore in more detail how meta-genres regulate students' abilities to productively engage in interdisciplinary research and how the assumptions reinforced by these meta-genres shape the ways in which students negotiate their scholarly identities. First, though, I turn to how meta-genres regulate assumptions about specifically *interdisciplinary* research.

Chapter 5: The Nature of Interdisciplinary Research and Writing – According to Meta-

Talk

Tracing indirect and direct meta-talk – and implicit and explicit meta-genres – in the previous chapter pointed to interdisciplinary writing being regulated by contradictory assumptions. Explicit meta-genres (e.g., institutional policies) and direct meta-talk characterize interdisciplinary writing as simple, so long as writers can translate their ideas using clear language. Implicit meta-genres and indirect meta-talk, however, dispute this characterization of interdisciplinary writing as *simple*. Indeed, participants often struggled to reconcile the complex, rhetorical demands they faced with dominant meta-talk and institutional meta-genres. At this point, I turn to examining how genres, which are inherited forms of social knowledge and practices (e.g., Bazerman, 1988), interact at disciplinary boundaries.

Interdisciplinary work is often discussed as collaborative. Its aim is to bridge disciplines while maintaining traditional academic structures and ways of knowing (Klein, 2010). In fact, discussions of interdisciplinary work characterize it as "mixing," "bridging," or "integrating" disciplines (Klein, 2010; OECD, 1972). In the previous chapter, much of the arhetorical meta-talk (and some of the language in policy meta-genres) echoed these assumptions. Interdisciplinary writing is largely assumed to involve *translating*, *explaining clearly*, and *providing detailed descriptions* of research. These processes complement the notion that interdisciplinary research is a matter of mixing and bridging – the process of integrating research disciplines should be a matter of explaining clearly, and minimizing technical language, to establish consensus (see Myers, 2003).

As I discussed in Chapter 2, interdisciplinary research programs have been characterized as sites of potential conflict (Graham & Herndl, 2013; Rowland, 2002). As Rowland (2004)

writes, "interdisciplinary work can be exciting, but it is hard. It involves *negotiating* disciplinary boundaries, not removing them" (emphasis added, para. 10). Despite being a site of potential conflict, much of the talk surrounding writing in interdisciplinary programs does not acknowledge the negotiations that have to occur for interdisciplinary work to be successful. This talk often fails to acknowledge interdisciplinary research sites as spaces where disciplinary epistemologies, boundaries, and structures may be contested (Rowland, 2002). Indeed, from a rhetorical genre perspective, interdisciplinary research programs are locales where tension is likely to emerge. These are after all sites where values and assumptions that have evolved historically in different settings are integrated to solve particular problems.

This chapter explores how interdisciplinary research and writing are constructed by meta-talk and traces evidence that suggests interdisciplinary research and writing are prone to epistemic tension. I begin by tracing interdisciplinary meta-talk that participants produce when describing the nature and goals of their research. I go on to explore how participants recount their experiences writing to interdisciplinary audiences and suggest that dominant meta-talk hides the fraught relationship between interdisciplinary research and writing. Finally, I discuss how this contradicting talk suggests the existence of added demands for interdisciplinary doctoral writers.

Interdisciplinary Meta-Talk

In this chapter, to trace how meta-genres regulate assumptions about writing and research in interdisciplinary life sciences doctoral programs I am moving away from institutional documents and focusing, instead, on how participants' meta-talk hints at implicit and powerful assumptions about interdisciplinary writing and research. In other words, throughout this chapter, participants' meta-talk provides an entry-point to implicit and taken-for-granted meta-genres.

The insights generated in this chapter emerged largely from interviews with participants, although emails and field notes also impacted my search for how meta-genres regulated assumptions of research and writing.

Working with interview data, I saw a familiar pattern emerge in their narratives. Once again, participants' meta-talk about interdisciplinary writing and research contradicted their experiences with writing. I traced participants' experiences with writing and compared them to their direct meta-talk using a rhetorical genre framework (see Chapter 3). Doing so, I noted that two patterns were emerging from the data that responded to my second research question: how do implicit and explicit meta-genres enable and constrain doctoral students' research activities? The first pattern I discuss emerged from participants' direct meta-talk about interdisciplinary writing and research. This pattern, informed by participants' interviews, suggests that interdisciplinary research should be complementary, harmonious, and mutually beneficial. While tracing harmonious talk about research, I began teasing out another pattern in participants' meta-talk, a pattern that suggested interdisciplinary writing was not as complementary as participants often believed. This second pattern of meta-talk often emerged in response to questions I asked that attempted to clarify what I have come to see as *common sense* talk about interdisciplinary research; that is, interdisciplinary research should be complementary and mutually beneficial for all parties. Analyzing this second pattern of discourse revealed interdisciplinary research and writing were often fraught with underlying tensions. Before delving into this second pattern, I begin with how participants often characterized interdisciplinary research.

Interdisciplinary research should be complementary. Emerging from explicit meta-talk about interdisciplinary research and writing were narratives that suggested interdisciplinary research is, at its core, complementary. Before detailing how this emerged in the data, I should

note that the experiences detailed below tend to characterize participants' experiences and

assumptions about interdisciplinary *research*. While these experiences often resulted in writing

(e.g., manuscripts, conference posters and talks), the narratives are largely concerned with

research activities. Despite this, the meta-talk I trace does provide an entry point to

understanding *implicit* regulations about interdisciplinary writing; that is, the unspoken

regulations about the ways of knowing, doing, and being that shape and are shaped by written

genres. The talk about research activities, and in some cases writing activities, indicate the

existence of meta-genres that subtly reinforce ideas that interdisciplinary work should be

complementary. Tracing such talk reveals how participants "translate their tacit know-how into

discursive knowledge" (Giltrow, 2002b, p. 190). In doing so, participants' talk about research

activities that lead to writing experiences help reveal their understanding of implicit rules of

scholarship in interdisciplinary programs.

To begin, I turn to a topic that participants often spoke of during interviews: the

importance of considering the audiences to whom they write (see Blakeslee, 2001). Meta-talk

about interdisciplinary research suggests that it is inherently collaborative. For instance, when

Victor discussed a manuscript he was involved in writing, he spoke about the project and the

resulting paper as an attempt to "find a way to merge […] two points of view [physics and

biology] together, the kind of biological point of view where you have something that's very,

very descriptive, very overly complex" (V_INT1). When Victor talks about "merging" here, he

echoes dominant ideas about interdisciplinary research being a matter of merging approaches or

theories to create more integrative approaches to addressing complex questions (Klein, 2010;

Newell, 2013). In fact, Victor's discussions about collaborating with different groups reinforced

this idea of collaborations being a way for him to "make life simpler" (V_INT3) for biologists in particular.

Victor spoke about two interdisciplinary collaborations that were meant to make biologists' lives easier. The first project was undertaken with a group of cancer biologists. A student co-supervised by Victor's supervisor approached him about developing an algorithm to reduce "*huge* networks of super messy [models in cancer research]" (V_INT1). The aim of the project was to help cancer biologists and "guide them toward testing a, b, c and not the whole alphabet" (V_INT1). Although the collaboration was initially enthusiastically undertaken, it was eventually abandoned. As Victor explained, the project included an entrepreneurial element that became cumbersome for the group and in the end, the biophysicists and biologists had different expectations about what the project should accomplish (V_INT2). Despite the eventual dissolution of the collaboration, Victor emphasized that working with the biologists was a positive experience because he felt as though he was engaging in true interdisciplinary research:

> It was a back and forth between our [and the biologists'] two visions of the project [….]
> So I feel the back and forth between the two groups was constructive, it was definitely
> more… I don't know. It felt like we were actually working toward something that could
> be useful to both sides. Building this project that would be a compr- not a compromise
> but some, you know. [….] Mutually beneficial to both groups. (V_INT2)

Victor spoke about the collaboration involving a degree of "back and forth" and working towards a "mutually beneficial" outcome. The language that Victor uses to describe interdisciplinary research is complementary – the point of this work should be to make life easier or bridge disciplines for mutually beneficial purposes. Note that even though the project was abandoned, in part because of mismatched expectations, Victor emphasized the constructive

environment in which the project was initially designed and planned. The emphasis on the

research being constructive and meaningful to both the biologists and biophysicists indicates that

these features are assumed to be characteristic of interdisciplinary research.

Diana, too, spoke about interdisciplinary research as complementary. She emphasized

that her work was inherently collaborative and merged approaches, which enabled her to

accomplish research not possible on her own. For instance, Diana spoke about working with a

theoretical biophysicist who "came up with the entire theoretical model to predict [what I'm

researching]" (D_INT1). She also spoke about her collaboration with a cancer research lab

because they were "interested in what we can do to help further their research" (D_INT1). The

nature of Diana's research is discussed as inherently collaborative and complementary: what

Diana and her collaborators do together is much greater than what they could do alone. This

complementary and harmonious talk about writing was particularly common in Aliya's

discussion of her experiences with interdisciplinary research and writing. When speaking about

her experience spending a semester in a biology lab during her rotation year, Aliya commonly

discussed the research and writing process as complementary. Complementary language was

especially common when Aliya recounted her experience contributing to the biology lab's

manuscript using computational methods. Aliya explained that:

> I've realized, actually, this is a *perfect* collaboration. I've had group projects in the past,
>
> not necessarily at the grad level and not in research *per se*, but it really hit me that, this is
>
> a really good example of a good partnership, where we have really complementary skills
>
> and a lot of mutual respect for each other. (Al_INT1)

Aliya characterized the collaboration as "perfect," saying that it was a "good partnership"

with "a lot of mutual respect." At other times, Aliya spoke about this particular experience as

being "a good, short-term, but win-win kinda thing. […] I remember [the biologists] kept saying, oh this is really nice timing, you could learn some cell biology and you could bring in your expertise on this [computational] part" (Al_INT2). Again, the way Aliya talked about this experience was very positive. It was "win-win" for her and the biologists because Aliya was able to learn about biology she was not familiar with and the biologists were able to take advantage of Aliya's expertise.

While Aliya's discussion of her time with the biologists largely revolved around the research process, the writing process did come up in this conversation. This is, in part, because Aliya later became involved in writing a manuscript with this group—an experience I return to later in this chapter. Again, during this rotation, Aliya helped rewrite portions of the biologists' manuscript to a high-impact journal using her expertise in computational biology. Aliya worked especially closely with an advanced doctoral student in the biology lab and spoke about the mutually beneficial nature of their collaboration. Indeed, Aliya described working with the biology doctoral student as being:

> Literally complementary [….] I couldn't even validate things the way she did, I couldn't run the experiments, but similarly she couldn't, without a lot of training, do the analysis that I did. […] In that sense we were both able to do something that was more than either of us could do alone. (Al_INT2)

Aliya's descriptions of the research process as "complementary" echoes the language participants used to describe the nature of their work. Even when Aliya admitted that the biology lab was not well equipped or trained to engage in computational approaches to data analysis, she did so quite gently. She very carefully explained that all of the lab members were biologists. The one lab member who was familiar with computational approaches was capable, but self-taught,

which Aliya felt limited the degree to which the biologists could use computational approaches. When planning her rotational semesters, Aliya was offered the opportunity to spend a semester in this lab. The aim was for Aliya to work closely with an advanced Ph.D. student to learn about biology and for Aliya to support the biologists' computational analysis. As she said:

> At the same time as they were needing somebody to- or needing some more support deepening this part of the analysis, like the computational side of things. She's [the advanced Ph.D. student] not a big data person and we've had a lot of her [a biologist] explaining biology things to me and me trying to explain statistics to her. (Al_INT1)

Although the biologists were not overly familiar with computational approaches, Aliya remained very careful to characterize the collaboration—and eventual revision of their manuscript—as mutually beneficial. She spoke about the opportunity for her and the biologists to learn from each other and said that she had many experiences with the biologists helping her learn about biology and Aliya explaining statistics to the biologists. Aliya's description of her experience in the biology lab are again very harmonious and, as Aliya might say, "win-win."

Descriptions of interdisciplinary research as harmonious and complementary were especially common when participants tried to talk about what *not* to do in interdisciplinary research programs. For instance, when speaking about his research with biologists and computer scientists, Stefan talked about having to ensure that he wasn't "stepping on other people's feet" (S_INT1). Stefan spoke about how, in his experience, there is risk in interdisciplinary research of writing something that might offend collaborators or other disciplinary groups. He gave an example of a physicist who published a paper theorizing a process also found in machine learning, saying:

In [comes] an arrogant physicist saying, hey I figured it out! [….] So we're cautious with

this. Same a little in biology. There aren't even that many examples, but the ones there

are, is like *wow*. So you try to be cautious not to be like those people, you know?

(S_INT1)

Stefan uses the example of the physicist as a cautionary tale: to avoid being perceived as

an arrogant physicist, Stefan speaks about the importance of caution because instances where

care was not taken to avoid "stepping on feet" are pretty egregious. Stefan's discussions of not

wanting to disrupt the status quo, of wanting to ensure all parties are on the same page, reveals

that there are rules about how to write, and behave, for science to get done. In their meta-talk,

participants reproduce assumptions that to be successful, interdisciplinary research should be

complementary and writers must avoid claims or arguments that might threaten fellow

researchers.

The talk about interdisciplinary research that participants produced constructs an image

of interdisciplinary research as *complementary*, *win-win*, and *mutually beneficial*. The meta-talk

produced by participants echoes language often used to describe interdisciplinary research:

despite the bridging, merging, and integrating of different disciplines, interdisciplinary

collaboration should ultimately be harmonious and complementary.

Complementary meta-talk suggests particular assumptions about science. Meta-talk

characterizing interdisciplinary research as harmonious suggests particular assumptions are being

regulated behind the scenes. Participants' use of language paints interdisciplinary research and

writing as harmonious, echoing discussions about how scientists navigate conventions of

politeness in science *writing* more generally (e.g., Myers, 1989). When science writers try to

gain recognition by making knowledge claims, they are potentially threatening or challenging

established conventions and undermining the research agendas of others (Hyland, 1996). To mitigate risk and maintain politeness, science writers might employ *hedges* (e.g., discourse markers like "may," "perhaps," "could") to soften claims (Hyland, 1996). Hedges, though, are not always enough to mitigate the risks that occur with particularly strong claims, or claims where "the imposition [of the writer] is too great, or the power of the offended party too great, or the social distance is too great for any politeness device to mitigate the offence" (Myers, 1989, p. 25). In cases where power differentials are too great or where disagreements or other threatening claims may have severely adverse consequences, writers may *avoid* the undermining claims altogether to avoid rocking the boat of science.

In this case, doctoral students are not often in positions of power within their communities. As such, they are likely to encounter instances where *avoiding* conflict in favour of maintaining harmony is perceived as their best option to maintain collaborations and avoid offence. Indeed, Myers (1989) argues that the avoidance of threatening discourse in favour of politeness often "stresses the communality of [a] project" (p. 27). Scientists, he argues, are not supposed to impose criticism or conflict on readers or on collaborators. From this perspective, participants' meta-talk indicates that their beliefs about interdisciplinary research are in line with assumptions that science should be largely harmonious. Taken in conjunction with much of the language surrounding interdisciplinary writing (e.g., as "bridging," "merging," "integrating" [Klein, 2010]), participants' meta-talk suggests the existence of underlying meta-genres that regulate assumptions about interdisciplinary research as harmonious and win-win. These meta-genres function to reinforce talk about interdisciplinary research as complementary, as doing more together than could be done apart, and warn against offending other groups. They function to prevent students from, to use Stefan's words, "stepping on people's feet" (S_INT1).

Of course, meta-talk positioning interdisciplinary research as complementary does not fully account for the nature of *writing* in interdisciplinary doctoral programs. Much like my discussion in the previous chapter about arhetorical meta-talk occluding the rhetorical nature of interdisciplinary writing, harmonious talk serves to occlude underlying *tensions* that emerge in interdisciplinary research programs (Rowland, 2002). This tension is not necessarily negative; indeed, Rowland has argued that critical negotiation at disciplinary boundaries has potential to generate new and innovative ways of "understanding the familiar" (para. 10). But, complementary and harmonious meta-talk does not acknowledge the potential for tension to emerge when disciplines with diverse histories meet and interact – it works to hide the existence of tension or contingency all together. That is, characterizations of research as complementary hide the tensions that occur when research is discursively constructed into disciplinary genres that interact in interdisciplinary spaces. This became clear when probing participants about their experiences *writing* in interdisciplinary programs, a pattern of commentary emerged indicating that the ways in which interdisciplinary research was *written* was not as harmonious as direct meta-talk makes it out to be. Aster, for example, pointed to the tensions and contestations he experienced writing the literature review chapter for his dissertation (the vignette, see Chapter 4):

> I guess I just don't really- part of me hates the term interdisciplinary because it's not. We're all talking about developmental biology. But not only that, you can find people doing research programs that can reveal these types of frictions. (As_INT2)

Aster is reluctant to characterize his work as interdisciplinary because in his view, everyone is talking about developmental biology. Yet, in the next sentence, he talks about research that reveals frictions in the idea of a unified system. This crystallizes tension that I see existing in interdisciplinary writing: the work is, ideally, harmonious; but when working across

genres emerging from different disciplinary traditions and beliefs, frictions and tensions are difficult to avoid.

Tensions in interdisciplinary writing. Tracing direct meta-talk about interdisciplinary research as complementary led me to start teasing out an underlying narrative. This narrative often emerged from my prompting participants to further explain how they experienced the complementary nature of research. Tracing this underlying pattern, I noted that while participants certainly *talked* about interdisciplinary research as complementary, their experiences engaging in writing told a different story. The underlying narratives about participants' encounters with interdisciplinary writing showed cracks in dominant complementary assumptions about interdisciplinary research—assumptions reminding writers of the status quo.

Perceiving problems and learning to negotiate. To begin illustrating where cracks started to occur in assumptions about interdisciplinary research as complementary, I return to one of Aliya's encounters with writing. Above, I outlined how Aliya discussed her experience working with the members of a biology lab as "literally complementary" and "win-win." This collaboration, however, was not completely free of challenges. Prior to Aliya's rotation, the biologists had been writing a manuscript for submission to a fairly high-impact journal. When Aliya joined the team for her rotation and contributed to the computational analysis, she became involved in writing this manuscript. In fact, Aliya approached the biologists and asked to be a part of the writing team so that she could rewrite a section of the manuscript detailing computational methods and analysis. Reading the manuscript in preparation, Aliya perceived problems with the analysis from a computational biology standpoint. Parts of the analysis were incorrect, while others were not accurate, and Aliya believed that more could be drawn out of the biologists' data. When she discussed these elements of the manuscript with the biologists, they

were happy to have her to contribute as a co-author. Aliya was happy to contribute to the

manuscript in part because she enjoys writing. But the chance to co-author the manuscript also

gave her a chance to address what she saw as inaccuracies in the analysis:

> Part of it was I didn't want my name on something that I thought was incorrect and I
>
> didn't want [the biologists] to write up my results that they probably, possibly didn't fully
>
> understand and to have that conflict. [….] It was tricky because when I first got a look at
>
> the analysis that had been done, I was like, 'oh I'm not so sure about this, I would
>
> actually reconsider this. I know this is done a bit… questionably.' And there were also
>
> challenges with the data itself that made it difficult to ask the questions we
>
> [computational biologists] typically ask. (Al_INT1)

This excerpt illustrates the tensions lurking beneath complementary meta-talk. Even

though Aliya described her experiences with the biologists as "literally complementary," she did

not want her name or reputation attached to a manuscript that she felt was "done a bit…

questionably" (Al_INT1). Aliya's talk about interdisciplinary research contrasts with meta-talk

about writing and suggests a dissonance between what interdisciplinary research is *supposed* to

be and the realities she experienced as this research was constructed discursively. Aliya aligns

herself within a community of computational scientists and implies that there was a barrier she

had to overcome to *fix* the paper. Aliya's concerns were such that she requested a part in

rewriting the manuscript because as she said, "I didn't want my name on something I thought

was incorrect" (Al_INT1). This results in a contradiction: Aliya tries really hard to frame the

writing as complementary, but at the end of the day she could not ignore what she perceived as

serious issues with how the computational analysis was done and written in the manuscript.

Aliya further discussed how interdisciplinary research *should* be win-win, but that she found herself navigating the practices of biologists and at times contesting these practices. After submitting the biology manuscript for review, Aliya explained that she faced juggling different sets of expectations and gave examples of how she changed the manuscript. Discussing these expectations, Aliya wondered whether the changes she made were a result of "how different fields or disciplines like to explain things" (Al_INT2). Recounting her experience with the biology manuscript, Aliya admitted that she was used to computational analysis being the focus of manuscripts and papers. In the biology lab, however, the computational work became a smaller part of an experimental paper. Because of this, Aliya had to learn how to contextualize computational approaches within a larger biological experiment—a novel experience for her. Explaining how she managed to write the analysis, Aliya spoke about negotiating with the biologists about how much computational analysis to include. In this way, Aliya hoped to address the inaccuracies and mistakes she saw in the analysis while also trying to make sure that the manuscript was still recognizable as a biology paper.

To illustrate this negotiation, Aliya spoke about a figure that was included in the biologists' original manuscript. This figure was meant to show how biological samples clustered based on certain conditions using computational analysis. But, as Aliya later realized, "the features [the biologists] were using to do the clustering are the ones that most distinguish the conditions [and] if you do that, then you *should* see clustering by condition, […] but that's not a result, that's a natural consequence" (Al_INT2). Originally, this was not explained in the manuscript and Aliya spoke about having to *convince* the biologists that, from a computational standpoint, not having that explanation was problematic and "very misleading" (Al_INT2). Aliya spoke about this experience as an example of how she had to carefully negotiate the different

expectations between her and the biologists. She also revealed that it took her a while to

convince the biologists of *why* the text had to change:

> That was something that took a while to just explain why this- we would *expect* this. It's
> great, but it's not an experiment, if that makes sense. As we were preparing this
> manuscript, we saw a couple [manuscripts] that were on similar topics and they had done
> similar experiments in different conditions and we were seeing similar figures. And I
> even pointed out a couple: 'This is the same thing, but they do say what it's based on so
> that's acceptable.' [….] I don't know if that's not like, this field likes to do this and my
> field likes to do that. Maybe it's just not fully understanding what the algorithm is doing
> or what the conclusions are. But those are the kinds of changes I had to make. Things that
> I thought were obvious to me I really had to explain to my collaborators while writing
> with them. (Al_INT2)

In the above excerpt, Aliya shifts away from harmonious talk about interdisciplinary

work. Instead, writing in interdisciplinary programs became a negotiation of distinct approaches

to writing research. Aliya spoke about having to convince the biologists that their

characterization of computational approaches and results could be misleading. Further, although

she characterized this work as *explaining* (see Chapter 4), her language suggests that Aliya is

actually involved in careful argumentation and negotiation of disciplinary knowledge and writing

conventions. Her experience powerfully illustrates how meta-talk about interdisciplinary

research being harmonious contradicts the reality she encountered when engaging in a crucial

part of interdisciplinary work: writing. When contributing to the manuscript, Aliya encounters

unexpected tensions between how she (a computational biologist) felt the analysis should be

written and what the biologists did.

Further, negotiating this tension was not easy: not only did Aliya spend a great deal of time learning how to convince the biologists of the manuscript's inaccuracies, she had to contest biology writing conventions while in a vulnerable position. Aliya was not in a powerful position in the lab – she was a first year doctoral student on a three-month rotation with little biology knowledge. It was risky for her to subvert politeness conventions (Myers, 1989) and modify the kinds of claims the biologists made. Indeed, she frames most of her experiences in the biology lab as complementary and win-win. Yet, there were times when Aliya's perceived problems with how the biologists wrote and used computational methods were glaring enough that she did not want her name on the paper unless it was modified. This indicates significant tension: the meta-talk characterizing research as complementary cannot account for the tension that Aliya encountered when writing this research for interdisciplinary review and debate.

In fact, Aliya encountered such tensions during other experiences writing. One example stems from a manuscript Aliya contributed to with her supervisor. This paper, emerging from a large interdisciplinary collaboration including doctors, oncologists, experimental biologists, and developmental biologists, was a significant experience for Aliya. It was a highly anticipated project with a great deal of funding and interest from medical and science communities alike. During her work on this paper, Aliya recounted that she and her supervisor had to write very carefully about the developmental aspect of the project. Aliya explained that developmental biology was a new field for her and her supervisor, so they "had to do a lot of learning about developmental biology […] and consulting of [X] scientists and so on. [That] was required […] for us to do anything credible [….] for us to do anything at all, actually" (Al_INT3). Like her experiences in the biology lab, Aliya had to navigate competing assumptions about knowledge and research to do anything at all. Notable here is Aliya's subtle acknowledgement that the

interaction of multiple disciplinary writing and research conventions is not always harmonious. Indeed, Aliya also noted that even the co-authors of the paper struggled to understand the manuscript as a whole because it brought together so many different fields (Al_INT3).

  Conflicting approaches to writing science. Evidence that interdisciplinary writing involves a significant degree of negotiation and contestation emerged as a pattern of commentary amongst all participants, not just Aliya. Participants experienced the realities of writing in an interdisciplinary program in ways that diverged from complementary and harmonious expectations about research. One of the biophysics students, Stefan, recounted an instance when he and his supervisor tried to publish a manuscript in an interdisciplinary journal for biologists and physicists. Despite the journal focusing on quantitative biology (the focus of Stefan's manuscript), the manuscript was rejected. Speaking about this manuscript, Stefan admitted to being surprised by the negative reviews, and suspected the criticism was a result of the reviewers – all of them biologists – not understanding the science. As Stefan said, they looked "in their narrow-minded view at the paper in which they did not see any breakthroughs. So they were like, 'nah, not our style, doesn't seem relevant'" (S_INT2). Speaking about the rejected manuscript, Stefan expressed his frustration with the reviewers: they were, he said, picking out problems that did not exist. One such problem Stefan spoke about at length was that of *analogies*.

  According to Stefan, analogies are common way for physicists to explain and justify complex physics models. Physicists, he said, "do analogies all the time" (S_INT2), especially those like Stefan who develop computational and analytical modelling systems. Analogies are a way for physicists to take very complex processes and relate them to phenomena about which they already know a great deal. For example, Stefan explained that building a computational model of how water turns to ice under different pressures is very complex. To understand and

model how this might happen, Stefan said he would turn to a different system that also deals with what he called "phase transitions" (S_INT2) (e.g., liquid transitioning from water to ice under different pressures). It is, in other words, using a more established concept or easily modelled concept as an analogy. As Stefan explained, this is common in physics because it is sometimes the best way to understand how computational models might be developed and used. But, as Stefan learned, "as [biologists], you never mind it. [You care about] okay how do I learn more about my [cell], about [X], versus just science" (S_INT2). Note here that for Stefan, science is more than individual concepts, it is about analyzing systems – and using analogies to help in that endeavour. Analogies, for Stefan, are critical to interdisciplinary research because they are a way of negotiating the interests of biologists, computer scientists, and other physicists. But the biologist reviewers failed to see the analogies as new science. Instead, they questioned whether the paper presented any new science at all. Stefan recounted:

> [The reviewers] phrased it that, an analogy could be interesting, but an analogy by itself is not science. And the point was, 'what's the new stuff?' And there was new stuff in there, but they just didn't make it to the second half. (S_INT2)

The biology reviewers' failure to see the analogies as science was frustrating for Stefan. He wondered whether the paper was too technical for them and whether he needed to include "a better explanation both in the written part [and] the figures" (S_INT2). He expressed his belief that the paper had been rejected in part because one of the reviewers "did not understand technicalities which… he was supposed to be able to understand" (S_INT2). Stefan, unfortunately, did not encounter the kind of harmonious and mutually beneficially writing experience meta-talk regularizes. The use of analogy seemed natural for Stefan; after all, the journal audience was supposed to be an interdisciplinary mix of physicists and biophysicists, as

well as biologists. When the analogy was dismissed by the reviewers for not showing anything new, Stefan was left trying to understand why an audience that *should* have responded well to manuscript actually did the opposite.

Even after talking about the reviewers' comments, Stefan remained convinced that the negative reviews were a result of the reviewers not understanding the technical aspects of the paper. Discussing his doubts as to whether the reviewers read the entire manuscript or understood technicalities they "were supposed to be able to understand" (S_INT2), Stefan began pointing out what he saw as a *disconnect*. This represents a contrast to his earlier talk about being careful not to step on toes or to write something other scientists might find "weird" (S_INT1). His experience with the manuscript marks a different way of understanding interdisciplinary work, not as something mutually beneficial and harmonious, but as a practice fraught with competing ways of understanding scientific phenomena. Indeed, when outlining the changes Stefan felt he would have to make, he admitted that there had been "a disconnect" (S_INT2) between himself and the biology reviewers. He explained:

> [My supervisor and I] assumed [the reviewers] would know more machine learning. There was another point… there was the first referee who we had high hopes of, he was a physicist who turned [biologist], so he should have had this physics background. But then he didn't know much about machine learning and was making an argument about how something trivial- no, how some not so trivial argument was trivial in his eyes. But it was even the whole point. [So] we'll have to focus better; this is *not* trivial. [In this case], you do take the weighted average, [even though the cell] can't do that and we know this. But in the machine learning case, you do actually take the weighted average. (S_INT2)

Stefan's account exemplifies the complexity of writing across disciplines: in trying to communicate across disciplinary boundaries, Stefan encountered contradictory expectations about writing. Something that was trivial to the reviewer was, in Stefan's mind, was the whole point of the manuscript. While this is arguably not unique to interdisciplinary writing, this example does illustrate the potential consequences of genres like the manuscript being read from a disciplinary frame different enough that the writing is perceived as problematic. The perceived triviality of an argument resulted from a misunderstanding in audience expectations: Stefan and his supervisor assumed the reviewers would have enough knowledge of biophysics to accept their argument, when in fact the paper was read from a different disciplinary frame. From an RGT perspective, this is to be expected. Physicists and biologists have different ways of making arguments and emphasizing the importance of research findings (Blakeslee, 2001). It further indicates that there is a difference between what doctoral writers *expect* (i.e., complementary and mutually beneficial experiences) and what they *encounter* (i.e., totally different ways of constructing a particular kind of cell, resulting in tension).

Reflecting on the reviews from the biologists, Stefan articulated his growing belief that instead of just "not stepping on people's feet" (S_INT1) interdisciplinary writing involves negotiating fundamentally different understandings of research objects that can lead to misunderstandings. Stefan explained that in the reviewers' area of biology, the concept Stefan was working with was not clear. Biologists, he explained, would have difficulty understanding the usefulness of the concept because it is a known feature of cells. In biophysics and machine learning, though, understanding the mechanics of this feature is critical in understanding how cells operate. As Stefan explained this, he admitted that:

The perspective of the people in their respective fields on their respective concepts,

they're different. So again, I guess that's contradictory, so we have to point them out. In

the machine-learning community it is of interest to make your networks more robust,

while for the biological community, it's of interest to see why this has evolved as a

feature that is there. [….] So I guess that's why it has been more difficult to convince

[biologists] of our case because it's a known feature [for them] and that's all there is to it.

(S_INT3)

In this excerpt, Stefan acknowledges that there are contradictions between the interests

and perceptions of biophysicists, machine-learning scientists, and biologists. He also astutely

points out a tension that complementary and harmonious meta-talk cannot account for: there are

concepts that are just *known* features to biologists. They simply understand and research these

concepts differently, and these approaches are not complementary – they are contingent. In fact,

the barrier to articulating why Stefan's work was important for biologists was too great to

overcome. Stefan and his supervisor decided against submitting a revised version of the paper to

other interdisciplinary biology journals. Instead, they rewrote the paper for physics and machine

learning audiences—groups who already had similar understandings of cells and who were more

likely to understand the significance of Stefan's research. The paper was seen, because of

conflicting disciplinary assumptions and expectations, as being problematic. Since it was read

from a biological perspective, reviewers perceived issues that, for biophysicists, would not be

issues at all. The analogies, common in physics, were critiqued as not showing any new science.

Claims that were trivial for biologists were central for Stefan and his supervisor. These

contradictions led to Stefan giving up on the journal: the epistemic and ontological gaps were too

great to overcome and, for Stefan, too tricky to navigate.

In fact, participants often spoke about being misunderstood by interdisciplinary audiences. That is, a journal reviewer, a dissertation examiner, or an audience at a conference might perceive problems with a genre because it did not conform to their established disciplinary expectations. This happened with Stefan when biology reviewers failed to recognize the new findings in his manuscript and instead characterized them as trivial. Victor had a very similar experience. Like Stefan, Victor worked on a manuscript with his supervisor that was returned with referee comments questioning the relevance of the research. Victor recounted his reaction to these comments:

> [The reviewers] said, 'we don't understand if it's of any relevance' when […] we built this algorithm that was mainly inspired by the work of someone else that was published in this very same journal. It was in the same vein, the *exact* same kind of tool, but then we got rejected because it doesn't fit with the journal, it wasn't relevant, which didn't really make sense to us. [….] *I* think we fit more with this journal that we got rejected from. [….] And as I said, they had published others, very similar algorithms in the past and we couldn't understand why we got rejected. Maybe we didn't write our objective clearly, how it was useful? (V_INT2)

The relevance of Victor's work, like Stefan's was called into doubt when reviewers questioned the utility of the manuscript. While Victor and his supervisor clearly saw how their research could be useful and relevant to readers of this particular journal, the editors and referees had other impressions. Embedded in this segment is a sense that the journal referees had different ways of understanding and arguing the research. Again, from an RGT perspective this is unsurprising – we would expect genres developing out of different disciplines to have different ways of writing and arguing knowledge (Bazerman, 1988; Hyland, 2008). But, for Victor, the

problem was that reviewers did not see the paper's relevance, which should have been obvious.

Note also how Victor assumed that the relevance, the objective, was not made clearly enough.

He identifies this as the potential problem and not, as was likely the case, the tension between

genre expectations of the biophysicists and the journal reviewers.

Victor also spoke about how dominant assumptions about interdisciplinary research as

mutually beneficial were at times contradicted by his experiences. I wrote about this next excerpt

in the previous chapter (to illustrate the contradictory nature of arhetorical meta-talk and the

rhetorical work expected of students), but draw attention to it here because it also crystallizes

how interdisciplinary writing can result in tension. Victor reveals that his experiences producing

genres in an interdisciplinary program sometimes forced him to confront tensions between

disciplinary conventions. One example he shared was of a presentation he gave to a biology lab

on physics modelling. When recalling this experience, Victor admitted:

> I'd say there's this, like, I don't know… this *idea* in biology and systems biology that if
>
> you describe *everything*, everything, then naturally the science will emerge. [….] But in
>
> physics, a lot of the models, we know that's not possible. [….] So that's an idea, in
>
> biology, that is not well grasped, I feel. The details sometimes don't matter and you can
>
> coarse-grain it a little or change your scope to account for or model something well that
>
> can explain a lot of things. And it's okay that it doesn't explain *everything*, it's not
>
> supposed to. [….] What we're doing, what we're saying is that once you model
>
> something, you can reduce what it is you're modelling. You don't need all of this mess. A
>
> lot of people ask the question, 'but the stuff that you're removing is *there* in reality, it's
>
> there for a reason! I don't understand why you would remove it.' [….] I'm not denying

it's actually there in our bodies or whatever, but for modelling purposes, for

understanding purposes sometimes you don't need all of those little details. (V_INT3)

When Victor talks about having to establish with biologists that, for modelling purposes,

tiny details are not important he is alluding to a fundamental difference between physics and

biology: physicists try to simplify, and biologists (at least the ones Victor works with) prefer

details. When Victor tries to build models to facilitate biologists' research, he must take into

consideration that his field and biology are not completely complementary. Victor talks about

having to establish, or perhaps more accurately *argue*, how and why a physics approach to

modelling might be useful to biologists. In doing so, Victor articulates a significant challenge for

doctoral writers: research is meant to be complementary, yet Victor and others find themselves

having to negotiate different writing conventions.

Trying to resist normalized disciplinary assumptions. I have pointed out how

participants encounter contradictory assumptions about interdisciplinary research and writing in

manuscripts and presentations, but Aster also encountered contradictory ideas about

interdisciplinary writing while producing his dissertation. One experience that Aster discussed

was a literature review he wrote for inclusion in the dissertation (Aster, as a reminder, wrote a

manuscript dissertation, so the literature review was eventually meant to be published). Aster

revealed that he wrote the chapter in a novel way, saying:

> I don't know if you've had a chance to read my paper, but on the one hand it's really
>
> different. [….] On the other hand, outside of having a fairly long discussion about [X]
>
> model, I don't think it has any new ideas compared to the previous ones. It just fully
>
> explains them and discusses aspects. [….] I also just got rid of a lot of the explanation
>
> that was tandem to it. But I think that it's that process of, how do I work this into

narratives that are socially acceptable. [….] I would say I have problems getting it to the

form that people want. (As_INT3)

Aster talks about his struggle to write things in socially acceptable forms and meeting

people's expectations, despite his assertion that writing in biology is not that different from

publication to publication (aside from the vocabulary). His meta-talk reveals a contradiction:

biology writing is supposed to be stable, but Aster encounters difficulties meeting social

expectations about forms and talks about his paper being really different. Indeed, early drafts of

Aster's paper *were* different. Aster initially tried to use the metaphor of a vignette to show how

the field of evolutionary and developmental biology was organized. His goal was to illustrate

that evolutionary biologists exploring limb development (for example) were not just working

within a single developmental system; they were working with several interconnected systems.

But in trying to harmonize systems in developmental biology, Aster appears to have subverted

the expectations of some sects in the field.

In addition, Aster spoke about being surprised at just how much resistance he

encountered from readers about the vignette:

> I feel like to a certain degree, the things I'm making more explicit are things that perhaps
>
> I've gotten a comment that this is all obvious and everybody knows this. But if
>
> everybody knows this, show me where everybody makes this point. [….] And that's why
>
> I started writing about the vignettes. I didn't think it was- I think it's a useful way to
>
> describe these things and useful way to make this idea explicit in a way that was often
>
> implicit in other work, but I guess I'm amazed at how people didn't really like, it got
>
> kicked out before I really sent it out, mostly because people who read it just didn't seem
>
> to take. (As_INT2)

Aster tried to make explicit how particular ideas within systems and developmental biology are connected, but encountered obstacles when others (e.g., his supervisor, colleagues) didn't see the value in this kind of work. Aster encountered contradictions when trying to illustrate these connections: he tried to explicitly push and transform conventions to harmonize thinking about a biological system; however, he faced opposition from readers. Other biologists didn't appreciate Aster's articulation of the field, indicating a policing or regulating of conventions (Giltrow, 2002b, p. 203). That is, by asking questions that developmental and evolutionary biologists did not normally ask, Aster was subverting the status quo and trying to push conventions to make innovative claims about the field. In subverting the status quo, however, Aster contravened accepted conventions about writing and research in developmental and evolutionary biology, which led to other members of the field rejecting his claims.

Aster recognized that was contravening his field's expectations about writing and research, but also explained that keeping to the status quo would limit the impact his work could make. Aster explained that the significance of "big finds" in his field is defined by their "interdisciplinary-ness" (As_INT1). But in trying to write about these big finds, Aster struggled against *competing* expectations and conventions about writing. Again speaking about the vignette, Aster indicated that the resistance to the vignettes likely stemmed from a desire amongst biologists to maintain the status quo. He explained that people generally do not like thinking about how the field is organized and how there may be competing interests and practices within developmental biology. Aster believed that most research avoids addressing and thinking about these tensions. When he tried to use the metaphor of the vignette to showcase tensions he saw within evolutionary and developmental biology, he encountered a great deal of resistance. Aster explained:

People don't really like those types of discussions and thinking clearly about how the

field is organized. [….] So by saying then, no, you're probably dealing with a whole

bunch of different- kind of one system which then feeds into another, which then feeds

into another, making arguments about here are the break points, here are where those

differences are is something I don't think a lot of researchers really want to hear.

(As_INT2)

Aster's difficulties stemmed partly from his wanting to make arguments that other

biologists just did not want to hear. The arguments he discusses wanting to make do not fit into

the established norms of evolutionary and developmental biology writing; norms that Aster

views as resulting in "little more than just annotated bibliographies" (As_INT2). But in trying to

make his arguments, Aster appears to be pushing too far and encounters little appreciation for his

attempts to illustrate how his field is organized. He is, in other words, upsetting established

practices about politeness and harmony in science writing (cf. Hyland, 1996). In trying to use the

vignette to illustrate how he understands the field of developmental biology, Aster is also

subverting meta-talk that tries to hide tensions and contradictions. He is, in effect, breaking some

of the unwritten rules of interdisciplinary writing: make sure writing at least appears harmonious.

But, as the patterns of significant statements continue to show, interdisciplinary writing

contingent by nature.

Aster talked at length about the struggles he had writing the dissertation. At one point,

Aster expressed his belief that his struggles emerged, in part, from the *interdiscipline-ization* of

biology, where biologists were increasingly forming ties with chemistry, engineering, physics,

etc.:

[There is a] swallowing up of biology by health science. And I think it's very much

health science. [….] A lot of doctors are more practitioners than scientists, although they

have to understand science to a certain degree. It's not like they *do* science. And I think

that kind of weird melding of semi-engineering mindset with the semi-scientific mindset

means that, yeah, that kind of appeals for credit are becoming to a degree more important

or like the only currency? I think that there's a lot of good use in *basic* biology.

(As_INT3)

In Aster's case, taxonomic, observational biology knowledge becomes subservient to

medical knowledge. As he explained, his research is useful but only when written in a way that

has medical implications, or implications for medical engineering or cell development. In his

case, where interdisciplinary research and writing are supposed to be integrated and harmonious,

Aster continually encountered competing approaches and interests that left him struggling

against contradictory assumptions.

As I established earlier in this chapter, much of the meta-talk surrounding

interdisciplinary research assumes that it is harmonious and complementary. But, when

participants recount their experiences with writing, their meta-talk indicates tensions lurking

beneath the harmonious surface. For instance, biology reviewers perceived Stefan's manuscript

to be flawed because they read the paper from a different disciplinary orientation. Of course,

these differences are hardly ever discussed – indeed, dominant meta-talk works to sweep

contingent practices and expectations under a rug. It is the consequences of occluding contingent

practices and tensions that I turn to now.

Meta-Talk Occludes Contingent Practices and Tensions

The patterns emerging from significant statements in this chapter illustrate how meta-talk regulates assumptions that interdisciplinary research should be complementary, harmonious, and mutually beneficial. On closer examination, however, interdisciplinary writing is a far more complex process than assumptions regulated by meta-talk suggest. Underlying participants' talk about interdisciplinary research as a complementary and mutually beneficial process is the following assumption: since the research process is complementary, the writing process should be, too. In other words, the research should *translate* across fields in writing. But the research *doesn't* translate easily because the writing practices that construct this research discursively result from long histories and established practices. Writing that *should* unite disciplinary approaches to research actually result in tension.

Interdisciplinary research is, as Rowland (2002) argues, contentious by nature. The contradiction between what interdisciplinary writing and research should be and how these practices are experienced by participants indicate that meta-talk *occludes* the contingent nature of interdisciplinary writing. Insights generated from data in this chapter suggest that meta-talk characterizing interdisciplinary research as complementary:

a) Occludes underlying epistemological and ontological tensions emerging when genres interact in interdisciplinary programs

b) Naturalizes contingent practices emerging when genres interact across disciplinary boundaries

c) Removes tension and contestation as a viable rhetorical resource to create knowledge in interdisciplinary programs

To understand how meta-talk occludes tensions arising from interdisciplinary research and writing, it's helpful to once again turn to the concept of meta-genre. From a meta-genre perspective, assumptions that regulate beliefs about interdisciplinary research as complementary obscure how fraught navigating conventions can be when there is an imagined ideal (Giltrow, 2002b, p. 194). In other words, meta-talk reproduced by participants suggests the existence of a single status quo in interdisciplinary research and writing. The desire to collaborate on mutually beneficial research should be able to overcome disciplinary research and writing preferences. Indeed, this is not unique in interdisciplinary programs. In science writing at large, unwritten guidelines and conventions regulating what Myers (1989) called the "pragmatics of politeness" (p. 1) obfuscates the rhetorical work in which writers must engage. In an interdisciplinary context, however, negotiating hidden tensions and conflicts is particularly difficult. It's hard work because not only must writers learn how to juggle genre conventions across disciplines, they must do so under the guise of everyone getting along. Thus, when Aster, for example, encountered tension between different biological ways of thinking and writing, he was not presented with opportunities to confront the tensions he experiences. Aliya, too, encountered this contradiction when writing with the biologists. She experienced significant tension between the unwritten rules of computational biology and biology to the point where she spoke about not wanting her name on a manuscript paper because the analysis was *wrong*. Yet, when Aliya recounted this experience and tried to express the tension she encountered, she did so in a way that maintained dominant assumptions; that is, she *still* framed the collaboration as "win-win" and "complementary." This indicates that harmonious and complementary meta-talk about interdisciplinary research serves a particular function in interdisciplinary programs: it occludes tensions that emerge when genres interact at disciplinary boundaries.

In participants' talk about writing, meta-genres in interdisciplinary doctoral programs

occlude practices that may hint at friction or ontological discord and instead encourage people to

get along. In fact, in some cases, the assumptions reproduced by complementary meta-genres

caused interdisciplinary researchers give up on writing in between disciplinary divides and

search for an audience with a more closely shared history, as Victor and Stefan did. For Aliya,

Victor, and Stefan, the meta-genres in interdisciplinary research contexts naturalized disciplinary

discrepancies often and powerfully. Instead of negotiating claims and knowledge, participants

framed interdisciplinary research and writing as "sharing ownership" and ensuring research is

"mutually beneficial" to all parties.

Dominant assumptions that interdisciplinary writing should be complementary are

regularized by meta-talk controlling writers' engagement "in the collective…differentiating,

initiating, restricting, inducing forms of activity" (Giltrow, 2002b, p. 203). Meta-genre, even an

occluding one, patrols writers' engagement with genres; this, meta-talk that occludes the

rhetorical nature of writing signals an investment, or a continual reaffirmation perhaps, of a

particular understanding of science discourse. Significantly, although participants discuss

differences between what Knorr-Cetina (1999) has called epistemic cultures between science

disciplines – "cultures that create and warrant knowledge" that "in a given field make up *how we*

know what we know" (p. 1) – acknowledgements of differences do not tend to extend to written

discourse. Along with arhetorical meta-talk regulating assumptions about interdisciplinary

writing as just translating, harmonious meta-talk suggests that epistemic differences between

disciplines do not extend to science *writing*. As I discussed in the previous chapter, talk about

interdisciplinary writing suggests it is one thing: there may be differences in length, technical

language, and perhaps style, but on the whole science writing is fairly unified from discipline to

discipline. But as many writing studies scholars have found, science disciplines do not share a unified way of writing (Blakeslee, 2001; Myers, 1990; Schryer & Spoel, 2005) – there is not one status quo.

The consequences of *believing* in the existence of a single status quo, from an RGT perspective, are significant. Genres are discursive realizations of particular communities, in this case particular scientific disciplines. These disciplines, of course, have specific histories, exigencies, and consequently (re)produce specific social situations. Disciplinary genres can therefore be thought of as inherited forms of human collectives that evolve, but remain rooted within, a specific history (Freedman & Medway, 1994; Schryer, 1994; Starke-Meyerring et al., 2014). Disciplinary genres, then, reflect and reify particular ways of knowing, doing, being, and arguing, which helps explain why interdisciplinary doctoral writers encounter such tensions when writing in interdisciplinary programs.

The meta-talk surrounding writing implies that there is one status quo, one way of being a so-called good writer – interdisciplinary research is complementary, so students should not have any issues writing for diverse disciplinary audiences. From this perspective, Stefan should have had no problems communicating his research to a group of quantitative biologists so long as he translated his knowledge claims clearly and simply (cf. Rose, 1985). Of course, excerpts from participants indicate that this is not the case. When describing their encounters with interdisciplinary audiences, participants did not characterize the process of knowledge translation as easy. It was "hard work" (S_INT3). Yet, meta-talk and meta-genres give the impression that there is one status quo that students must adhere to in their writing, when in reality there are several. To meet these status quos, students must engage in a complex and fraught process of transforming written knowledge so that it becomes recognizable and acceptable to other

disciplines' historically situated ways of knowing, doing, being, and arguing. Blakeslee (2001) in her study of physicists writing to biologists, emphasizes the care and tact that physicists employed when learning about how to transform their work for a biology audience – an audience with different, but related, goals and different ways of arguing knowledge (cf. Myers, 1991).

In the interdisciplinary programs I explored, however, an added demand for participants is that disciplinary tensions are often avoided completely. In fact, the notion of tension between disciplinary writing conventions is rhetorical: it suggests that there are multiple competing interests, beliefs, values, and assumptions intersecting and interacting (Bawarshi & Reiff, 2010; Coe et al., 2002; Paré, 2002). Unfortunately, the data in this chapter suggest that tension remains largely unavailable to doctoral writers. The assumption that there is one status quo students must learn prevents them from engaging with the tensions they actually experience writing in interdisciplinary programs.

The data discussed above point to a significant contradiction between interdisciplinary research and interdisciplinary writing. While dominant meta-talk reproduces the assumption that interdisciplinary research and writing should be complementary, participants' experiences reveal that interdisciplinary work is not without tension. Yet, because of unwritten rules of politeness (e.g., Myers, 1991) tension remains largely elusive as a rhetorical strategy for writers. Instead, they are expected to get and on go on "despite hunches and suspicions" (Giltrow, 2002b, p. 201). In siloed fields, perhaps a meta-genre that evades contingent practices, that keeps everyone in line, isn't a bad thing. In these scenarios, naturalizing meta-genres ensure things actually get done. But I'd argue that in interdisciplinary research the act of occluding tensions produces added demands for students. When tensions are hidden by naturalizing meta-talk, the rhetorical

work remains an *unspoken* negotiation of *unspoken* interests – in other words, negotiations and contestations often get pushed aside because of implicit interests.

Chapter Summary

 This chapter traced assumptions about interdisciplinary writing and research by exploring the meta-talk of interdisciplinary life sciences doctoral students. Tracing doctoral students' meta-talk, I found that interdisciplinary research was often characterized as complementary. The aim, for participants, was to engage in research that could be beneficial across disciplinary borders. However, examining the experiences of doctoral writers illustrated that interdisciplinary writing and research was more complex than explicit meta-talk suggested. Doctoral writers experienced interdisciplinary writing as complex and encountered tensions between disciplinary expectations. These tensions, however, were often occluded by meta-talk regulating interdisciplinary writing as complementary and harmonious. Practices that were contingent across disciplines were naturalized and tensions between genres occluded. Under the guise of politeness and harmony, doctoral writers were faced with particularly hard work: not only did they have to carefully argue their research across disciplinary boundaries, they also had to do this work following politeness conventions. As such, tension often remained unavailable for writers, even though their narratives suggest that confronting tensions between genres may have been productive.

 This offers evidence that dominant meta-talk characterizing interdisciplinary writing as harmonious and complementary is a powerful regulating force in interdisciplinary programs. It has significant consequences for how doctoral writers learn to navigate epistemic and ontological conventions across disciplinary boundaries, which I explore further in the following chapter.

Chapter 6: Conventionalized, yet Unfamiliar and Uncomfortable – Identity in

Interdisciplinary Doctoral Programs

Up to this point, I've traced meta-genres that suggest interdisciplinary writing is a matter of translating, explaining, and clarifying. Further, these meta-genres regulate assumptions that interdisciplinary research and writing should be harmonious and complementary. The contradictory nature of participants' meta-talk – and indeed some explicit institutional meta-genres – indicate the existence of implicit meta-genres occluding tensions and contingent practices. Interdisciplinary writing should be a process of translating jargon and explaining concepts clearly, but involves a great deal of justifying and arguing. Interdisciplinary writing and research should be harmonious and complementary, but participants discuss encountering tensions. Contingent practices are naturalized and made to seem *common sense*, with meta-genres patrolling how students are able to participate in interdisciplinary communities. These meta-genres, and the meta-talk that accompanies them, all provide a sense of the context of writing; that is, meta-genres help reveal what actions are possible in a collective, what is restricted, and control how individuals can participate in these collectives (Giltrow, 2002b). Thus, in teasing out meta-genres existing in interdisciplinary life sciences doctoral programs, I am also tracing how these meta-genres enable and constrain doctoral writers' participation within interdisciplinary communities.

Building on the findings established in previous chapters, in this chapter I focus on how students develop and negotiate their identities across disciplinary boundaries. Doctoral writing has been identified as a key site where doctoral students develop identities (Aitchison et al., 2012; Jazvac-Martin, Chen, & McAlpine, 2011; Kamler & Thomson, 2014), yet little of this research has focused in identity in interdisciplinary programs (cf. Hibbert et al., 2014). I aim to

understand how doctoral students develop scholarly identities through writing in interdisciplinary programs where disciplinary boundaries become blurred and overlap (Lattuca, 2001). Where disciplines meet, implications of arhetorical talk about writing have significant implications for students' identity (Kamler & Thomson, 2014). Arhetorical meta-talk has been found to create paradoxes wherein students are expected to come into the doctorate having acquired the historically and socially situated and value-laden genres of their field and experience guilt and failure when they have not (Starke-Meyerring, 2011). Internalizing failure and guilt over being somehow deficient as a writer are particularly damaging to students' developing identities. Similar arhetorical meta-talk exists in interdisciplinary programs, as I have shown in this dissertation (see Chapter 4), and my goal in this chapter is to delve into the implications of interdisciplinary meta-genres for students' identities.

To begin this discussion, I briefly return to how I conceptualize identity as a rhetorical construction and negotiation. I then outline how students experience writing and go on to discuss the costs and possibilities of tensions hidden by dominant meta-genres for students' identities.

Understanding Identity

Since I'm largely concerned with doctoral writing in interdisciplinary life sciences, my discussion about identity assumes that students' ability to adopt specific genre-d identities has a significant impact on their ability to succeed and participate within the doctoral process. To explore writing as a way in which identity is developed, negotiated, and enacted, I start by returning to my earlier discussion of genre theory to conceptualize identity as rhetorical.

I've already discussed identity as a rhetorical negotiation in which individuals produce genres in particular ways to position themselves as members of a community (see Chapter 2). In doing so, I have conceptualized the process of identity negotiation and construction as a complex

and non-neutral process: by learning to produce a genre, students learn how to position themselves within a community, how to enact particular values, and indeed what values are worth having in the first place. As Bawarshi (2003) argues, "we cannot understand genres as sites of action without also understanding them as sites of *subject formation*…[producing] subjects who desire to act in certain ideological and discursive ways" (emphasis added, p. 78). That is, learning to produce a particular genre is, in essence, learning how to produce a particular kind of identity (Bawarshi & Reiff, 2010). When individuals learn to produce genres, they are also learning about the subject positions (i.e., the identities) made available by the genre's inherited collection of values, practices, and assumptions. Genres, in other words, make available particular kinds of subject positions to writers. Thus, when I use the terms *subject position* and *available identities*, I am referring to the implicit assemblage of expectations, values, and practices shaping the identities that writers are expected to enact or negotiate to achieve a particular social action.

In learning to produce a historically situated and non-neutral genre individuals must learn to enact particular ways of being, even though the histories from which these genres emerge can make for difficult experiences with identity. Tensions can arise from producing genres with unfamiliar or uncomfortable beliefs stemming both from individuals and situations (Paré, 2002). In understanding identity as rhetorical and negotiated, there has to be space in this conceptualization to allow for identity to be messy. The non-neutral nature of genre has an important impact on the kinds of identities that writers can assume. As Bawarshi (2003) and Paré and Smart (1994) point out, the power of genre to conventionalize is such that roles and identities in a particular community are on the whole regularised by the community.

By conceptualizing identity negotiation as a rhetorical process, I view identity as a *situated*, *non-neutral*, *negotiation* that occurs implicitly (Artemeva, 2006; Bazerman, 2002; Devitt, 2004). The ways in which interdisciplinary doctoral writers are positioned, and try to position themselves, as they participate in learning and producing meaningful genres is negotiated and co-constructed with readers, reviewers, and other community members. While genre-d identities assume particular positions for doctoral writers, these positions are sometimes fraught with tension that students must negotiate, particularly should the positions that genres make available do not resonate with students' goals, aims, assumptions, or beliefs (Freedman & Adam, 1996; Paré, 2002). A rhetorical understanding of identity acknowledges that identity is a non-neutral and situated negotiation that positions writers in particular ways and aligns them with particular ontologies and epistemologies. This conceptualization of identity provides a means of understanding how the tensions between genres, and *meta-genres*, have consequences for the identities of interdisciplinary doctoral writers.

To trace how participants negotiated their identities in interdisciplinary programs, I return to the data I generated with participants and tease out patterns of significant statements. I should again note that there are several conduits for identity development; writing, while only one of them, is my focus. To locate narratives about identity, I approached the interviews with participants using the rhetorical genre frameworks outlined in Chapter 3. My analysis focused on examples of how participants experienced writing and how this enabled and constrained the ways in which students were able (or unable) to negotiate identities in interdisciplinary programs. Examples emerging during my inquiry ranged from participants successfully negotiating identities across diverse genre expectations to participants blaming themselves for struggling to give their audiences what they wanted. Exploring accounts of participants'

struggles and triumphs enables an analysis of how dominant regulating assumptions influence students' understandings of their experiences and how they negotiate identities across disciplinary boundaries.

Looking for Identity

Below, I trace the patterns I saw emerging in the data revealing insights about identity in interdisciplinary life sciences doctoral programs. I'll reiterate that although identity can be negotiated and developed through several conduits, my interest lies in *writing* as a locus of identity development and negotiation. When looking for identity, I traced how participants talked about writing experiences and what these experiences revealed about their attempts to position themselves (Burr, 1995) and genre themselves (Bazerman, 1994) into particular identities. As such, I saw identity talk not only as participants characterizing themselves (e.g., I'm an interdisciplinary scientist), but also as participants grappling with the kinds of identities afforded to them (e.g., you're not a biophysicist). Specifically, using an RGT framework (see Chapter 3), I saw identity talk in how participants spoke about what they could and could not say, the goals they could and could not have, the practices in which they had to participate, and the values they were expected to reproduce. Further, I was less concerned with identities afforded by individual genres than the identities made available to students through explicit and implicit meta-genres (Chapters 4 and 5 traced these meta-genres in more detail). I begin with a pattern emerging from explicit talk about writing experiences – talk that suggests identities (like genres) are normalized by meta-genres. I then trace how this conventionalization is called into question by participants who experience writing themselves into uncomfortable and unfamiliar identities. Finally, I outline how participants' experiences suggest that genre-d identities exist in tension with each other.

Identities are *taken-for-granted*, often leading to struggles with fitting in. To begin my analysis of identity, I illustrate a trend that suggests explicit meta-genres and direct meta-talk (see Chapters 4 and 5 for more detail) conventionalize identity in interdisciplinary life sciences doctoral programs. Just as genres conventionalize assumptions about writing, knowledge, and reality, they also conventionalize the roles and identities available to writers (e.g., Bawarshi, 2003; Paré & Smart, 1994). The identities made available through genres are often taken-for-granted – they are so entrenched in disciplinary communities that newcomers often struggle to *fit in* with established yet implicit values, beliefs, and identities (e.g., Artemeva, 2006; Paré, 2002). The consequences of such struggles often emerge as beliefs about newcomers' (in this case doctoral students') inability to produce acceptable examples of disciplinary genres. These beliefs, in turn, deeply affect how newcomers construct their identities within particular communities (e.g., Starke-Meyerring, 2011).

This section traces how, in the absence of explicit regulations, interdisciplinary students were negotiating identities that were conventionalized to the point of being taken-for-granted and common sense. As a result, participants were surprised when their attempts to genre themselves across disciplinary fields were challenged. The conventionalized nature of identity in interdisciplinary programs, much like the conventionalized nature of arhetorical meta-talk, left participants struggling to negotiate recognizable identities across disciplines. Taken-for-granted and implicit assumptions about identity emerged in data as stories about participants struggling to fit in with the ways of knowing, doing, being, and arguing of interdisciplinary communities.

Taken-for-granted assumptions position students as not knowing the rules. At times, the taken-for-granted nature of identity emerged as participants not *knowing the rules*. That is, in the absence of rhetorical guidance (i.e., guidance recognizing the situated and inherited nature of

writing), participants were left to believe that they were deficient or unable to fit into particular

communities. Aster, the only participant to have completed his doctorate (at the time this study

was conducted, at least), spoke about encountering such struggles fairly regularly. Indeed, Aster

talked about failing his first attempt at the dissertation and his growing disillusionment with

science writing generally. Aster talked about a particular chapter that was deemed problematic in

some detail: the vignette (also discussed in Chapter 5). The vignette, as I've written before, was

rejected by readers, even though, as Aster explained, the ideas in the chapter were not radically

different from ideas in most developmental biology manuscripts. The difference, he said, was

how the chapter constructed issues relevant to developmental biologists. Aster discovered that

this chapter did not conform to the conventions prevalent in developmental biology – Aster was

asking questions he should not have been asking and making arguments he was not supposed to

be making. Aster admitted that he often found himself wondering, "how do I work this into

narratives that are socially acceptable? [….] I […] have problems getting it to the form that

people want" (As_INT3). A struggle for Aster was navigating socially acceptable forms; in other

words, navigating *genres* that other developmental biologists would recognize and accept. Of

course, working data into socially acceptable forms is not particularly easy – especially when so

often these forms are implicit and taken-for-granted. When trying to rewrite the dissertation

chapter, Aster talked about developing "a lot of disillusionment about [writing]… I do feel like

there should be a consciousness about participating in these discussions and the fact that you are

making these types of points" (As_INT2). As Aster explained, he felt that he and many others in

his field lacked a consciousness about what their writing was doing.

  As a result, Aster often talked about feeling like a poor writer (often before my recorder

was turned on or after it was turned off), saying that he felt as though:

> There's already a process to try and figure out who has […] intuition about what is the kind of writing that makes sense in a scientific context […] If my writing is already poor, I don't think that they have the generosity […] to say, 'well this is what it seems like you're saying and this is why it doesn't quite make sense' or something like that. (As_INT2)

Aster's experiences with writing often entailed some sort of struggle: he talked about feeling cut off from the developmental biology community and not having an adequate understanding of how to position his work so that it could be recognized. Interestingly, Aster mentioned his belief that there is a process to figure out who has writing intuition. Aster described this as a "winnowing process" (As_INT2), saying that those *without* intuition about how to write are left to muddle along on their own. Also notable is how Aster positions himself as a writer lacking an innate sense of what science writing should look like. For Aster, the taken-for-granted assumptions about how to write to be recognized as a developmental biologist were limiting. He was not only unable to access any kind of support to learn *why* his bids to be recognized were being challenged, but he also identified himself as a problematic writer. Aster reiterated his struggles with figuring out implicit rules that everyone else seemed to understand, saying:

> I do have a lot of problems with grappling with those implicit expectations. […] I *don't* have a very good way, or at least the way people *get* expectations and get that implicit, 'oh, this is what I'm supposed to explain my [ideas] against' is something I've had a really hard time with. And I think the reason other people don't have a hard time is because it's just they are more implicitly communicated than […] when I present something. (As_INT3)

Notable in these excerpts is the struggle to tease out conventionalized ways of arguing and being. Aster talks about needing intuition and a consciousness about writing to grapple with implicit expectations, but also points out that he never felt he was able to write his way into this way of being. Indeed, he admits that he has had problems conforming to implicit expectations throughout the doctorate and even after graduating speaks about feeling as though he doesn't fit in.

Taken-for-granted identities differ across disciplines. Narratives about struggling to learn accepted ways of thinking, being, and arguing emerged from other participants as well. Aster's experiences illustrate how taken-for-granted assumptions about genre and identity have consequences for writers' ability to fit into their communities. Other participants, though, recounted experiences where the taken-for-granted identities available to them were different across disciplines. Victor, one of the biophysicists, also spoke about struggling against taken-for-granted expectations about how to negotiate identity. For Victor, many of these examples emerged from his experiences collaborating with biologists and experimental physicists. For instance, Victor spoke about collaborating with a group of cancer biologists with the goal of applying his research to reduce complex and unwieldy biological cancer models. Although there was a great deal of initial excitement, the project eventually fell apart. When talking about why this project never came to fruition, Victor explained one reason was that he and the physicists working on the project:

> Realized we were quite naïve going into this biology field with our premade idea of what biology was. And it's something people say about physicists, they try to solve everyone's problems with their own conceptions of what your problem is [….] but as a matter of fact, the problem is really different, it's more complicated than that. (V_INT1)

In this case, Victor and his fellow biophysicists entered into the collaboration with taken-for-granted ideas about what the biologists wanted and needed. They tried to genre themselves using these expectations, but as it turned out they were attempting to negotiate with the wrong kinds of assumptions, arguments, and beliefs. Victor's taken-for-granted idea of biology did not match the biologists' and resulted in Victor being unable to fit in with them. The mismatch of expectations and goals, in fact, suggest that both groups had different values and assumptions and thus different subject positions. They were enculturated into different scientific practices and so occupied different identities.

Victor also spoke about the challenge of fitting in when recounting an experience at a biophysics conference. At this conference, Victor presented a poster that was meant for a fairly broad interdisciplinary audience. Because the conference was supposed to be about biophysics, Victor assumed that his poster would generate conversation with other attendees; however, the conference audience did not match Victor's expectations. In fact, Victor revealed that when he left the conference, he wondered whether he could be considered a biophysicist at all:

> Turns out, I'm not a biophysicist. I do some kind of quantitative biology or something. That conference was all about molecular dynamics and people that were looking in this very specific protein, have done crystallography on it, seeing its shape and thinking, 'if I add this molecule over there it's gonna bend this way…' So the whole conference was about that. So I'm not a biophysicist maybe? I don't know. (V_INT1)

Again, note that Victor's taken-for-granted assumptions about the interests and practices of biophysicists were challenged. He left the conference wondering if he needed to reframe his field: was he a biophysicist? A quantitative biologist? Something else entirely? Like Aster, Victor's experiences trying to genre himself into interdisciplinary collaborations and

communities met with some friction and made him question whether or not he actually fit into the biophysics community. When trying to navigate the expectations of multiple fields – biology, theoretical physics, experimental physics – Victor encountered multiple assumptions about what could be said, by whom, and when. These assumptions, of course, are part of what make up the kinds of identities genres make available to writers. Because these identities are largely conventionalized and taken-for-granted, however, Victor was surprised when he encountered a biophysics identity that did not resonate with his expectations.

The above narratives suggest that participants struggled to fit into identities conventionalized by genres, but they also struggled to *recognize* these conventionalized identities in the first place. Aster and Victor only started to recognize that their attempts to genre themselves into particular subject positions were unsuccessful when they faced challenges from others. Diana had a similar experience. At the beginning of her second year in her doctoral program, Diana gave a conference talk to a group of biomedical scientists. Two days before her talk, Diana met with her supervisor and one of her supervisor's colleagues to go over Diana's presentation. At this meeting, Diana was asked to completely redo the beginning of her talk because it would not resonate with medical biologists. Diana realized, after she had been given "a million suggestions for how to change the introduction" (D_INT3), that she had been trying to genre her research (and by extension herself) to a different kind of audience. As Diana said, "I didn't realize there was much of a difference [between biologists and medical biologists] [….] I hadn't realized there was a difference between if you're talking to a [medical] audience versus a biophysics audience" (D_INT3). The presentation, Diana said, was very well received, but this was in part because Diana was able to write herself and her work into conventionalized forms

that her medical audience responded to. To do so, however, Diana had to genre herself into a position recognizable to medical biologists.

The taken-for-granted nature of identity prevents students from consciously reflecting on their positionalities and identities. Notable about participants' stories of struggling to fit in and – in Diana's example – scrambling to adapt to new conventionalized identities is the embedded nature of identities within genres. That is, as mentioned above, the identities genres make available to writers are often hidden and taken-for-granted. In interdisciplinary doctoral programs, this can prevent students from reflecting on, or even acknowledging, how the identities they are negotiating may shift or be resisted across fields. Instead, identity is conventionalized to the point where students are unlikely to think about it at all. Aliya admitted that had she not been confronted with such questions during her participation in this study, she would not have been thinking about her positionality between disciplines. During her final interview, Aliya explained:

> I actually don't think I would have been thinking about [identity] at all actually, and positionality […] I think interdisciplinary was a good enough, broad term for me. Especially in my program, that's just *all* we can say about ourselves. We're interdisciplinary, there's *nothing* more specific we can be. It's very varied. (Al_INT3)

Notable in this excerpt is Aliya's belief that in an interdisciplinary program *all* she and her colleagues could say about themselves was that they were interdisciplinary. The variation in research is such that Aliya feels they cannot be more specific about how they align themselves. But she also points out that in confronting taken-for-granted labels (e.g., "interdisciplinary was a good enough, broad term"), she was pushed to think about how she fit in and navigated conventions that others seemed to struggle with.

The taken-for-granted nature of genre, and hence identity, also emerged in talk about how participants perceived others' expectations of them. That is, in their experiences with writing and interactions with their scholarly communities, participants spoke about feeling pressure to understand implicit rules about genre and identity upon entering the doctorate; that is, they felt pressure to fit in with taken-for-granted conventions immediately. Victor, for example, claimed that others "expected [me] to have the same [knowledge] as [my] supervisor […], but I mean it's not realistic to expect that" (V_INT3). As Victor explained, though, without experience negotiating with diverse audience, fitting in is hard. Victor's experiences suggest that identity is conventionalized to such an extent that doctoral students are expected to be able to navigate inherited and non-neutral genres across several disciplines. Stefan, too, spoke about expectations that he found difficult to meet. Like Victor, he explained that as an interdisciplinary doctoral student, "if you come from a Master's program then you'll be thrown into work and expected to do certain things and you're like, really? I don't know how to do this" (S_INT3). Aliya, too, talked about wanting to be able to contribute more to her research community, but feeling as though she lacked the knowledge and experience to do so. As Aliya said, "I feel like a baby Ph.D. student, [and] I was really building the background for this project as we were doing it, whereas my [supervisor] obviously had many years of experience in this field" (Al_INT3). This echoes and extends previous insights into students internalizing failure and challenges to their identities. In *siloed* disciplines the cloak of normalcy shrouds the social and situated nature of genres and, as Starke-Meyerring (2011) argues, denies "writing as a site of…identity production in doctoral education" (p. 91). In interdisciplinary doctoral programs, ignoring writing as a site of identity production means that students are effectively prevented from recognizing the nuanced differences in how identity is constructed across disciplines. Victor's experiences, for

example, suggest that while taken-for-granted rules did not necessarily lead him to the belief that

he was a poor writer, he encountered challenges when trying to adapt a taken-for-granted identity

developed learning physics genres to biologists.

Just as genres conventionalize ways of knowing, being, doing, and arguing, they become

taken-for-granted and conventionalize the roles available to writers (Paré & Smart, 1994). The

identities genres make available are entrenched in "how we are socialized to respond to recurring

situations" (Bawarshi, 2003, p. 97). For instance, social workers are encouraged to use

impersonal language when writing reports so they can maintain a position that keeps them

detached from their clients (e.g., Paré, 2002). The positions made available by the social work

report encourage some identities and discourage others (e.g., personal attachments, opinion).

Even though these identities may be uncomfortable or unfamiliar for social workers, they are

expected, when they produce reports, to write themselves into an impersonal identity. As the

above excerpts illustrate, participants often struggled to genre themselves into subject positions

acceptable to their audiences. Even in cases where students were able to fit in with

interdisciplinary communities (e.g., Diana and Aliya), identities remained largely

conventionalized and taken-for-granted.

Although genres do conventionalize identities, these positions are not set in stone. That

is, even though there are certain identities that genres make available, there is always room for

improvisation, resistance, and transformation -- *especially* when genres interact (Bawarshi, 2003;

Giltrow, 2002b). In the interdisciplinary doctoral programs I explored, where multiple

disciplinary ways of knowing, doing, being, and arguing interacted, participants had to negotiate

several conventionalized identity practices.

Participants encountered identities that were uncomfortable and unfamiliar, and existed in tension with each other. When tracing how identities were conventionalized by meta-genres in interdisciplinary life sciences programs, I noted that participants often struggled to fit into with their community's ways of knowing, doing, being, and arguing. Genres are, after all, historical, situated, and non-neutral. When writers learn to produce a genre they are also learning to produce a certain set of practices, beliefs, and ways of being – they are learning to produce a particular kind of identity (Bawarshi & Reiff, 2010). Learning how to produce and negotiate genre-d identities, however, occurs implicitly. Thus, when students encounter genres that are unfamiliar, they are also encountering an unfamiliar set of practices and beliefs – an unfamiliar *identity*. These encounters can be quite uncomfortable for writers, particularly writers trying to *develop* a scholarly identity. Many of these narratives, upon closer inquiry, suggested that participants were encountering genres that offered subject positions with values, assumptions, and ways of arguing that sat uncomfortably with their values and beliefs. That is, participants were struggling with taken-for-granted identities in part because they were negotiating several value-laden and inherited genres.

When only uncomfortable identities are available, students are restricted from meaningful engagement across disciplines. Several examples of participants encountering uncomfortable and unfamiliar identities come from Aster. In fact, Aster's experiences with writing were rife with examples of him confronting, challenging, and struggling with expectations and positionalities that he often found uncomfortable. One example that stands out as a powerful illustration of the kinds of uncomfortable identities interdisciplinary writers encounter comes from his experience writing the dissertation. Aster's first attempt to pass the dissertation was failed and Aster spoke at some length about the conflicted feelings he

experienced when re-writing the dissertation. When speaking about the revision process, Aster revealed that although he felt he became a better writer, he didn't feel as though he became a better *scientist*. In Aster's words, "I did become a better writer, but on the other hand it was just a mastery of the form" (As_INT3). Aster went on to explain his belief that mastering the form required by the dissertation made him a socially acceptable scientist, but that he felt there were issues with what his field deemed socially acceptable. Indeed, Aster said that he eventually came to see the mastery of a form as a way of gaming the system. As he explained:

> I realized that if I wanted to commit academic fraud, then it is through the mastery of that form that you actually kinda gain the tools to do that. I basically learned all the things that I would say, on one hand, makes me a more socially accepted scientist, but on the other hand […] is that kind of socialized process [that lets] people shove problems under the carpet, or ignore things, or are able to focus narratives away from the issues that they have. (As_INT3)

Re-writing the dissertation, Aster was forced (if he wanted to pass, at least) to adopt a form, and thus an identity, that made him a more socially acceptable scientist. In other words, he had to produce a genre that other developmental biologists would recognize and accept. But, in doing so, Aster spoke about having to work in a form that sat uncomfortably with his own beliefs about what it means to do science. It restricted him from focusing on and engaging with issues that he felt were important, but that others would rather ignore. After all, the power of genre to conventionalize identity meant that Aster had to abandon some of the issues he felt were important. He had to instead take up socially accepted and recognized positions, despite these positions being at odds with his beliefs about what constitutes good science. Although Aster's

dissertation did pass, Aster had to write himself into a subject position that he continued to find

problematic months after graduating.

While Aster did admit that he had learned to think "about […] things that people like and

how to better appeal to those types of references" (As_INT3), he made it clear that he did not

think this was the mark of a good scientist. As he clarified:

> I would never confuse a facility in movement in any kind of social circles with [a] of
>
> mastery of science or reality. […] If you're doing interdisciplinary science it's good to
>
> have a mastery of that socialization [….] but it's there so that other people don't have to
>
> learn and don't have to think terribly hard about the ideas that they're communicating.
>
> (As_INT3)

Although Aster was able to genre himself into an identity that other developmental

biologists could recognize and accept, he talked about that identity being uncomfortable. He

pointed out that being able to write to be recognized by interdisciplinary audience, to facilitate

his own movement in these disciplinary circles, did not necessarily indicate a mastery of science.

In fact, Aster problematized the genre-d identity that the dissertation required. The genre of the

dissertation required Aster to ignore problems, focus away from underlying issues in the field,

and maintain a status quo that (to Aster's mind) let people off the hook from thinking too hard.

Indeed, Aster admitted that he was frustrated with the way he had to write the dissertation and

revealed that the expectations he had to meet were largely a result of "pretentious experimental

biologists being pretentious" (As_INT2). In the end, Aster had to negotiate an identity position

that did not sit comfortably with his established beliefs about what science writing, and in this

case the dissertation, should be. Instead, he had to negotiate his identity with "pretentious"

experimental biologists.

When writing in interdisciplinary doctoral programs, other participants also spoke about encountering genres with unfamiliar and uncomfortable subject positions. Stefan, for example, reflected on his experience writing a manuscript for an interdisciplinary journal. This experience was documented in detail in Chapter 5, but elements of this narrative also speak to the unfamiliar identities students must navigate at disciplinary borders. As mentioned, this manuscript was rejected by biology reviewers, who struggled to find new science and relevance in the paper. Although Stefan had tried to engage with biology audience, his writing was not recognized as meaningful by the reviewers. This was especially frustrating for Stefan because the point of his article was to *help* biologists facilitate their research. As a result of the reviews, Stefan admitted that the paper would be revised for a totally different audience. As he said, "based on all of the things we heard from the reviewers, we'll make some adjustments […] but we're purely gonna address physics people because they'll be the ones who like this" (S_INT2). Note here that Stefan decides to just focus on physicists and give up on writing this paper to biologists. The values, assumptions, and ways of arguing embedded in the genres Stefan is used to producing – and this the genre-d identities is used to negotiating – are not recognizable to biologists. The practices and values that allowed Stefan to identify as a biophysicist are the same that *prevented* him from being recognized by biologists. The two sets of writing conventions existed in tension with each other. To negotiate an identity recognizable to biologists, Stefan would have had to adopt unfamiliar or uncomfortable ways of writing.

While Stefan still felt his work to be a combination of physics, biology, and computer science, he explained his orientation to these fields shifted. Stefan revealed that much of his work is now directed to physicists and computer scientists as these fields have similar ways of understanding and arguing the phenomena Stefan studies. As Stefan said, "[computer] scientists

[…] have for some reason a more accepting view and they appreciate this. And physicists, because we're physicists ourselves, we're a physics department, this is a biophysical model of physics thinking" (S_INT3). Although Stefan talks about exploring elements of biology in his work, he largely changed his orientation to the biophysics field because the expectations of biologists were so unfamiliar and uncomfortable. It was an identity position Stefan was unwilling to negotiate. Doing so would have meant abandoning assumptions and values that made him recognizable as a biophysicist.

The productive potential of engaging with unfamiliar identity conventions. Victor also recounted experiences in which he encountered unfamiliar identity conventions when writing across disciplines. One such incident occurred when Victor was preparing a presentation for his doctoral committee. This presentation was an update on his research and meant to provide an opportunity for Victor's supervisor and committee to comment on his progress. Victor spoke about this presentation as an opportunity to position his work to committee members (a bioengineer and experimental physicist) as meaningful and important. Both of Victor's committee members are experimental scientists, whereas Victor's work is largely theoretical. In designing the presentation, Victor spoke about the necessity of genre-ing his work in an experimental frame. As he said, "I didn't want to look like the theorist in his ivory tower [….] I wanted to show that we can apply our method and it's useful" (V_INT3). Victor also admitted that learning how to explain his work so that it could be recognized by experimentalists was difficult – their interests and their ways of arguing and understanding science were unfamiliar to him as a biophysicist. As Victor said, "I'm still a physicist that tries to apply math and physics to biology to […] *uncover* first principles or uncover laws that define nature" (V_INT3). As Victor engaged with these groups, however, he realized that to genre himself to experimentalists, he had

to start changing his perspective. He had to become familiar with assumptions that were

unfamiliar to him and, sometimes, at odds with his goals. For instance, Victor's research aims to

simplify complex models. To ally himself with biologists, Victor had to learn to "tailor

[research] more to what they care about" (V_INT3). In tailoring his research, Victor was not just

learning about a new way of writing his research, he was learning a new set of rules governing

what he could write, when, and how. Learning the conventions of unfamiliar genres helped

Victor avoid being positioned as an outsider, despite these conventions sometimes being at odds

with his beliefs as a physicist.

These examples have shown how students in interdisciplinary life sciences programs

encounter genres that make available identities which are uncomfortable and unfamiliar. The

subject position Aster had to write himself into for his dissertation enabled him to pass and be

recognized by his community; however, this subject position also forced him into an

uncomfortable position. He felt he was ignoring problems and sweeping issues under the rug.

Stefan's position was challenged by biologists and, rather than negotiate an identity at odds with

his expectations, he shifted his research agenda. Victor had to compromise his position as a

biophysicist to that he could collaborate with experimentalists. To work across disciplinary

boundaries, participants were forced to negotiate identities that were contradictory to taken-for-

granted assumptions. Indeed, these examples suggest that tensions emerge when participants are

working across disciplinary boundaries. This is significant because it suggests that the identities

made available by genres interdisciplinary students encounter exist in tension. The subject

position made available to Aster, for example, in his dissertation is at odds with Aster's own

beliefs about what interdisciplinary writing should do, for example. The tensions that emerged

when participants did encounter uncomfortable and unfamiliar identities often resulted in their

identities being challenged by members of other fields. When their identities were challenged, participants were left blaming themselves for failing to fit in. As I mentioned above, Aster characterized himself as a poor writer throughout the interview process and during his last interview admitted that writing "hasn't stopped being a challenge" (As_INT3). Even as Aster was working on a post-doc, he admitted that he still saw the acceptable, socialized writing he was doing as problematic and continued to encounter resistance to his attempts to push genre (and identity) conventions. Aster revealed that he wondered "about whether or not I have a place for any of these ideas at all, or an audience" (As_INT3).

The uncomfortable and unfamiliar identities encountered by participants echo findings about tensions between identities made available by genres and other subject positions writers occupy. Aster, for instance, was forced to occupy a subject position that he felt ignored important issues in his field so that he could be recognized as contributing to developmental biology. This echoes Paré's (2002) discussion of Inuit social workers. These social workers were identified as poor writers because their reports were not impersonal or detailed enough to be used in legal assessments. The subject position made available by the social work report conflicted with the Inuit social workers' desires to protect already vulnerable members of their community. In transforming community members' problems into a detailed and impersonal bureaucratic genre, the social workers risked betraying a community that they were deeply entrenched within. The genres produced by participants in this study also at times pushed writers into subject positions where they did not feel "at home" (Bawarshi, 2003, p. 99).

But, where tensions arise so, too, do possibilities for change and resistance. As Bawarshi (2003) argues, "resistance rises from the contradictions individuals experience in their multiple subject positions" and this resistance may actually be "an effort on the part of writers to work …

through the contradictory subject positions and relations they assume as they write various

genres" (p. 100). While there were examples of students conforming to the subject positions

made available by genres, there were also instances where students engaged with tensions

between subject positions and resisted and transformed the identities they assumed.

Resisting genre-d identities. Though rare, I did see examples of participants trying to

resist some of the values and assumptions inherent in the genres they were producing. The

clearest example comes from Aliya's experiences during her rotation in a biology lab. I've

written about this experience extensively in Chapters 4 and 5, but this example is a powerful

illustration of how genre norms, and consequently identities made available by these norms, may

be successfully resisted. Readers may recall from Chapter 5 that Aliya often characterizes about

her collaboration with the biologists as "win-win" and complementary. Yet, when explaining

why she asked to help re-write parts of the manuscript, Aliya admitted to perceiving problems

with the paper. Speaking about this experience, Aliya revealed that the issues she perceived were

so severe she did not want her name on the paper. In her words, "I didn't want my name on

something that I thought was incorrect and I didn't want them to write up my results that they

probably possibly didn't fully understand and to have that conflict" (Al_INT2). Instead of

putting her name on something incorrect, Aliya made a risky move for a first year doctoral

student: she resisted. In asking to rewrite a portion of the paper, she said she realized that she and

the biologists had different ways of explaining things. As she explained, "there was definitely

negotiation about what to include. [….] I really worked on the text that they had so it wasn't a

totally unrecognizable thing, but there were ways of explaining things that I modified"

(Al_INT3). When working on the manuscript, Aliya was in a tricky position: she encountered a

situation where taken-for-granted subject positions made available by meta-genres were not

conducive to *her* goals and interests. Her values and position as a computational biologist was in conflict with the positions made available by the genre produced by the biologists. What they saw as acceptable findings were, to Aliya, wrong. Aliya, though, was resourceful in resisting the identity position made available in the biology genre. Instead of writing herself into an uncomfortable subject position to be accepted by the biologists, the negotiated underlying tensions. In doing so, Aliya was able position herself so that she could make the claims she felt was important as a computational biologist without totally rejecting or conforming to a subject position she wanted to resist.

Again, I want to emphasize that examples of participants *successfully* resisting and transforming subject positions made available to them through implicit meta-genres were rare. Indeed, Aliya was the only participant who was able to genre herself into an identity that resonated with the values and beliefs of computational biologists. Aliya, though, was not the only participant who tried to resist the identities inherent to genres she was producing. Aster, too, attempted several times to resist identities made available to him through experimental genres by using analogies like the vignette. Of course, as illustrated above, these attempts were never successful and Aster was forced to negotiate roles that, for him, were very uncomfortable and left him wondering whether he had a place in academe. Thus, while resistance is possible, participants' narratives suggest that it is by no means easy. Disciplinary values, assumptions, and identities are deeply rooted and tough to change, even in contexts where these values come into contact with each other. Yet, instead of making it easier for interdisciplinary researchers to negotiate and transform subject positions available to them, implicit meta-genres are even less likely to be surrendered (Giltrow, 2002b). That is, while resistance does appear to be possible, it is not easily achieved.

Complexities, Nuances, and Potential for Resistance in Interdisciplinary Genre-d Identities

At this point, I want to explore what the above narratives suggest about the nature of identity in interdisciplinary doctoral programs; that is, how identities are developed and negotiated in interdisciplinary contexts. The patterns I have traced in this chapter suggest:

a) Identities in interdisciplinary programs are conventionalized and assumed to be stable across disciplines, but

b) Students in interdisciplinary programs are confronted with identities that they may find uncomfortable and that may exist in tension, and

c) The tensions between subject positions can lead to resistance and transformation, although this can be inherently risky for students.

These patterns suggest some meaningful insights into how meta-genres regulate identity negotiation and development in interdisciplinary programs. To explain how and why, I return to an important point about how I conceptualize identity: learning to produce a particular genre is essentially learning how to produce a particular kind of identity (Bawarshi & Reiff, 2010). When students learn to write particular genres, they are learning how to enact a particular way of being within a particular situated context. Even as individuals bring their own idiosyncrasies to these subject positions, they are on the whole regularized by the larger disciplinary community. Evidence of this can be seen in how participants try to write themselves into conventionalized identities made available by the meta-talk and meta-genres patrolling interdisciplinary doctoral writing. The same meta-genres and meta-talk that suggest writing is a matter of explanation (see Chapter 4) and that it should be mutually beneficial (see Chapter 5) also normalize identity. Participants spoke about implicit expectations and socialization, about feeling naïve about their expectations of interdisciplinary researchers, and about their struggles to meet elusive

expectations. This suggests that explicit meta-genres provide only the haziest sense of what constitutes the values, beliefs, and roles of interdisciplinary researchers. Taken-for-granted expectations about identity are a result of several different *disciplinary* expectations: experimentalists recognized one kind of identity and theorists another, biologists one kind of identity and physicists another. Since the identities afforded by explicit meta-genres are so hazy, participants were left to struggle against uncomfortable subject positions. They were forced to negotiate subject positions that were at times in conflict and were only rarely able to resist these subject positions. Instead, participants were often left confused or frustrated as to *why* they were not being recognized by interdisciplinary research communities. Recall Aster's frustration with pretentious experimentalists, Victor's confusion as to whether he was really a biophysicist, and Stefan's struggle with ill-informed biologists. Aliya and Diana, too, encountered instances where their attempts to negotiate their identities were met with disinterest or were challenged.

Examining the assumptions regulated by meta-genres, then, helps us understand the risk students take when contradicting or attempting to subvert established norms. Meta-genres promise students that, if they follow the rules, if they translate, if they co-operate with others, their writing will eventually be accepted. The meta-genres I have traced suggest all scientists are on the same team, after all. But there is ample evidence that this is *not* the case, which has significant implications for students' identities. Aster, for instance, has his dissertation failed and is forced to adopt a form that he sees as problematic and that appears to ostracize him from other scientists—as he said, he wonders whether he or his ideas even have a place in academe. Stefan and Victor presume that their attempts to write manuscripts to interdisciplinary audiences will be rewarded, eventually, but tensions and contradictions between genre conventions prevent them

from effectively positioning themselves to interdisciplinary audiences. Furthermore, the power of meta-genre is such that they are not, as Giltrow writes, "lightly surrendered" (p. 199).

Identity is conventionalized to the point where it is assumed that there is only one status quo: an interdisciplinary one. As Aliya said, the only thing she and her colleagues could say about themselves was that they were interdisciplinary. But the conventionalized subject positions made available by explicit meta-genres are actually misleading. They promise subject positions amenable to everyone but what students actually experienced was quite different. Working in interdisciplinary programs, they were pushed to negotiate and enact nuanced, but still *different*, identity practices. What seems apparent is that even in interdisciplinary research, the genres produced by students still carry inherited values, beliefs, and subject positions deeply embedded in the fabric of the genre. Thus, the subject positions made available by disciplinary genres interact in interdisciplinary contexts and sometimes result in tensions. These tensions can only be resolved by students writing themselves into subject positions that are uncomfortable or unfamiliar, or by careful resistance and negotiation. The tensions and conflicts that emerge when participants struggled to negotiate and resist interdisciplinary identities suggest that explicit meta-genres are perhaps dysfunctional (Gitlrow, 2002b, p. 197). Instead of providing novices with opportunities to access, even subconsciously, the multiple values, beliefs, and subject positions available to them (e.g., Kamler & Thomson, 2014; Paré, 2011; Starke-Meyerring, 2011), these meta-genres isolate students and cut them off from valuable opportunities to develop genre-d identities. Explicit meta-genres that conventionalize understandings of science, writing, and identity have significant consequences for doctoral students' participation in their fields.

When meta-genres prevent students from accessing rhetorical strategies to confront underlying tensions, they are effectively prevented from learning to negotiate rhetorical identities across disciplinary boundaries. As Starke-Meyerring (2011) argued in her exploration of writing discourses in doctoral education, assumptions about writing as simple and straightforward often cause students to internalize failure. That is, when students struggle with writing, they internalize failures "as [their] own deficiency" (p. 91) when these struggles are the result of deeply situated, but very well hidden, disciplinary conventions. In interdisciplinary programs, there are a host of normalized assumptions about research and writing that students could not possibly know, never mind negotiate. Indeed, interdisciplinary students are prone to get stuck in established beliefs and practices and operate within meta-genres that likely do not always work in their favour, despite promising eventual ratification of their efforts (Giltrow, 2002b). When interdisciplinary students work uncritically within meta-genres that reinforce harmony and when their programs are steeped in arhetorical meta-talk, they are at great risk of missing chances to engage with tensions that exist at interdisciplinary boundaries. In maintaining the status quo reinforced by meta-genres students are prevented from recognizing the potential of productivity in tension. In uncritically accepting meta-genres, students miss chances to engage with tensions and are forced to adopt uncomfortable and unfamiliar beliefs. When contestation and tension remain unavailable for students, they are excluded from opportunities to position themselves with diverse disciplinary groups because they are cut off from discourse that would allow them to do so (e.g., Burr, 1995; Holland et al., 1998)

Indeed, findings indicate that interdisciplinary identity negotiation is best facilitated by *challenging* dominant meta-generic assumptions. It is in these cracks formed by underlying genre tension that doctoral writers might find the tools to allow them to navigate and negotiate

their identities across disciplinary boundaries. As Starke-Meyerring (2011) explained in her

discussion of paradoxes in doctoral writing, there is "potential for doctoral student learning if

students explore…the ways in which the discursive practices of their research cultures are

regularized to produce certain kinds of knowledge and certain kinds of researcher identities"

(p. 93). That is, students are likely to benefit from *critically* engaging with the assumptions that,

in this case, meta-genres reproduce by reflecting on where they are situated and to account for

how they are positioning themselves. Indeed, this was the case with Aliya. Although risky, Aliya

pushed back against the subject position made available to her in the biology manuscript.

Through careful negotiation on her part, Aliya was able to negotiate an identity position that was

recognizable to the biologists, but would also be recognizable to other computational biologists.

Chapter Summary

In this chapter, I explored how interdisciplinary doctoral students develop and negotiate

their identities in interdisciplinary programs. I found that explicit meta-genres and meta-talk

again conventionalized interdisciplinary identities. When writing in interdisciplinary programs,

participants were surprised when their bids for recognition and attempts to write themselves

across disciplines were often challenged. Participants recalled struggling to understand how to

produce genres that would be accepted by interdisciplinary audiences. Often, they encountered

resistance and challenges stemming from genre-d subject positions that existed in tension. This

tension tended to result in participants being forced to genre themselves into uncomfortable

subject positions and sometimes ended in participants giving up on being recognized by another

group. Although some participants were able to resist and transform subject positions, these

instances did not occur without students making some risky moves. The finding emerging from

this chapter is that in interdisciplinary programs, different implicit conventions push students to enact identity practices that are sometimes at odds with each other.

I have argued in this chapter that dominant meta-genres have important implications for how students are able to negotiate their identities. First, findings indicate that operating within dominant meta-generic assumptions can limit interdisciplinary students' access to important rhetorical tools to negotiate their identities across disciplines. When this occurs, students are restricted to writing themselves into genres that carry unfamiliar or uncomfortable values, beliefs, and assumptions, leaving students stuck in disciplinary ways of thinking that may not be conducive to their goals. Second, findings suggest that when given resources to reflect on normalized assumptions reproduced by meta-genre in interdisciplinary life sciences students are able to engage with productive tensions. That is, students are able to reflect on the risks and possibilities afforded to them as they write and thus have more resources at their disposal to locate how to best position themselves across disciplinary boundaries.

Chapter 7: Discussion of Findings

My purpose in this study was to explore how doctoral students in interdisciplinary life sciences programs learn to produce and navigate assumptions about writing, knowledge, and identity. The data have pointed to how meta-genres function within interdisciplinary life sciences doctoral programs. Exploring the kinds of assumptions explicit and unwritten rules regulate have indicated that:

a) Interdisciplinary writing is often perceived *arhetorically*: meta-talk and explicit institutional meta-genres suggest writing is a matter of translating, explaining, and clarifying ideas across disciplines, yet hides the rhetorical work doctoral writers must do;

b) Interdisciplinary writing and research are characterized as complementary – a characterization that occludes underlying epistemological and ontological tensions and naturalizes these tensions when genres interact across disciplinary boundaries;

c) Arhetorical and occluding meta-talk and meta-genres perpetuate assumptions that identities are stable across disciplines, yet underlying tensions force doctoral writers to either assume uncomfortable genre-d identities or resist and transform identities made available by genres (although this is not without risk).

Collectively, these findings present compelling insights into the nature of meta-genres in interdisciplinary life sciences doctoral programs and the actions and assumptions they regulate. Particularly notable are how all findings suggest that explicit meta-genres and meta-talk often contradict the unarticulated rules governing genre production at disciplinary boundaries. In essence, arhetorical meta-talk perpetuated beliefs that interdisciplinary doctoral writing should

have been simple – but it *wasn't*. Instead, participants faced challenges understanding how to argue themselves, and their research, across disciplinary boundaries because the rhetorical nature of writing was hidden by arhetorical meta-talk. Further, they had to do so within guidelines that occluded, and at times completely avoided, the rhetorical nature of these negotiations. Indeed, these arhetorical guidelines served to reinforce damaging assumptions about failure as individual instead of resulting from deeply entrenched and occluded beliefs and practices about disciplinary writing.

To tie these threads together, I discuss the implications of the findings for how we might understand and characterize the nature of meta-genres in interdisciplinary life sciences doctoral programs. I begin by discussing the nature of meta-genres in interdisciplinary life sciences. Based on findings emerging in Chapters 4 through 6, I explore what I have come to see as duelling meta-genres fighting to regulate writing, knowledge, and identity in interdisciplinary programs. I go on to discuss the implications of these meta-genres for doctoral student writers, paying close attention to the costs of contradictory and occluding meta-genres for doctoral students' research and their identity development and negotiation. Finally, I consider meta-genre's potential to serve as an empowering resource for doctoral writers – a resource that might help them locate themselves and their research in complex interdisciplinary landscapes.

The Nature of Meta-Genres in Interdisciplinary Life Sciences Doctoral Programs

A significant outcome of this study has been its articulation of the nature of explicit and implicit meta-genres, as well as direct and indirect meta-talk, in interdisciplinary life sciences doctoral programs. By this, I am referring to findings that have revealed the rules, regulations, allowances, and constraints that govern writing at disciplinary boundaries. Explicit articulations of such rules suggest interdisciplinary writing is harmonious and largely a matter of translating

jargon across stable status quos. These rules, however, constrain writers from engaging in implicit conventions that sometimes clash at disciplinary boundaries. Previous research has provided insights into how meta-genres act in professional (Berkenkotter, 2001; McNely, 2017) and academic settings (Giltrow, 2002b; Pantelides, 2015). As I mentioned in Chapter 2, this research has been largely undertaken in siloed fields and disciplines with fairly stable genre conventions (see Schryer, 1994). Meta-genres traced in these studies illustrate how articulated and unarticulated conventions about what can be said, when, and how regulate communities with relatively shared histories, goals, and practices. Note, too, that even in siloed disciplines, critical RGT perspectives would raise questions about how shared community goals and practices are (Paré, 2014a). Indeed, in her discussion of meta-genres in undergraduate academic writing, Giltrow (2002b) admits that even within disciplines, the regulations dictating the kind of work that *counts* tend to be generalizing and misleading. In interdisciplinary programs, where multiple disciplines are negotiating genre practices, findings have pointed to the existence of not just one meta-genre controlling interdisciplinary writing. Indeed, findings point to the existence of multiple sets of meta-genres that exist in tension and that occlude the rhetorical nature of writing.

The contradictory nature of meta-genres. In the interdisciplinary life sciences doctoral programs that I explored, I did not see evidence of a unified meta-genre regulating the writing and research activities of doctoral students. The findings of this study suggest the existence of two sets of meta-genres attempting to regularize activities in interdisciplinary programs. The first set of meta-genres is codified in institutional documents. These documents include program policies, departmental tip sheets, and university guidelines on the dissertation that codify explicit expectations about doctoral writing. As detailed in Chapter 4, these expectations dictate that writing should be clear, concise, and exact. Such expectations are also echoed in arhetorical

meta-talk produced by participants, which characterizes writing as simple translation in contexts where everyone's research – and ways of writing research – is complementary. Of course, the findings of this study also suggest the existence of more slippery meta-genres, ones that are relegated to the background but continue to have a powerful influence over the actions of doctoral writers (see Starke-Meyerring et al., 2014). These are the rules that, though are perhaps never articulated, we absorb through osmosis and observation. Indeed, the findings suggest the existence of duelling sets of expectations, both of which attempt to regulate the conventions and actions of interdisciplinary writers. There are the regulations that reassure writers that so long as they translate their work and make it clear, their writing will be recognized and accepted. But there are also hidden regulations about how knowledge claims must be argued and negotiated across epistemological and ontological boundaries that contradict articulated regulations about clarity and translation.

The challenge is that the explicit and unarticulated meta-genres in interdisciplinary life sciences programs do not work in tandem to regulate social actions in the way the meta-genres of the dinner party, for instance, do. Dinner party rules, both spoken and unspoken, support the same kinds of social actions: enjoy yourself and the company, but be polite so that the hosts and other guests can enjoy themselves, too. The meta-genres I've traced in interdisciplinary life sciences doctoral programs, however, often exist in tension with each other. Explicit conventions traceable in institutional texts and filtering into arhetorical and harmonious meta-talk about writing exist in tension with underlying expectations about the nature of writing, knowledge, and identity.

The existence of meta-genres seemingly working at cross-purposes is significant because they offer doctoral writers trying to enter into scholarly communities two competing sets of

regulations. In her characterization of meta-genres, Giltrow (2002b) argues that meta-genres, "whatever their inefficiencies, are widely recognized frames for the writing they direct, shared by readers and writers, collating their perceptions, and promising, *perhaps misleadingly but nevertheless assuringly*, an eventual ratification of writers' efforts" (emphasis added, p. 198). That is, meta-genre conventions promise writers that their efforts will be rewarded so long as they follow the rules. If doctoral writers just write clearly, if they just make sure not to offend anyone, their writing will be accepted. In the case of meta-genres in interdisciplinary life science doctoral programs, explicit meta-genres and meta-talk are misleading: they promise writers acceptance so long as they can write clearly, translate their thoughts, and engage in complementary research activities with other fields. So long as doctoral writers write clearly, carefully translate jargon into simple language, and ensure that they are working harmoniously with other scientists, their efforts to engage in interdisciplinary research should be rewarded. But, writers working within these conventions, and indeed reproducing them through their own arhetorical meta-talk, experience a totally different set of conventions. This set of *unarticulated* rules demands that students engage in complex rhetorical negotiation across disciplines. To do so, they must fundamentally transform their claims by arguing phenomena into diverse epistemic and ontological frames (Blakeslee, 2001; Myers, 2003).

Particularly significant is how the contradiction between meta-genres materializes: it is the arhetorical meta-genres and meta-talk that overtly guide the expectations for doctoral writers in interdisciplinary programs. This is particularly evident when tracing arhetorical meta-talk reproduced by students. This talk avoids the rhetorical work they must do in order to enter into interdisciplinary research communities. The issue is that the rhetorical work remains an

unspoken negotiation of *unspoken* interests – in other words, negotiations and contestations often get pushed aside because of implicit interests.

Occluding (and avoiding) rhetorical work. A recurring theme amongst the findings has been the occluding nature of explicit meta-genres and of meta-talk. Arhetorical meta-talk characterizing interdisciplinary writing as *translating*, meta-talk characterizing interdisciplinary research and writing as complementary, and meta-talk suggesting identities are often taken-for-granted all occlude the complex and rhetorical nature of writing.

A consequence of the occluding nature of arhetorical meta-talk is its power to generalize what writing is and does. That is, arhetorical meta-talk generalizes writing as simple, translating, and explaining, but writers are left without any concrete understanding of what is involved in these processes. Aliya, for example, often spoke about writing as translating (Table 3, C1) but when asked what that process entails, she struggled to articulate what the translating process actually involved. This echoes Lingard's (1998) examination of medical students' case presentations, in which terms like "relevance," "important," and "pertinent" are common in curricular documents – yet, what counts as relevant, important, and pertinent are never made explicit. Thus, even though students are unlikely to miss these terms, they are equally unlikely to understand what underlies them. While not discussed as meta-genres, Lingard's study pointed out the contradiction between how students may see meta-genre markers but misunderstand what these markers ask of them. Genre research more generally, particularly research concerned with professional and academic genres, also points to this distinction. Social workers are confronted with guidelines demanding that they remain objective (Paré, 2002), engineers are told to be specific (Winsor, 2003), and documents outlining midwifery policies are filled with language about informed choices and decision-making (Schryer & Spoel, 2005). Yet, each of these

directives remain largely abstract: experienced social workers, engineers, and midwives

understand the nuances of these generalized terms, but newcomers are often left mystified by the

implicit meanings of this language. Such language, although hinting at underlying genre

conventions, is often difficult for students to comprehend because they read these rules as

separate from the social situation and exigence. As Giltrow (2002b) argues:

> When such terms are habitually and repeatedly used in the absence of instantiations – as
>
> they are in academic contexts – they may only reinforce insiders' mutual understandings
>
> while estranging newcomers from this consensus. And this may be especially so when
>
> students hear the same workings in different disciplinary contexts. (p. 196).

While this excerpt theorizes meta-genres in distinct academic and professional

communities, the same challenges are experienced by interdisciplinary writers. In

interdisciplinary programs, the distinctions between insiders and outsiders, and importantly the

consequences for newcomers, are significant. Insiders to physics and biology both have specific

ideas about what constitutes clear writing, yet students – like Stefan – are left under the

assumption that explaining is the same process no matter the discipline. Terms like "explain,"

"translate," and "clarify" serve as stand-ins for *rhetorical* talk about writing, leaving

interdisciplinary students not only cut-off from disciplinary insider knowledge, they are

prevented from learning how to negotiate this rhetorical knowledge across disciplinary

boundaries. The key here is that when arhetorical terms used to characterize interdisciplinary

writing are *habitually and repeatedly* used without an understanding of the underlying *rhetorical*

meaning of this language, students are estranged from learning to engage in a critical site of

knowledge and identity development: writing.

Further complicating newcomers' (i.e., doctoral students) entry into these communities is that this arhetorical language is used across disciplines, which suggests the existence of a single status quo, a unified consensus about science, writing, and identity. The guidelines and conventions obfuscating the rhetorical work happening behind the scenes often cuts students off from engaging in underlying rhetorical conventions. Opportunities to enter into what Giltrow (2002b) characterizes as a rhetorical consensus are further limited when writers must navigate disciplinary conventions in such a way as to conform to arhetorical guidelines. In other words, because everyone has to appear to get along, participants are left with few chances to peel back habitual language about writing and are left to assume they are the only ones struggling (e.g., Starke-Meyerring, 2011). Students talk about writing as a process of translating and explaining, but they struggle when they trying to explain or translate ideas to other fields. For instance, Aster struggled to explain his research to the larger evolutionary and developmental biology community and Victor struggled to translate his physics research to biologists. Both of them, however, characterized their struggles as *their* problem: Aster labelled himself a "poor writer" (As_INT2) because he couldn't translate his research (Table 3 C2R1) and Victor questioned whether he wrote his claims clearly enough (Table 4 C4R2). This is in part because of differently situated epistemic and disciplinary cultures (Hyland, 2004; Knorr Cetina, 1999; Myers, 1990) interdisciplinary students are forced to navigate. Students' struggles to reconcile their writing with arhetorical meta-talk suggest that they are operating within a meta-genre regularizing science writing itself.

The meta-genres regulating participants' experiences with writing occlude and evade "highly contingent practices, [which] may not be bad in itself, but, rather, a sign of unspoken negotiations among conflicting interests, a way of everybody getting on and going on despite

hunches and suspicions" (Giltrow, 2002b, p. 201). In siloed fields, perhaps, these unspoken

negotiations are ways of maintaining the status quo despite conflicting practices. Paré's (2002)

exploration of social work genres shows powerfully how institutional conventions naturalize

conflicting interests. The conventions of social work genres are so powerful that when social

workers resist or attempt to subvert them, they are characterized as poor writers. The occluding

nature of meta-genres in the interdisciplinary programs I explored, however, have serious

consequences for doctoral writers.

Arhetorical meta-talk and meta-genres occlude, and indeed completely *avoid* the

rhetorical work doctoral writers must engage in. That is, by hiding the rhetorical nature of

interdisciplinary writing, arhetorical meta-talk is also hiding the deeply situated and non-neutral

nature of different disciplines' genres. Hiding potential conflicts and tensions does help reinforce

assumptions about interdisciplinary research and writing as complementary (Klein, 2010), but it

also further entrenches doctoral writers into contradictory meta-talk. In preventing students from

accessing rhetorical assumptions, it also prevents them from accessing rhetorical tensions that

exist between disciplinary conventions and expectations that could prove *generative* for

interdisciplinary research (Graham & Herndl, 2013; Gygi & Zachry, 2010). The meta-genres I

have traced construct a particular atmosphere around interdisciplinary doctoral writing: one that

occludes the rhetorical nature of writing and leaves students to struggle with contradictory

assumptions about conventions and practices of writing in interdisciplinary programs.

Implications of Interdisciplinary Meta-genres for Doctoral Writers

Having discussed the nature of meta-genres in interdisciplinary life sciences doctoral

programs, I turn now to the implications these competing and occluding forces have for doctoral

writers. Specifically, I discuss how meta-genres in interdisciplinary programs impact doctoral

writers' ability to engage in written knowledge production and the implications of

interdisciplinary meta-genres for the development and negotiation of their scholarly identities.

The implications of contradictory and occluding meta-genres for knowledge and

research. To begin discussing what implications contradictory and occluding meta-genres have

for interdisciplinary knowledge, I turn to the implications of harmonious meta-talk and meta-

genres. As I mentioned above, a function of meta-genre is to naturalize contingent practices so

that everyone can cooperate and work toward a particular goal, despite "hunches and suspicions"

(Giltrow, 2002b, p. 201). As I noted in discussing the occluding nature of arhetorical meta-talk,

the function of meta-genres to ensure everyone can get along is discussed in the context of

undergraduate writing and siloed professional fields (e.g., engineering, bank economists). In

these contexts the costs to naturalizing contingent practices are relatively small. To pass a history

course, a student may have to set aside personal conceptualizations of what counts as an

argument and adopt the specific understandings of the discipline. But in interdisciplinary

contexts, the costs of harmony can be high.

Recall, for example, the paper that Aliya wrote with her supervisor in a large team of

scientists with diverse disciplinary associations. Writing this paper, Aliya and her supervisor had

to juggle the conventions of oncologists, developmental biologists, computer scientists, and

medical scientists. When negotiating these conventions, Aliya revealed that to get anything done

at all, she and her advisor had to subvert some of the genre expectations of research members.

But, in subverting these expectations, Aliya and her supervisor were able to reach conclusions

that would have been impossible to reach. Aliya spoke about a widespread assumption that a

particular kind of tumour originated in a particular cell, but that she and her advisor had to argue

convincingly that, in fact, the tumour started somewhere else entirely. If Aliya and her advisor

had not pushed back against conventions dictating harmony and argued the research into a new

ontological frame, the claim never could have been published. In contrast, other participants

(e.g., Stefan and Aster) were prevented from publishing innovative disciplinary research in part

because their writing did not conform to the kinds of harmonious and complementary

conventions regulated by interdisciplinary meta-genres. For Aster and Stefan, the cost of meta-

genres naturalizing contingent practices was particularly high: knowledge claims were

abandoned because they did not adhere to meta-generic expectations.

These examples illustrate the costs of harmony in interdisciplinary doctoral research.

When arhetorical and complementary assumptions are codified into normalized and taken-for-

granted assumptions about writing interdisciplinary innovation can be stifled. Prior research in

transnational professional and educational environments has also shown that *local* regulatory

forces often work against innovation (Gygi & Zachry, 2010; Starke-Meyerring & Wilson, 2008).

In their exploration of engineering communication in a transnational corporation, Gygi and

Zachry (2010) argued "the rigidity of established policies and infrastructures and the ways in

which they worked [reproduced and reinforced] the status quo of walled, locally-bounded

learning" (p. 375). That is, the most common obstacle for knowledge innovation was local

regulations within the corporation – not the disparate practices of international partners. In

interdisciplinary doctoral programs, a similar phenomenon seems to exist. It is perhaps not the

disparities between genres and the tensions emerging therefrom that pose the most risk for

knowledge and innovation. Indeed, as I discuss below, engaging with tensions emerging from

genres meeting at disciplinary boundaries actually seems *productive* for doctoral writers. It

appears that the greatest risk to interdisciplinary innovation are meta-genres that reproduce the

status quo of writing as simple, clear, and complementary. Further, as these assumptions are

codified in powerful textual meta-genres like the dissertation policy (e.g., Starke-Meyerring et al., 2014), there remain few opportunities for writers to work against the status quo.

Findings of this study illustrate how assumptions controlling harmonious beliefs about writing also occlude the epistemic nature of writing (Bazerman, 2002; Dias & Paré, 2002). Notions of complementarity presume that interdisciplinary research may be accomplished when disciplinary hunches and suspicions may be silenced in favour of unity (Myers, 1989; Rowland, 2002). I discussed the consequences of this above, but there were instances when students were able to make acceptable claims and avoid criticism and conflict. Both Aliya and Diana recounted instances where they were able to negotiate and justify their work within unspoken and unfamiliar (to them) interests. Diana, for instance, spoke about rewriting the introduction of a presentation to a group of medical biologists and how she had to transform the work to justify its usefulness (cf. Myers, 1991).

The experiences of participants who successfully transformed knowledge across disciplines suggest the potential of tensions being productive and suggests a further a price to be paid when frictions between meta-genres and experiences remain hidden and occluded. Unlike in examples where participants encountered epistemological roadblocks that prevented them from participating in a larger interdisciplinary field, here tensions appear to have been productive. Diana and Aliya were able to engage meaningfully with interdisciplinary communities through, in Aliya's words, making a logical leap. This echoes discussions that argue that rhetorical tensions and frictions are not always limiting. In Bazerman and De los Santos's (2005) discussion of the fields of toxicology and ecotoxicology, they argue that incommensurability (Harris, 2005) has the potential to be productive. They argue that "practical concerns of applications and interests *foster* … creativity and flexibility" (Bazerman & De los Santos, 2005,

p. 458). To them, incommensurability is a luxury afforded by purely theoretical sciences, something applied sciences – and I would include medical research and applied physics research in this – do not have. For Bazerman and de Los Santos, outside social, economic, and political forces are too powerful for these kinds of sciences to close their eyes to methodological tension. In fact, they seem to suggest that facing tension and friction can be productive. This is similar to an argument made by Graham & Herndl (2013) in their discussion of medical practitioners involved in pain management, who find that practitioners located in different epistemic and ontological silos are able to collaborate despite these differences. It seems that for Diana and Aliya, something similar happened. The underlying rhetorical tensions made it necessary for them to recast written knowledge in order for their claims to be taken up by an interdisciplinary audience.

The implications of contradictory and occluding meta-genres for scholarly identity development. A significant consequence of the contradictory and occluding nature of meta-genre is its impact on doctoral students' identity negotiation and development. Generally, writing is denied as a site of identity and knowledge development in doctoral education (Starke-Meyerring, 2011). It is often relegated to the margins of academic life and thought of as separate to *real* research work (Kamler & Thomson, 2014), and as such writing tends to be a site of struggle for doctoral writers. Further, because writing tends to be an invisible practice, the struggles associated with it become hidden and give "doctoral writing a deceptive appearance of smooth assimilation" (Starke-Meyerring, 2011, p. 81). Research in doctoral writing has illustrated that when identity practices are normalized doctoral students are at risk of internalizing quote-on-quote failures and allowing issues of self-blame to fester (Kamler & Thomson, 2014; Paré et al., 2011; Starke-Meyerring, 2011). When this occurs, students are

prevented from engaging in important conversations about their emerging identities as scholars and researchers. Preventing students from engaging in critical discussions about their field and their identities in relation to their field results in worrying consequences no matter the discipline; after all, it is these struggles with writing and identity that are so often linked to doctoral attrition (Garnder, 2009).

Struggling under a cloak of normalcy has particularly significant implications for students in interdisciplinary programs. As I have argued above, students in these programs must learn and navigate the assumptions, practices, and identities of several fields. Further, the contradictory and occluding meta-genres regulating interdisciplinary writing make the challenges associated with learning identity practices even more pronounced. Consider how the direct meta-talk and explicit meta-genres normalize writing as simple translation and as a complementary practice. They naturalize potential conflicts and, as mentioned above, ensure that work can get done in spite of individuals' suspicions of each other (Giltrow, 2002b). But when meta-genres occluding contingent practices create the illusion of a single interdisciplinary status quo – a set of assumptions and conventions shared amongst interdisciplinary scientists – doctoral students struggle against identities that are unfamiliar and uncomfortable. Recall, for instance, how Aster struggled to identify what he called socially acceptable norms (As_INT3). Aster's difficulty identifying and producing socially acceptable writing stemmed, in part, from his resistance to the beliefs and values embedded socially acceptable writing required. Indeed, he was forced to negotiate identities that he found uncomfortable: they may have been the identities acceptable to the wider community, but they clashed with Aster's goals and perceptions of what writing should be and do. Interdisciplinary doctoral writers are prevented from fostering interdisciplinary identities because these identities are shrouded by normalized and often arhetorical meta-talk.

This meta-talk prevents students from engaging with meta-genres as sites where "language users give accounts of themselves, and try to come to a situated understanding of their activities [and] their positions vis-à-vis one another" (Giltrow, 2002b, p. 203). That is, when meta-talk works to avoid the rhetorical nature of writing students are left without resources to contend with unfamiliar and uncomfortable identities. Indeed, these arhetorical meta-talk and meta-genres can be especially damaging in cultures where knowledge is supposed to be easily accessible so long as writing is clear, simple, and non-confrontational (Myers, 1989). When this is not the case, when students experience writing as fraught, they are often left feeling as though their perceived lack of writing skills is their fault (Kamler & Thomson, 2014). Aster, for example, is a powerful illustration of this. Although writing should have been simple and conflict-free, Aster's experiences with writing show that he often encountered challenges from readers. When his research, and consequently his identity as an interdisciplinary researcher, was challenged he was left self-identifying as a poor writer and questioning whether he belonged in academe at all.

When meta-genres prevent students from accessing rhetorical strategies to confront underlying tensions, they are effectively prevented from learning to negotiate rhetorical identities across disciplinary boundaries. As Starke-Meyerring (2011) argued in her exploration of writing discourses in doctoral education, assumptions about writing as simple and straightforward often cause students to internalize failure (p. 91). In doing so, struggles to write across disciplinary boundaries are viewed as personal failures and not as the result of deeply situated, but very well hidden, disciplinary conventions. In interdisciplinary programs, there are a host of normalized assumptions about research and writing that students could not possibly know, much less negotiate. This is due to arhetorical meta-genres and meta-talk signifying "a functional collusion of understandings, a deep socialization and isomorphism of practice and identity" (p. 199). They

reinforce assumptions that there is only one kind of identity students must learn to develop, yet cannot account for the struggles and challenges encountered by students trying to foster identities across disciplines. Indeed, interdisciplinary students are prone to get stuck in established beliefs and practices and operate within meta-genres that likely do not always work in their favour, despite promising eventual ratification of their efforts (Giltrow, 2002b). When interdisciplinary students work uncritically within meta-genres that reinforce harmony and when their programs are steeped in arhetorical meta-talk, they are at great risk of missing chances to engage with tensions that exist at interdisciplinary boundaries. In maintaining the status quo reinforced by meta-genres, students are prevented from recognizing the potential of productivity in tension. In uncritically accepting meta-genres, students miss chances to engage with tensions and are forced to adopt uncomfortable and unfamiliar beliefs. When contestation and tension remain unavailable for students, they are excluded from opportunities to position themselves with diverse disciplinary groups because they are cut off from discourse that would allow them to do so (e.g., Burr, 1995; Holland et al., 1998).

      Meta-genre's potential for empowerment. In my discussion of meta-genres in interdisciplinary programs, I do not mean to suggest that they are good or bad. While they may saddle interdisciplinary writers with an added set of writing demands, they also have the potential to be empowering resources for doctoral writers. Indeed, findings indicate that interdisciplinary identity negotiation is best facilitated by *challenging* dominant meta-generic assumptions. It is in these cracks formed by underlying genre tensions that doctoral writers might find the tools to allow them to navigate and negotiate their identities across disciplinary boundaries. As Starke-Meyerring (2011) explained in her discussion of paradoxes in doctoral writing, there is "potential for doctoral student learning if students explore…the ways in which

the discursive practices of their research cultures are regularized to produce certain kinds of knowledge and certain kinds of researcher identities" (p. 93). That is, students are likely to benefit from *critically* engaging with the assumptions that, in this case, meta-genres reproduce by reflecting on where they are situated and to account for how they are positioning themselves. In this way, meta-genres have the potential to become empowering resources for students.

Aliya is an example of how meta-genre can be an empowering resource allowing doctoral writers to critically engage with taken-for-granted assumptions about writing, knowledge, and identity at interdisciplinary boundaries. For Aliya, accounting for how she was positioned at the intersection of disciplines helped her to subvert the regulatory demands of the meta-genres in interdisciplinary environments. By reflecting on where she was situated, Aliya was able to see writing not as translating or simplifying, but as arguing a position. Indeed, by subverting dominant expectations about interdisciplinary writing, Aliya was able to carve out a position for herself at disciplinary intersections; she was, in other words, able to subvert conventions and genre herself into an identity that facilitated her interdisciplinary research. This echoes Paré's (2002) argument that a "critical consciousness [is] required to undermine [institutional processes and] escape the identities our own discourse compels" (p. 69). In other words, critically engaging with meta-genres, as Aliya did, provided the tools for her to develop identities that were not stuck in established disciplinary norms and practices. Instead, she was able to productively work across disciplines. It gave her access to, as Burr (1995) might write, the discursive tools to position herself with unfamiliar audiences. Exploring how participants contested genre conventions using meta-genre and positioning provided a way of understanding how genre conventions were *productively* undermined and contested to allow writers to work across disciplinary genre-d identities.

When left to operate within meta-genres uncritically, interdisciplinary students are prevented from engaging with normalized assumptions about interdisciplinary writing. As a result, they are left to work within dominant assumptions that writing should be simple and complementary. Within these assumptions, there is little space to negotiate identities that contradict these ideas and as such, interdisciplinary students are limited to negotiate identities that align with dominant meta-genres. Without resources to reflect on the status quo, interdisciplinary students are left to get *stuck* in established disciplinary ways of thinking and doing. They are, in other words, only equipped with rhetorical tools that reproduce meta-generic assumptions and practices. These tools operate to "make sense 'common' and to locate individuals in identities and relationships that maintain [values] and allow them to pass as 'sense'" (Paré, 2002, p. 68). When interdisciplinary students are left only with rhetorical strategies that reinforce the norm, they are deprived of strategies that might be useful in questioning common sense assumptions and in *re*locating their identities and relationships in novel and at times contested contexts. Indeed, in confronting tensions and contradictions inherent in meta-genres, interdisciplinary doctoral writers appear to be engaging in meaningful and innovative identity work. As Lingard and Haber (2002) have argued, engaging with normalized assumptions about writing transforms taken-for-granted assumptions into "propositions that can be questioned and critiqued" (p. 168). When tensions hidden by occluding meta-genres are confronted, interdisciplinary doctoral writers are engaging with rhetorical conventions and practices. In doing so, these students are afforded opportunities to "give accounts of themselves, and try to come to a situated understanding of their activities, their positions vis-à-vis one another, the risks incurred and indemnities afforded as they compose" (Giltrow, 2002b, p. 203). That is, by peeling back the normalized assumptions propagated by meta-genres in

interdisciplinary programs, doctoral writers are given access to understand what risks might be worth taking (as Aliya did), what positions they must take with diverse audiences (as Diana did), and how to compensate for these risks and differences (as Victor did). In this way, meta-genres may be seen as either a blessing or a curse for students developing and negotiating identities across disciplines. It can either mire students in dominant and normalized ways of thinking in order for everyone to get along (despite their suspicions) (p. 201), or meta-genres can be a powerful way of reflecting on how and where students are located when underlying tensions are confronted. When given the ability to reflect on their positions, interdisciplinary students are able to better understand the rhetorical nature of their work and develop valuable tools to reflect on these processes.

To negotiate across disciplinary boundaries, and across *genres*, students had to find ways to subvert disciplinary expectations. Disciplinary genre conventions compel writers to enact and conform to inherited and value-laden identities (Bawarshi, 2003; Bawarshi & Reiff, 2010; Schryer, 1994). Here, though, students are expected to work across disciplinary boundaries that, as I've illustrated, are not as unified and harmonious as meta-genres suggest. Thus, in order to negotiate identity across different communities, students must find rhetorical strategies to engage in genre contradictions. Otherwise, students are at risk of getting stuck in established disciplinary conventions, which in turn limits their potential for creating innovative interdisciplinary knowledge and limits their potential to meaningfully engage in interdisciplinary communities. To do this, students need a resource to *critically reflect* on how they are positioned to take advantage of cracks in genre expectations and pushed genre boundaries (Paré, 2002; Schryer & Spoel, 2005).

Meta-genre, based on my findings, appears to be a resource that can facilitate this critical reflection. Indeed, using meta-genre to explore the articulated and unarticulated rules controlling genres allows us to understand how writers may, or may not, subvert or contest genre conventions regulating identity and research. But in this study, meta-genre has also worked to reveal how tension occurring in interdisciplinary writing, research, and identity work are not only a result of different genres interacting, but also of *power*. Meta-genre's power to explore the forces that constrict some actions while allowing others provides a lens that helps us see how genres are implicated in larger power dynamics (e.g., disciplinary hierarchies, institutional hierarchies and structures) and in how the possibility to subvert conventions may be truncated because of the conventionalizing power of genre.

Chapter Summary

This chapter has discussed what the findings of this study reveal about the nature of writing in interdisciplinary life sciences doctoral programs. I have argued that there are two contradicting sets of meta-genres and meta-talk regulating assumptions, practices, and regulations about writing at disciplinary boundaries. Explicit meta-genres like institutional policies, as well as arhetorical meta-talk, suggest interdisciplinary writing should be clear, simple, and relatively free of conflict. This set of assumptions and expectations work to naturalize contingencies and ensure that multiple disciplines can work together to get things done. But the explicit meta-genres I traced also occluded *unspoken* assumptions about writing in interdisciplinary programs. This second set of rules and conventions often contradicted those codified in written institutional meta-genres and those reproduced in taken-for-granted talk about writing. The implicit set of meta-genres and meta-talk suggest that spaces where disciplinary conventions meet and interact are sites of tension, contestation, and negotiation. When these

remain hidden, shrouded by normalized assumptions of writing as clear and conflict-free, interdisciplinary doctoral writers face added demands when trying to negotiate disciplinary conventions.

I discussed how the competing and occluding nature of meta-genres create an atmosphere of writing with significant implications for how doctoral writers learn to produce writing, knowledge, and develop their scholarly identities. I have argued that the occluding nature of meta-genres can be costly both for knowledge construction and innovation, as well as for how doctoral students learn to write themselves into their scholarly communities. When the rhetorical nature of writing remains shrouded by arhetorical meta-talk and policies, students are prevented from productively engaging with tension. This is notable because, as I have discussed, being able to confront tensions through developing meta-awareness of writing conventions can be an empowering resource for writers.

Chapter 8: Conclusions, Implications, and Next Steps

This dissertation has inquired into and discussed the nature of writing, research, and identity in interdisciplinary life sciences doctoral programs. To do so, I approached writing, and the research process, from a rhetorical genre perspective, exploring how meta-genres and meta-talk regulate assumptions about writing and patrol how doctoral students engage and position themselves within interdisciplinary research communities. Surprising was the emergence of a research narrative steeped in tension and contradictory talk about interdisciplinary writing. Ostensibly, interdisciplinary writing was supposed to be simple. Interdisciplinary doctoral students should have been able to easily genre themselves across disciplinary boundaries. But, of course, it never was as simple as it was supposed to be. Indeed, the findings emerging from this study suggest implications not just for interdisciplinary doctoral writers, but also for how we understand the nature of writing at the boundaries of situated communities and their consequences for knowledge and for identity.

To conclude the dissertation, I briefly revisit my research questions and summarize how I approached answering them. I go on to recap the findings and how these findings suggest the existence of powerful, normalizing meta-genres controlling assumptions about interdisciplinary writing and, consequently, knowledge and identity. I then outline what I view as the practical and theoretical implications and contributions of this study. Finally, I outline some of the challenges I faced and improvements that could have been made before suggesting how this study points to further avenues of research.

Initially, my goal was to understand how interdisciplinary doctoral writers learned to produce genres – and what this did to their identities – but my interests gradually shifted to the assumptions controlling writing beliefs and practices in interdisciplinary programs. In order to

better understand the nature of interdisciplinary writing, and its implications on research and

identity, this study was guided by the following questions:

1. What is the nature of meta-genres and meta-talk in interdisciplinary life sciences

    doctoral programs? What assumptions do they regulate?

2. How do meta-genres enable and constrain the writing, research, and identities of

    interdisciplinary doctoral students (i.e., what actions do meta-genres enable and

    constrain)?

3. What implications do meta-genres in interdisciplinary life sciences have for

    doctoral students learning to develop and negotiate their scholarly identities?

I approached these questions from a rhetorical genre theory perspective, which

understands writing as socially situated, inherited, and non-neutral (Coe et al., 2002; Miller,

1984). From this perspective, I was able to discuss genres as key sites of knowledge and identity

production. When learning how to produce particular genres, after all, individuals are also

effectively learning about the practices, beliefs, and ways of being within a particular community

(Artemeva, 2009; Paré, 2002). RGT also acknowledges, however, that the socially situated and

non-neutral nature of genres can give rise to tensions when individuals must produce genres with

unfamiliar or uncomfortable values and beliefs. In tracing tensions, I also found it useful to draw

on Giltrow's (2002b) concept of meta-genre: the conventions regulating genres and genre

production. In this case, I explored textual institutional meta-genres and traced the meta-talk of

participants. In doing so, I was privy to how students internalized and understood conventions,

which provided an entry-point to identifying implicit meta-genres controlling the activities

associated with interdisciplinary writing. I also approached this study in a way that would

highlight writing. Again drawing on RGT, as well as narrative inquiry, I focused on how

powerful and normalized assumptions about interdisciplinary writing shape and patrol how doctoral writers understand, engage with, and negotiate their identities through writing.

Summary of Findings: Tension, Occlusions, Contradictions

A clear thread woven through my discussions of writing, research, and identity in interdisciplinary programs is that of tension and occlusion. Explicit institutional meta-genres (e.g., policy documents, departmental guidelines) and participants' meta-talk indicated an understanding of interdisciplinary writing that was rooted in arhetorical assumptions. That is, interdisciplinary writing was supposed to be a matter of conciseness, explanation, and translation. As others have noted, these understandings of writing remain fairly prominent in higher education (e.g., Starke-Meyerring, 2011; Starke-Meyerring et al., 2014), but significant was how specifically interdisciplinary doctoral students experienced these assumptions. Assumptions that writing across disciplines is a matter of cutting out jargon, explaining things clearly and simply, and translating methods or theories suggests that writing across disciplines should be no more difficult than writing within disciplines. When pressed, however, participants admitted that interdisciplinary writing was often a challenge. Indeed, it was evident that serious contradictions existed in meta-talk about interdisciplinary writing: it was supposed to be as simple as translating, but ended up being a complex process of *transforming* arguments and claims and justifying them across disciplinary boundaries (see also Myers, 1990, 2003). Arhetorical meta-talk actually occluded the deeply rhetorical work students were engaged in, often resulting in struggles to write across disciplinary boundaries.

Tracing meta-talk to find evidence of implicit meta-genres by searching for "disparities [and] collusions" (Giltrow, 2002b, p. 199) revealed that overtly, interdisciplinary research was discussed as harmonious, complementary, and mutually beneficial. Again, however,

contradictions in this meta-talk soon emerged. While interdisciplinary work was supposed to be harmonious, participants encountered many instances where interdisciplinary writing was fraught with conflict, misunderstandings, and tension. Interdisciplinary meta-genres that I traced occluded the contingent nature of interdisciplinary writing. That is, meta-genres regularized assumptions that science writing is, with minor changes to technical language and style, largely the same no matter the discipline. When engaged in producing genres for interdisciplinary audiences, however, participants found themselves negotiating diverse interests, beliefs, and values.

Finally, findings emerged that point to the costs of occluding meta-genres for interdisciplinary doctoral students' identities. I found that interdisciplinary writers often struggled to negotiate rhetorical identities in interdisciplinary programs, largely because of how dominant, implicit meta-genres control assumptions surrounding writing. In attempting to position themselves across disciplinary boundaries, participants spoke of encountering tensions between readers' expectations and their own; tensions that emerged even as implicit meta-genres regulated assumptions about interdisciplinary research and writing as simple and harmonious. In exploring how doctoral students negotiated their scholarly identities across disciplinary boundaries, I found that although tension was (according to dominant assumptions) best avoided, participants who confronted disciplinary tensions were able to develop valuable rhetorical strategies for reflecting on implicit meta-genres.

All of this *should* have been simple. But it never *was*. The gist of these findings is that explicit meta-genres suggested that interdisciplinary writing should be simple. Interdisciplinary research should be easy, it should be harmonious, and it should be free of tension – but it never actually was. When I traced and discussed meta-genres in interdisciplinary life sciences, I was

continually confronted with stories of tension. Interdisciplinary work is not simple. It is *hard.* It is *complex*. Indeed, my findings resonate particularly powerfully with discussions about interdisciplinary research as sites of intense contestation (e.g., Rowland, 2002). Interdisciplinary research can of course be rewarding and useful (Rowland, 2004), but it requires deft and agile negotiation on the part of writers (Graham & Herndl, 2013). Interdisciplinary negotiations where researchers must compromise, argue, or justify across epistemic boundaries are nuanced processes that require complex rhetorical work (Wilson & Herndl, 2007). For interdisciplinary doctoral students who are still learning the ways of knowing, doing, being, and arguing of their communities, the tension created by contradictory meta-genres places added demands on writers. Not only must doctoral students learn how to *transform* their research across disciplinary boundaries and how to negotiate their identities with diverse audiences, they must also do so in meta-generic atmospheres that position writing as arhetorical and harmonious.

In fact, the occluding meta-genres that I traced had significant implications for doctoral writers. These meta-genres functioned to occlude the socially situated, historical, and non-neutral nature of writing and instead reproduced assumptions that position interdisciplinary writing as simple translations and as complementary. By occluding the deeply rhetorical nature of interdisciplinary writing, as well as the tensions and contradictions emerging from these occlusions, interdisciplinary writers are left to operate under assumptions that writing should be easy, leaving them largely on their own to navigate fraught disciplinary conventions (see Starke-Meyerring, 2011). While it may seem beneficial to characterize interdisciplinary research and writing as translations and as harmonious, these assumptions actually prevent interdisciplinary doctoral writers from engaging in rhetorical work necessary to producing knowledge and negotiating their identities. Indeed, I observed that when participants were given access to

discourse to confront tensions underlying interdisciplinary research and writing, they were able to develop strategies to effectively write and negotiate across disciplinary divides.

Contributions and Implications

This study has contributed to a growing body of scholarship exploring writing in doctoral education. Much of this work, as I mentioned, focuses on the dissertation as a primary site of writing "intervention." Discussions surrounding doctoral writing often then look to best practices for supervision, writing groups, and publishing as a way to support students in producing the dissertation. This study contributes to recent calls for doctoral writing scholarship to extend beyond the dissertation (CAGS, 2018) and to re-imagine what doctoral writing *is* and our assumptions about the practices associated with it (Badenhorst, Amell, & Burford, in press). In an attempt to contribute to these conversations, this study has explored interdisciplinary doctoral writing from a meta-genre perspective to explore assumptions about writing beliefs and practices. The contributions of this study point to implications for rhetorical genre theory as well as for doctoral writing and education.

Theoretical implications. While the findings of this study indicate the potential of acknowledging tension and contradiction in interdisciplinary doctoral writing for knowledge and identity, they also have implications for theory, particularly for our understandings of meta-genre and how they function in interdisciplinary contexts. A great deal of rhetorical genre research in academic writing has focused on its disciplinarity: disciplinary communities build knowledge, values, and identities in particular ways and this is all reflected, and indeed reproduced, through the discipline's genres (e.g., Artemeva & Fox, 2011; Bazerman, 1988; Medway, 2002; Wickman, 2015). With few exceptions (cf. Blakeslee, 2001), genre has not been deployed to explore writing in interdisciplinary spaces. Interdisciplinary work productively complicates

genre theory: genres emerge from and (re)produce communities with shared histories, but interdisciplinary communities are supposed to *merge* or at least negotiate these histories. In such interdisciplinary communities, research teams are composed of members with values and assumptions that are, while perhaps not totally contradictory, not in total agreement. When disciplines are merged, interact, or compete, how are we to understand the genres produced in these contexts?

On a theoretical level, this study has made a contribution to how writing studies might understand how meta-genres function at disciplinary boundaries. Giltrow (2002b) does point out that meta-genres "flourish at boundaries" (p. 202) and that the presence of several meta-genres may create sites of contest. This, however, is argued in the context of how several meta-genres might contest assumptions about the purpose, form, and function of a particular genre. For instance, different meta-generic understandings of the dissertation genre might lead to an abundance of meta-generic text and talk, ranging from guidelines and policy documents (Starke-Meyerring et al., 2014) to prescriptive and proscriptive accounts (Pantelides, 2015) in an attempt to "recruit dominant interests, or impose discipline on diversity" (Giltrow, 2002b, p. 191). As a result, meta-genre has been largely taken-up to explore how texts regulate particular professional practices (Berkenkotter, 2001; McNely, 2017) or to explore the assumptions and practices regulated by particular genres like blogs (Maurer, 2009) and dissertations (Pantelides, 2015; Starke-Meyerring et al., 2014). Exploring meta-genres regulating particular genres, in short, has contributed to understandings of how generic status quos are maintained. Such research has traced how contingent practices are mitigated in order to maintain the implicitly agreed-upon genre conventions and practices. This study, however, suggests that meta-genres act differently at disciplinary boundaries where diverse situated, social, and value-laden genres interact.

In this study, I was concerned with how meta-genres act at epistemic and ontological boundaries – in interdisciplinary programs. I found that while meta-genres do normalize and occlude tension in these contexts, they seem to do so for a different reason than in siloed disciplines. At interdisciplinary boundaries, what meta-genres seem to be doing is regulating *interactions of genres from different disciplines and trying to make them work together.* That is, instead of (re)producing and regulating assumptions about a particular genre or the genres of a particular community, in interdisciplinary environments meta-genres appear to be trying to regulate assumptions, values, and practices that (while perhaps not totally incommensurable) do not always sit easily with one another. Because these assumptions and practices are sometimes contingent, they give rise to tensions and conflict. I have explored meta-genres in interdisciplinary contexts where meta-genres work to maintain harmony and cooperation by taking care to occlude and normalize contingencies and contestations. In doing so, however, interdisciplinary meta-genres appear themselves to exist as a contradiction: in trying to maintain harmony, the restrict writers from confronting potentially productive tensions between genres. As an analytical device, then, meta-genre provides a powerful resource to account for the kinds of unexpected contradictions and contingencies that emerge not just in interdisciplinary spaces, but also contexts where disciplinary conventions interact.

Practical implications. The findings of this study teasing out the nature of meta-genres in interdisciplinary doctoral programs, and how these meta-genres are experienced by doctoral writers, have what I see as practical implications for doctoral writing pedagogy. Such findings contribute to current understandings of how doctoral writing is experienced in interdisciplinary programs and, as such, offers potential avenues for supporting doctoral writers.

For doctoral writing and supervision. A particularly noteworthy implication of this

research is how it speaks to doctoral writing pedagogy. Particularly significant was tracing the

nature of meta-genres patrolling writing in interdisciplinary doctoral programs. The articulated

and unarticulated meta-genre rules existed in contradiction to each other and created tensions

that interdisciplinary doctoral writers found themselves caught up in. Arhetorical meta-talk

positions interdisciplinary writing as simple, but this of course occludes the contingent nature of

interdisciplinary writing and avoids the rhetorical nature of this work. Significantly for doctoral

writers, in the absence of any other discourse about writing it is this arhetorical meta-talk that is

taken up and reinforced as the taken-for-granted way of doing things (Paré, 2002; Starke-

Meyerring, 2014). In spite of arhetorical meta-talk dominating conversations about writing,

participants in this study spoke of their desire to have meaningful conversations about writing.

The desire for such conversations is not limited to interdisciplinary writers. As Doreen Starke-

Meyerring (2011) found in her exploration of assumptions about doctoral writing, writers craved

meaningful conversations about writing – conversations that moved beyond style and content to

address writing as a knowledge-making practice. Aliya, for instance, wished to have

conversations about what she called the "meta-cognitive" (Al_INT3) aspects of writing, but was

disappointed that no one could give her any of the answers she was looking for. This does not

just have implications for doctoral students, though: when arhetorical meta-talk becomes the

internalized way of thinking about and doing interdisciplinary research and writing, the same

assumptions are passed down to and inherited by new cohorts of interdisciplinary doctoral

researchers (Paré, 2017; Starke-Meyerring, 2011). Much like genres themselves, these practices

become normalized and subconsciously reproduced. As new supervisors, students who never

engaged in rhetorical conversations about writing are unlikely to be able to engage in such

discussions with their students, no matter how much they may wish to. When this happens, only normalized assumptions are left to regulate how writing is understood and experienced – and these normalized assumptions are largely arhetorical, leaving writing to remain a non-question. Students are again left to muddle along by themselves, guided by assumptions that writing is a matter of being clear and non-confrontational. Findings from this study, however, indicate ways that more rhetorical discourse might be injected into interdisciplinary doctoral writing.

All participants in this study expressed a desire to be able to have conversations about writing that broke away from arhetorical meta-talk and confronted the contingent nature of interdisciplinary knowledge and writing. When doctoral writers are exposed to language that helps them peel back dominant assumptions and actually confront the rhetorical work of argument, transformation, and justification they are engaged in, it can be revolutionary (Starke-Meyerring, 2014). Indeed, this study suggests that when students are able to confront underlying realities of knowledge and identity transformation in interdisciplinary programs rhetorically, it is an empowering experience. Confronting tensions and contradictions provides interdisciplinary doctoral writers with a resource that lets them account for where they are located and what they are doing. That is, it gives doctoral writers rhetorical resources to deftly navigate across disciplinary boundaries and to develop a sense of how they must adapt and transform their research and their identities to resonate with other fields. There are, in fact, several ways that such rhetorical resources might be introduced to interdisciplinary doctoral programs. On a broader level, offering students opportunities to engage with and learn empowering meta-language could be integrated into workshops or courses situating doctoral students within their academic communities.

More powerful than courses and workshops, however, is how students learn genre conventions in collaboration with doctoral supervisors (Green, 2005; Paré, 2014b; Paré et al., 2009). With writing often shrouded in normalized assumptions, however, supervisors at times struggle to provide writers with the kind of "meta-cognitive" (Al_INT3) information they want and need since they, too, are often caught up in arhetorical assumptions about writing. Despite this, supervisors of interdisciplinary writers are key figures mentoring students in how to negotiate knowledge and identity across disciplinary boundaries. Designing strategies that facilitate the use of meta-genre and meta-talk as empowering resources would aid faculty mentors in having the kinds of complex and rhetorical conversations about writing students wish to have. Of course, this would entail encouraging established, or at least newly established, members of interdisciplinary communities to confront their beliefs about writing as well. Without doing so, the complexity of interdisciplinary writing would remain hidden. Establishing strategies to enable interdisciplinary writers to confront underlying contractions and tensions in interdisciplinary writing will also have effects for new faculty: when exposed to rhetorical resources themselves, there is more likelihood that these ideas will inform their own supervision practices (e.g., Paré, 2011).

For doctoral pedagogy. Also emerging from findings are potential implications for interdisciplinary doctoral programs. With interdisciplinary research steadily increasing (Looker, 2016) and with universities beginning to create interdisciplinary doctoral programs, this study points to ways in which these programs might integrate research-informed pedagogy into program design. The interdisciplinary programs I explored, particularly the newer rotational program in which Aliya was enrolled, are making efforts to address the unique demands of interdisciplinary doctoral work. As Aliya pointed out, students give presentations to their

colleagues that aim to teach students how to generalize their research, articulate their ideas clearly and simply, and explain without using technical language (see also Choi & Pak, 2007). This, however, reproduces arhetorical meta-talk and assumptions that tended to present challenges for interdisciplinary students. By maintaining that interdisciplinary communication is simply generalizing research, programs might be missing opportunities to infuse research-based rhetorical approaches to writing and communication into their programs. Instead of having students practice *generalizing* or *translating*, students might benefit more from being provided with research-based writing pedagogy that strips back arhetorical talk. This would illustrate the situated, value-laden, and social nature of disciplinary communication.

Reflecting on the Process

In keeping with my aim of maintaining a sense of *principled uncertainty* (Thieme & Makmillen, 2017), and in keeping with a rhetorical perspective towards research, here I discuss some of the challenges I faced during the research process. In the spirit of understanding research as situated and dialogic, I want to pause here and reflect on what I was *not* able to do in this study. Instead of discussing these as limitations, I want to ease out of the dissertation by re-examining what my lens, and situated perspective, prevented me from doing and seeing, and suggesting how this might prove productive for future avenues of research.

First, I need to address the sample size of this study. A total of five participants might be seen as a small population. What can a sample of five, after all, *really* tell us about the nature of writing and indeed the experiences of doctoral writers in interdisciplinary life sciences programs? I would address this, however, by reminding readers that my goal was never to make claims about interdisciplinary life sciences programs in general. Indeed, generalizing to a larger population was never the point of this study. While a small sample size may have its detractions,

in this case working with only five students allowed me to spend a great deal of time with their accounts and their experiences. It enabled me to create a careful and nuanced narrative about meta-genres, writing, research, and identity in interdisciplinary doctoral programs.

Perhaps more significant, particularly in light of the implications detailed above, is how the study design has likely influenced the findings of this research. Known at times as the "Hawthorne Effect" (e.g., Merrett, 2007), the approach that I took in designing and carrying out this research influenced the kinds of data that were generated and hence the findings and implications that I drew from them. I point this out not because it is a shortcoming of the study, but because I want to acknowledge how the participants and I shaped the research outcomes. Some of the more significant findings were a direct result of my interactions with participants. Specifically, insights into how meta-genre might be an empowering resource for doctoral writers likely emerged because I was engaging participants in discussions that forced them to confront their taken-for-granted assumptions about writing, knowledge, and identity. Often after my recorder was turned off, participants asked me about how I was interpreting data and findings and I shared with them my approach to inquiry. I explained how I conceptualized writing, why I was so interested in some of their insights, and I also told them about the kinds of insights I was generating. In fact, participants shared that interviews actually shifted their relationship to writing. At the end of our interviews, Victor was motivated to ask his supervisor to include more emphasis on writing in a compulsory biophysics doctoral course. Stefan told me that he found himself seeking out more opportunities to talk to his supervisor specifically about writing conventions. Aliya sought out literature about rhetorically informed writing strategies after our interviews and shared that she had begun to see writing as generative and situated herself. Diana, as I discussed in Chapter 6, confessed that our interviews helped her understand how and why

she had to rewrite the introduction to her biology conference presentation. As she said, "I remember [you] asking questions about how do you know that there's different audiences?" (D_INT3). Clearly, interviews influenced data generation; however, I do not believe it negatively impacted the findings and implications that this study offers. I am after all working within a methodological orientation that understands data as generated in dialogue with participants (Pinnegar & Daynes, 2007; St.Pierre, 1997). Instead, I acknowledge the effect I had on participants as less of a limitation and more of an unintended intervention. The discussions participants and I shared were rooted in questions that gently coaxed participants to confront taken-for-granted assumptions about writing, research, and identity. Some of the findings I trace and discuss above directly result from such coaxing; I point this out so readers are aware of the effect I perhaps had on how participants thought about and spoke about writing.

I also want to acknowledge that the accounts I draw on in this study are not as nuanced as they could have been. I have, in the interest of maintaining participants' confidentiality, omitted details that would have made accounts more specific. Despite these deletions and generalizations, I still feel that the accounts generated, and the findings that emerged, reflected the experiences that I heard from participants. Indeed, all the details that were omitted did not have a great impact on how I generated and interpreted findings.

As a final reflection on what this study accomplished, I want to turn to the theory guiding my inquiry: rhetorical genre theory. RGT, as I have previously discussed, was especially helpful in asking the questions driving this research. Throughout this study, I found myself working with narratives that saw doctoral writers making *risky* moves with genre, working in invisible but powerful hierarchies, and with their participation highly regulated by genre conventions. Even as I saw these patterns, I lacked language to articulate the deeply embedded power dynamics

controlling doctoral writers' participation in interdisciplinary spaces and, as Giltrow (2002b) has

written, "the risks and indemnities" (p. 203) afforded to them by the genres and meta-genres

regulating these programs. Since RGT focuses largely on inherited and established forms of

social action, there can be the potential to forget that these genres are often conventionalizing,

and thus conservative, forces (Plotnick, 2018). That is, genres often serve to reproduce

institutional or symbolic hierarchies. As such, when undertaking research from an RGT lens it

can be challenging to recognize and critically interrogate the structures being reproduced through

genres and meta-genres. Although questions of power seemed to simmer throughout participant

narratives and in my analysis, I was unable to use this dissertation to explore these structures

more closely. This is not to say that explorations of power are impossible from an RGT

perspective (e.g., Paré, 2002). Indeed, meta-genre's power to trace and articulate hidden rules

that reproduce non-neutral and situated practices embedded in genres has, I believe, much

potential to provide a conduit for interrogating power structures embedded in genres themselves.

Final Thoughts and Potential Future Avenues of Research

        To end this dissertation, I turn to some final (for now) thoughts on the outcomes and

insights generated during the research process. I want to first point out that this study has barely

scratched the surface of the complexities involved in interdisciplinary writing. I view these

findings as a starting point, a way of beginning to establish what kinds of atmospheres surround

writing in interdisciplinary doctoral programs. I find myself coming away from this study with

more questions than I started with. Interdisciplinary research programs have served as a

particularly rich site to explore questions of writing, knowledge, and identity, and there is much

more that could be gained from the exploration of such sites.

Indeed, future research might explore meta-genres that exist *outside* of university programs. While my focus in this study was on how writing and meta-genres functioned institutionally, these are admittedly only some of the meta-genres that regulate writing in interdisciplinary research. Indeed, because journals remain the primary way in which knowledge is disseminated and debated within academe (Paré, 2011a; Starke-Meyerring & Paré, 2011), they constitute an important site of future research into interdisciplinary writing assumptions and practices. Exploring meta-genres regulated by academic research communities themselves, instead of meta-genres constructed institutionally, would offer further insights into how genres— and the identities and research practices they (re)produce—*work* in interdisciplinary research. Exploring the articulated and unarticulated rules of writing that conventionalize prestigious genres in scholarly work would contribute to questions about how interdisciplinary writing functions. It would also provide insights into the practices of professional interdisciplinary writers, which would in turn assist writing researchers in their understandings of how such practices might be incorporated into doctoral pedagogy, supervision, and writing mentorship.

Aside from questions emerging from implications, my sense is that interdisciplinary programs have great potential for exploring questions of power from a rhetorical genre theory perspective, particularly amongst doctoral students. Questions of power, specifically who has power to subvert genre conventions, remain uncommon in genre research. In this study questions about who is allowed to subvert conventions and when, emerged when participants spoke about their challenges fitting in and their struggles genre-ing themselves into uncomfortable rhetorical identities. Interdisciplinary sites, where negotiation and tension occur, could prove to be powerful contexts in which to interrogate questions of genre and power. When can

interdisciplinary doctoral student subvert genre expectations? What are the consequences for science when risks are not taken, when power dynamics prove too powerful to subvert?

This study has raised several questions about how meta-genre might help us locate and understand the tensions and contradictions simmering beneath the surface of what appear to be stable and harmonious communities. Here, I have found that meta-genres existing at disciplinary boundaries have raised questions about contradictions and tensions. How could the concept of meta-genre be further developed to understand rule-breakers (Plotnick, 2018)? How might tracing the contradictory nature of meta-genres reveal insights about power in communities, and how this power can rhetorically shift? In addition, the nature of meta-genes existing in boundary spaces raises important questions about costs and potentials. If meta-genres function to hide genre tensions at boundary spaces, what implications might this have for how we understand interdisciplinary knowledge? Might it suggest that genres in interdisciplinary spaces are more flexible than those in siloed disciplines? Should this be the case, are there any insights that might be transferrable to pedagogy and training in other academic and professional communities?

Ideally, this study will have some positive outcomes for the community under investigation – in this case interdisciplinary life sciences doctoral programs. In this case, I'm left with some doubts as to how much impact this work will have beyond giving participants space to recount their experiences, at times air their grievances, and more often than not critically reflect on their engagement with implicit meta-genres. Future avenues of research could, and I think *should*, attempt to make writing studies useful to those who could greatly benefit from it. In fact, writing studies research has great interdisciplinary potential (e.g., Paré, 2010) and future avenues of research stemming from this study should, I think, find a way to make itself useful to the communities under investigation.

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Appendix A: REB Approval

McGill

Research Ethics Board Office Tel: (514) 398-6831
James Administration Bldg.
845 Sherbrooke Street West. Rm 325 Website: www.mcgill.ca/research/researchers/compliance/human/
Montreal, QC H3A 0G4

Research Ethics Board II
Certificate of Ethical Acceptability of Research Involving Humans

REB File #: 306-0118

Project Title: Doctoral Writing and Identity in Biological Physics

Principal Investigator: Sara Doody **Department:** Integrated Studies of Education

Status: Ph.D. Student **Supervisor:** Prof. Doreen Starke-Meyerring

Funding: SSHRC

Approval Period: March 5, 2018 to March 4, 2019

The REB-II reviewed and approved this project by delegated review in accordance with the requirements of the McGill University Policy on the Ethical Conduct of Research Involving Human Participants and the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans.

Deanna Collin
Ethics Review Administrator, REB I & II

* Approval is granted only for the research and purposes described.
* Modifications to the approved research must be reviewed and approved by the REB before they can be implemented.
* A Request for Renewal form must be submitted before the above expiry date. Research cannot be conducted without a current ethics approval. Submit 2-3 weeks ahead of the expiry date.
* When a project has been completed or terminated, a Study Closure form must be submitted.
* Unanticipated issues that may increase the risk level to participants or that may have other ethical implications must be promptly reported to the REB. Serious adverse events experienced by a participant in conjunction with the research must be reported to the REB without delay.
* The REB must be promptly notified of any new information that may affect the welfare or consent of participants.
* The REB must be notified of any suspension or cancellation imposed by a funding agency or regulatory body that is related to this study.
* The REB must be notified of any findings that may have ethical implications or may affect the decision of the REB.

Appendix B: Sample Interview Guide

Interview One – The Everyday Activities, Learning about Participants
1. Tell me how/why you got into the PhD.

   a. What made you decide to do a PhD?

   b. How did you come to work in your field?

   c. What are you working on? What are the goals of your research?

2. Walk me through a typical day of your doctoral work.

   a. What kinds of activities do you engage in when you do your research?

   b. When do you find yourself collaborating with other members of your research group, either in person or indirectly?

   c. Other than your research, tell me about the kinds of activities you engage in within the university. Do you lead/attend journal groups? Are you involved in applying for grants or conferences within the research team? What is role in publishing within the research team? What have your experiences been with this in the past?

3. Tell me about your research.

   a. What kinds of processes are involved in this work (e.g., computer simulations, building imaging technology, imaging, creating materials)?

   b. What do you look for when you are doing this work?

   c. What do you do if things go well? If you don't get the results you were hoping for?

4. Tell me about what happens toward the end of the process.

      a. Can you tell me about the dissertation process? What are the steps you have to take to get there and what do you think the process of doing the dissertation itself will be like?

5. Is there anything else that you think I should know that I haven't asked about?

Interview Two - Genres

1. Is there anything that came up between now and our last interview that you want to discuss?

2. I'm interested in learning more about your role in conferences and publications within the research team. Can you tell me some more about this process?

      a. You said last time that your role was (whatever it was). How did you feel taking on that role? Had you done it before, or was it something new? Was there anything particularly easy or challenging about it?

3. Can you tell me about the proposals/publications/conference paper/conference poster/etc. itself?

      a. What was the point of doing that? What were you trying to get across to the people reading it?

      b. Are there any kinds of "conventions" or "rules" that you think apply to these kinds of things? Why do you think these exist?

      c. Did you have any previous experiences with these kinds of writing, or other kinds (e.g., lab reports) that helped you? Or were these experiences not helpful, and why did you find that?

4. Do any experiences with writing that really stand out as being challenging or rewarding? Can you tell me a little bit about why?

5. I wonder if you could walk me through some of the comments you have received from supervisors/peer reviewers/other research team members.

   a. Can you tell me about the kind of feedback you have gotten in the past? What were you working on, were you given general/specific comments, do these change the way you approach writing now?

   b. Is there feedback that seems to occur often or that really stick out to you? What were you writing, who were the comments from, and why do you remember this particular feedback?

   c. How did you approach writing for experts in different fields? Does anything change when you need to write for a specific individual who does not work in your field and could you explain a little bit about these changes (or why you feel there aren't any different strategies you use?)?

6. Is there anything else you want to add or want me to know that we haven't discussed yet?

Interview Three – Identity and Writing

1. Did anything come up between now and our last interview that you want to discuss?

2. At this stage in your Ph.D. work, I wonder if you could tell me a little bit about the process up to this point.

   a. Are there any major events that stick out in your memory, like successes with your research, positive feedback at conferences, positive feedback from the lead researcher/your supervisor?

3. Based on your experiences thus far, can you think of any events that made you feel like a scholar, as opposed to a doctoral student/candidate?

a. What was did this event involve (what were you doing, where were you)?

b. Can you tell me briefly about the smaller occurrences leading up to this event?

4. How about the opposite? Are there any events that stick out as being challenges that you had to overcome?

a. What did this event involve? How did you tackle the challenge? Did you seek out advice from other team members, work through it on your own, are you still trying to tackle this challenge?

5. At this point, I'm interested to know about where you think your research fits in the biological physics spectrum.

a. Do you see yourself working across several different fields or not? Why?

b. Can you tell me about a time that stands out to you that illustrates this? Or can you think of an image or metaphor of where you see yourself and your research within biological physics to help me understand your position?

6. Is there anything that we haven't talked about that you want to bring up? Any comments or final thoughts that I haven't addressed?

7. Do you have any questions/ was anything we talked about surprising to you?