

Portraits of Parasites: Geographic Imaginaries in the Production of Health Knowledge

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Abstract

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Parasites, long understudied, can have tremendous effects on the health, productivity, and well-being of those infected with them. While common conceptions of parasites both within and outside of scientific literature rely heavily on biomedical constructions, the ways in which parasites are understood has not yet been examined. By examining how parasites are conceptualized within biomedical literature and how geographic imaginaries influence that conceptualization, this thesis illuminates some of the key influences on information that we take as fact. By examining how such knowledge is produced, we are better able to critically understand the research that has already been done relying on such knowledge as inherent truth. Focusing specifically on hookworm, a parasite of the developing world, and toxoplasmosis, a parasite of the developed world, this thesis compares their representations, both textual and visual, within biomedical texts to answer the question of how geographic imaginaries become entrenched within the biomedical

literature. Using discourse and content analysis, this thesis unravels how human perception of a parasite's geography influences scientific knowledge as seen in twelve parasitology textbooks. Ultimately this thesis argues that parasites, and diseases more broadly, of the developing world are constructed differently than similar diseases more common in the Global North. Developing world diseases are depicted as more grotesque, more environmentally and geographically linked, and as the product of more distal causes than their developed world counterparts. This pattern of representation reproduces the geographic imaginaries of today's parasitologists in future generations of doctors, medical researchers, and academics reading these books.

TABLE OF CONTENTS

List of Figures	ii
List of Tables	iii
Chapter I: Befriending the Parasite: An Introduction.....	1
I. Structuring the Thesis.....	3
Chapter II: Situating the Parasite within the Body of Geography: An Exploration of the Literature	9
I. Imagining Geography: Extending Geographic Imaginaries to Health Research.....	10
II. Producing Health Knowledge: Turning an Eye Toward the Production of Biomedical Truths	16
III. Positing the Parasite: Expanding Foucauldian Theorizations of the Body.....	20
IV. Introducing the Medicalized Parasite: An Overview of Hookworm and Toxoplasmosis	27
V. Developing a Conceptual Framework: A Case Study of Two Parasites	30
Chapter III: Analyzing the Parasite and its Image: An Examination of Methodology...	32
I. Defining the Unit of Analysis: Medical Textbooks	33
II. Conducting the Analysis: Combining Content and Discourse Analyses.....	38
III. Justifying a Methodology: Assessing the Strengths and Weaknesses.....	45
Chapter IV: Extracting the Imaginaries from Passages on Parasites: A Discussion of the Findings	48
I. Mapping the Geography of Parasites: Whose Geography Matters?	48
II. Picturing Parasites: Images and Imagery of Disease	53
III. Analyzing Causes of Disease: The Proximal Us and Distal Other.....	68
Chapter V: Repossessing the Parasite: A Conclusion	71
I. Contributing to the Literature.....	75
II. Advocating Directions for Future Research.....	77
Bibliography	i

LIST OF FIGURES

Image A: Eye in Congenital Toxoplasmosis	55
Image B: A Collection of Images of Hookworm Teeth (1-3).....	55
Image C: Cutaneous Larva Migrans	56
Image D: Young Boy with Ascaris Worms Protruding from the Anus.....	56
Image E: Neonatal Tetanus.....	58
Image F: Fulminating Varicella.....	58
Image G: Scrotal Elephantiasis as a Result of Onchocerciasis.....	59
Image H: Post-Kala-Azar Dermal Leishmaniasis (PKDL).....	59
Image I: Elephantiasis in a “Fijian”	60
Image J: Nodules on an “African”	60
Image K: Traditional Fishing as Means of Schistosomiasis Infection	61
Image L: Traditional Agriculture as Means of Hookworm Infection.....	61
Image M: Washing Clothes as Means of Schistosomiasis Infection	62
Image N: Collecting Water as Means of Onchocerciasis Infection.....	62

LIST OF TABLES

Table 1: An Example of Coding	40
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CHAPTER I: Befriending the Parasite: An Introduction

The notion held by the average person that humans in the United States are free of worms is largely an illusion—an illusion created by the fact that the topic is rarely discussed because of our attitudes that worms are not the sort of thing that refined people talk about, the apparent reluctance of the media to disseminate such information, and the fact that poor people are the ones most seriously affected. (Roberts & Janovy, 2000: 2)

As the quotation above suggests, many Americans have a very distorted understanding of parasites and their geographies. When I explain my work to people, I am constantly faced with questions and comments such as “but aren’t parasites only a problem in the Third World?” and “we don’t have parasites here,” not to mention the weird looks coupled with statements like “yuck” and “gross.” While the quote above suggests three reasons for our misconceptions about parasites, namely that it is not polite to discuss them, that the media does not report on them, and that they are largely a problem of the poor, Roberts and Janovy fail to include in their list the strong geographical imaginaries that people hold about the places where they imagine parasites to be located. This thesis deals primarily with geographic imaginaries and the ways in which they mediate what is known about parasites.

For the purpose of this thesis, I will use the CDC’s definition of a parasite as “an organism that lives on or in a host organism and gets its food from or at the expense of its host” (CDC, 2010). Of note is that this definition does not restrict the term parasites to only those parasites that are pathogenic. While we commonly conceive of parasites as harmful to the body, research that I will explore further below illustrates some potential health benefits of parasites. Though this thesis does not focus heavily on these benefits, I suspect that our common perception of parasites as pathogenic stems from the fact that only pathogenic parasites that have been heavily studied. So, while this definition

provides a grounding point for the discussion within the remainder of this thesis, I am less concerned with maintaining a strict definition of the term “parasite” and rather more concerned with exploring others’ understandings of parasites, as it is these understandings that fascinate me.

I find parasites captivating for the way in which they can rely entirely on another organism to survive, for the ways in which they manipulate those organisms they rely on, and for the potential benefits that some parasites offer their hosts. But even more intriguing than the parasites themselves are peoples’ reactions to them. Peoples’ frequent disgust at parasites sparked my interest. As I began to research parasites and peoples’ reactions to them, I realized that there were significant differences in the way parasites were conceptualized. Given what comes to mind when we think about parasites in general, hookworms, round worms, etc., often receive rather harsh responses from the public; other parasites that are far more prevalent in the United States do not produce the same effect.

These differences in the way people respond to specific parasites led me to wonder what caused these differences and how far these distinctions extended. Were they purely differences in the way lay individuals conceptualized the diseases, or were they visible within the scientific literature as well? Ultimately I settled on three questions that I would attempt to answer as I explored this captivating phenomenon.

1. Are differences in the way parasites are conceptualized visible within the biomedical literature?
2. To what extent can these differences be explained by the conceptions people hold about the places where they perceive parasites to be located?

3. How do these geographic imaginaries become visible within the scientific discourse?

By comparing two parasites with differing geographies, I will attempt to answer these questions, examining how each is represented in the biomedical literature. This research will specifically examine hookworm (*Necator americanus* or *Ancylostoma duodenale*), common in the developing world, and toxoplasmosis (*Toxoplasma gondii*), common in the developed world.

Answering these questions has the potential to shed light on how scientific knowledge is produced. By examining how parasites are conceptualized within the biomedical literature and how geographic imaginaries influence that conceptualization, this thesis illuminates some of the key influences on the information that we take as fact. Answering these questions is essential to our understanding of epistemology, or how we know what we know, the foundation upon which all other knowledge is built.

I. Structuring the Thesis

To answer these questions, this thesis is structured as follows. Chapter II outlines the literatures that I draw upon in my work. Chapter III explains the methodology that I use to answer the questions that I have proposed above. Chapter IV discusses the findings of my work, delving specifically into the discussion of geography, the use of images and imagery, and the discussion of the causes of disease within the texts. Finally, Chapter V draws conclusions based on the findings and discusses potential directions for future research.

Chapter II of this thesis outlines the bodies of literature from which this work has developed and to which it will contribute. Given that my thesis deals first and foremost

with parasites, one might expect medical geography to be the primary sub-discipline discussed. However, though the subject of my work is medical, the lens I use to conduct this work is more theoretical arising out of understandings of geographic imaginaries, analysis of health knowledge production, and Foucauldian understandings of the body.

While geographic imaginaries have been heavily researched within cartography and historical geography, they have not been used to theorize understandings of health. Relying heavily on the work of Said (1978) and Gregory (1994), among others, I outline the research that has been done to date exploring the geographical imagination. A significant portion of this work has been largely theoretical. Those empirical examples that do exist come from cultural works of art and historical discussions of imperialism, colonization, and slavery. Within cartography, imagined geographies have been considered as a means of exploring features critical to the production of maps. While there has been theoretical acceptance in a number of sub-disciplines of geography for the idea that all geography is to some degree imagined, there has been a lack of research illustrating this phenomenon outside of cartography.

Given the epistemological nature of the questions being asked in this thesis, I outline work that considers health knowledge and its construction. A growing literature in this area focuses primarily on popular perceptions of health as revealed in the analyses of magazines, newspapers, and popular press books. Within these, researchers focus on the militaristic metaphors of infection and the market-based metaphors of healthcare provision. While some researchers, particularly anthropologists and psychologists, have analyzed fringe fields of medicine, such as acupuncture and chiropractics, challenging

their constructions of knowledge, few geographers have engaged specifically with biomedical knowledge production.

Although Foucault has not directly discussed parasites, his framing of the body and of the tension between the individual and the medical lens can quite clearly be exemplified by the dualisms that arise out of the ways in which parasites are conceptualized. By their very nature, parasites transcend the mind/body, inside the body/outside the body, human/nature, and us/them dichotomies that are so prevalent to our understandings of the world and of ourselves. These Foucauldian insights allow us to begin to understand why people react so strongly to the idea of parasites, granting us insight into broader, more deeply entrenched thoughts and ideals. Finally, Chapter II offers a brief background on both hookworm and toxoplasmosis, giving the reader an understanding of the basics of each parasite.

Chapter III outlines the methodology used in order to answer the proposed questions. I performed both discourse and content analysis on twelve parasitology textbooks to examine the ways in which the authors represented both hookworm and toxoplasmosis, and to explore how geographic imaginaries become visible within biomedical texts. Because textbooks are the means by which the biomedical discipline is communicated to younger generations of parasitologists, clinicians, and researchers, they provide a window into the heart of biomedical discourse.

While similar studies have analyzed popular literature and news stories (see, for example, Wald, 2008; Chiang & Duann, 2007; Larson et al., 2005; Ostherr, 2005; Segal, 1997; Malone; 1999), few have examined the ways in which disease is constructed within the scientific discourse. Given that most health research relies on biomedical truths, the

way in which these truths are constructed has not been sufficiently explored. Using both emic and etic codes, I analyzed both the text discussing each of these parasites as well as the graphics (maps and images) present in the twelve textbooks. While each of the books differed slightly in focus, a clear pattern emerged between the texts.

Chapter IV details the findings of my research, providing clear examples from the texts to support my assertions. I begin with a discussion of how the geography of each parasite is described both in words and through the use of maps. I found that while hookworm is frequently mapped and many geographic references are made within its discussion, toxoplasmosis is not mapped in any of the twelve texts analyzed. While the geography of hookworm, specifically its geographic distribution and environmental interactions, is emphasized at a variety of scales within the texts, toxoplasmosis is painted as a disease of the developed world, but having no local geography or ecology. Ultimately, I concluded that unequal emphasis is placed on the geography and ecology of those parasites found primarily in the developing world.

I then move into a discussion of the images and imagery used to depict the parasites. I identify three major elements that differentiate the images of hookworm from those of toxoplasmosis. These are 1) the level of grotesqueness, 2) the way in which people are depicted in the text, and 3) the contextual photos used in the discussion of each disease. Images of hookworm are, on the whole, significantly more grotesquely represented than images of toxoplasmosis. While grotesqueness is somewhat subjective, this research compares images of a number of parasites with the potential of those images to be represented grotesquely. Images of hookworm and similar parasites often include the faces of people from the developing world, while similar images of toxoplasmosis

and other 'Global North' diseases cover or crop entirely the faces of individuals, thereby protecting their anonymity. Similarly, in images of hookworm, the people depicted are described both by their geography and their morbidity. Images of toxoplasmosis, on the other hand, do not venture to describe the individuals depicted.

Beyond the images included in the text, literary imagery paints a picture of each parasite in the mind of the reader. Hookworm is represented in such a way as to emphasize the grotesqueness of the parasite and the 'backwardness' of the societies that harbor it, distancing us from any emotional connection with the parasites or those infected by them. Conversely, imagery of toxoplasmosis uses discussions of kittens and babies, drawing out an emotional connection between the parasite and the individuals harboring them. In both the images and textual imagery in the parasitology books, I found a clear bias in the way parasites and their disease symptoms are represented; developing world parasites are depicted as far more grotesque than their developed world counterparts. Similarly, I found that the individuals and societies depicted as the hosts of these parasites were depicted as 'backward' and less deserving of our attention and emotional investment than similar individuals and societies in the developed world.

Finally the way in which each disease's causes are discussed in the texts differentiates the portrayal of hookworm from that of toxoplasmosis. While the more distal causes of hookworm, such as poverty and lack of education, are emphasized, toxoplasmosis is described as being caused by the ingestion of oocysts, a much more immediate cause of infection. While discussions of hookworm address some of the more immediate causes, they are not the focus. On the other hand, more distal causes of toxoplasmosis are entirely absent from the discussion. Ultimately, I found that

developing world diseases are attributed to more distal causes than their developed world counterparts.

The final chapter of this thesis ties together the findings of this research in an attempt to clearly answer the questions proposed above and discusses the contributions that this thesis makes to the literatures from which it is drawn. Finally, I suggest directions for future research that could further explore some of the themes discussed throughout this work. First, in an effort to develop and understand the full breadth of my findings, I suggest that similar research be conducted using other forms of biomedical discourse, including patient charts, medical journals, and grand rounds lectures. Second, the application of my methodological study in non-western medical discourses could further our understanding of the production of medical knowledge. Third, by exploring the understandings that individuals infected with parasites have about their own conditions, we will gain a better understanding of those individuals' experiences of health and disease. Finally, I recommend further theorization of the parasite from a Foucauldian perspective. Foucauldian theorizations of the body have much to gain from a conceptual engagement with the process of parasitism and the way that parasites transcend body boundaries.

Ultimately, this thesis sheds light on the epistemology of science by demonstrating how geographic imaginaries become entrenched within biomedical discourses of parasites. While this thesis focuses on parasites as an empirical example, this research addresses overarching patterns of biomedical knowledge production.

CHAPTER II: Situating the Parasite within the Body of Geography: An Exploration of the Literature

According to the World Health Organization, one in every four people is currently host to one or more parasites (WHO, 2011). Within geography, parasites have been studied for decades, though the amount of research devoted to individual parasites has been very uneven. While parasitic diseases like malaria have received significant attention (see, for example, Lindblade et al., 2000; Kovats et al., 2001; Mu et al., 2005; Patz and Olson, 2006; Lambin et al., 2010; Giles-Vernick et al., 2011), other parasitic conditions have become categorized as neglected tropical diseases or NTDs. As the term ‘neglected tropical diseases’ suggests, there has been a dearth of research concerning them, though this is quickly changing. Rising out of the work of Peter Hotez, David Molyneux, Alan Fenwick, and Lorenzo Savioli (see, for example, Hotez et al., 2006; Engles & Savioli, 2006; Hotez, 2008; Molyneux, 2012), NTDs have quickly become a new frontier for health research, receiving increased funding for basic and applied research and policy (Sachs & Sachs, 2008).

In response to Hotez’s and others’ pleas for researchers to study NTDs, geographers and others doing geography have increased research on parasites, logically focusing on geographic description (Muniz et al., 2002; Hotez, 2008), predictive modeling (Engles & Savioli, 2006; Chaves & Pascual, 2007), and policy implications related to parasite infection (Bethony et al., 2006; Hotez, 2008; Tanner et al., 2011). Revealing as this spatial perspective on parasites has been, it rests on unexamined assumptions about the relationships between humans and the natural world. Specifically, there has been no published geographic work that uses anything other than biomedical understandings of parasites as objective models of reality. In other words, biomedical

understandings are taken as unquestionable fact in a variety of disciplines. To date, none of this work troubles the construction of ‘the parasite’ provided by the biomedical community.

Given the focus of this research on disease, and specifically parasitic disease, one might expect it to draw largely from the work of medical geographers. Though I have used medical geography research as a starting point, particularly in selecting the parasites most appropriate for this analysis, this thesis draws more heavily on the research of geographers into the ideas of geographic imaginaries and health knowledge production. This chapter will outline the research on geographic imaginaries and health knowledge production that serves as the basis for my thesis research. I will then use the work of Foucauldian scholars and medical geographers to discuss how a particular look at parasites can contribute to the research. Ultimately this chapter will examine the literatures upon which my research draws and to which it will contribute.

I. Imagining Geography: Extending Geographic Imaginaries to Health Research

Discussions of geographic imaginaries have appeared in the literature for over half a century with little in the way of a clear or universal definition for the term. Geographers, often keen on inventing words, seem to have different terms for different ways of understanding the same concept. While Said discusses ‘imaginative geographies,’ Lowenthal refers to ‘personal geographies,’ and Tuan addresses the same concept as ‘perceptual geographies’ (Said, 1978: 417; Lowenthal, 1961: 251; Tuan, 2003: 878). Hagen defines ‘imagined geography’ as “ways of perceiving spaces and places, and the relationships between them, as complex sets of cultural and political practices and

ideas defined spatially, rather than regarding them as static, discrete territorial units” (Hagen, 2003: 490).

Said discusses ‘imaginative geographies’ as those geographies that are created through human psychological processes as a means of distancing ourselves from others (Said, 1978: 417). In other words, imaginative geographies are how we differentiate between ourselves and others, or between our culture and other cultures. Said suggests not only a particular motivation for the creation of imagined geographies, but also a mechanism by which these geographies are created. While he presents the argument in reference to the dichotomy that the West builds between itself and the Orient (Said, 1978: 418), the process can be applied at a variety of levels to turn all geography into imagined geography. As Tuan (1974) explains it, people choose specific language as a means of giving emotional meaning to a place beyond simple location or functionality. Tuan, like Said, points to a dichotomy between us and them, what Tuan refers to as the ‘we-they’ syndrome. He suggests that as we become familiar with a place and begin to care about it, we incorporate that place and the people living there into the ‘we,’ leaving the unfamiliar as the implied ‘them’ (Tuan, 1974).

In his book, *Geographical Imaginations*, Derek Gregory takes it one step further, suggesting that ‘imaginative geographies’ “articulate not simply the difference between this place and that, inscribing different images of here and there, but they also shape the ways in which, from our particular perspectives, we conceive of the connections and separations between them” (Gregory, 1994: 204). Like Tuan, he describes not only the productions of imaginative geographies, but also those of imaginative communities to whom either an ‘us’ or a ‘them’ label is assigned (Gregory, 1994: 204). Through this

creation of imagined communities, imagined geographies come to relevance. Once the us/them distinction has been made, it is only a small step to assign imagined descriptions, values, and personalities, not only to those falling within the ‘them’ category, but to those within the ‘us’ category as well.

The concept of imagined geographies arises out of John K. Wright’s conclusion of his 1946 Association of American Geographers presidential address in which he claims, “The most fascinating *terrae incognitae* of all are those that lie within the minds and hearts of men” (Wright, 1947: 15). In his Presidential Address, Wright outlines the imagination as the last frontier. He suggests that geographers’ interest in the discipline arises from their wonder and curiosity in response “to the stimulus of *terrae incognitae* both in the literal sense and more especially in the figurative sense of all that lies hidden beyond the frontiers of geographical knowledge” (Wright, 1947: 4). Tuan points to our ever growing sense of ‘we’ as globalization and an international lifestyle allows us to satiate some of our curiosity by becoming familiar with previously distant places (1974). Yet, as our ‘we’ grows, so too does our ‘them’ coupled with all the assumptions that accompany the unfamiliar.

In the absence of knowledge of a place, the human mind paints its own picture to facilitate the comprehension of the place. As Golledge explains in his 2001 Presidential Address to the Associate of American Geographers, “the human brain does not deal well with extreme diversity (chaos), but can handle variability” (2002: 11). Relph agrees, citing the way in which personal geographies are used to produce order from our own experiences (1976). Because it is difficult for us to store information that we do not understand, the mind assigns an understanding to observations in order to categorize

them within its existing organizational structure (Golledge, 2002). Said explains that, “all kinds of suppositions, associations, and fictions appear to crowd the unfamiliar space outside one’s own” (Said, 1978: 417), meaning that that which is unfamiliar, or unknown, gets assigned attributes and values by the mind. Golledge agrees, explaining that “intellectual or created knowledge extrapolates far beyond simple sensory or observational information” (2002: 1). It is these extrapolations, associations, and categorizations by the mind that form our geographic imaginaries (Said, 1978).

As Wright correctly points out, “if there is no *terra incognita* today in an absolute sense, so also no *terra* is absolutely *cognita*,” (Wright, 1947: 3-4) meaning that if there is no place left that is fully unknown, similarly, there is no place that is fully known. Likewise, Lowenthal claims that any geographic view is at most a partial view (Lowenthal, 1961: 246). No one can know all of anything. So, if all of the unknown is imagined, and nothing can be completely known, then we reason that everything is to one degree or another, imagined. While such imaginations are almost exclusively based on the mind’s best guess as to what reality would look like, and thus are not purposely invented fictions (Golledge, 2002), it is impossible to fully perceive of the world or any one piece of it (Lowenthal, 1961).

For a classic example of this we can turn to Said. Orientalism, as a way of thinking based on the differentiation between the Western World and the Orient, ‘creates’ Asia as an image of the ‘other’ (Said, 1978: 415). This overt use of the East as a backdrop on which to paint the Western World as a manifest paradigm of the civilized, the developed, and the successful, depicts the Orient as the antithesis of each of these qualities: barbaric, underdeveloped, and unsuccessful.

Orientalism is based on the imagined distinction between that which is 'ours' and that which is not 'ours,' or that which is 'theirs' (Said, 1978: 417). Said describes this dichotomy as "arbitrary" because it does not require 'them' to acknowledge the imaginary line drawn (Said, 1978: 417). It is then, through this dichotomy, that 'we' negatively define who 'we' are as the opposite of 'them.' It is thus crucial, within the mind, to draw clear antithetical distinctions between what 'we' know that 'we' are and what 'we' can thus surmise 'them' to be. "There is no doubt that imaginative geography and history help the mind to intensify its own sense of itself by dramatizing the distance and difference between what is close to it and what is far away" (Said, 1978: 418).

While Said specifically discusses the example of western perceptions of Asia, suggesting that "Asia speaks through and by virtue of the European imagination" (Said, 1978: 419), a similar process occurs every time any group of people conceptualize another. Both the trans-Atlantic slave trade and the colonization of the African continent were justified for centuries because of the imagined geographies perceived by the Western colonial powers. Because the Africans were culturally and physically different from people in Europe, Europeans considered them to be opposite of and inferior to themselves, creating an arbitrary us/them division (Landau, 2002; Falola, 2005). Whereas the Europeans considered themselves civilized, the Africans were considered uncivilized, despite the fact that Africa was home to numerous civilizations (Landau, 2002; Falola, 2005). Whereas the Europeans considered themselves as having scruples, the Africans were considered to be unscrupulous, to have no values, merely because their values were different from those of the Western World (Landau, 2002). Jarosz, in her 1992 piece "Constructing the Dark Continent: Metaphor as Geographic Representation

of Africa,” outlines the way these constructions have become entrenched within such diverse literatures as explorer and missionary accounts, literary writing in the 19th century, mass media accounts in the 1950s and ‘60s, and academic writing in the late 1980s.

While it is relatively easy to see such imagined geographies in history, it is important to realize that they continue to shape our world today and it is often through such imagined geographies that peoples become marginalized. When a people are not permitted to define their own identity, and instead are ‘created’ through the perception of others, these people are deprived of the opportunity to express themselves and their needs. As Spivak explains it, the marginalized, or the subaltern, are denied any opportunity to speak (Spivak, 1988: 80).

While Said’s Orientalism presents a more intuitive illustration of imagined geography by superimposing a population with an imagined version of its reality, the exclusion of marginalized groups in mapping represents a less obvious example. Because maps are generally taken as fact, and represent “unquestionably ‘scientific’ or ‘objective’ forms of knowledge creation,” they can easily be used to manipulate people both intentionally and unintentionally (Harley, 1989: 423). Foucault’s insistence on the power that is present in all knowledge extends to map making as well (Harley, 1989). Cartographers, through their production of maps, hold extreme power to influence the map-reader’s perception of reality, and thus it is crucial to maintain at the forefront of the mind the difference between the map and the reality of the landscape (Harley, 1989). It is through the maintenance of this distinction and the critical analysis of the map as a text

that map-readers are able to reclaim some of the power that would have otherwise been relinquished to the cartographer.

While Orientalism marginalizes populations by othering, mapping often marginalizes populations by distorting and erasing. Despite their differences, each system relies on the imagined geographies of the privileged to alienate the subaltern. Imagined geographies, by nature, grant power to the imaginer, so whether it is through the production of maps or of texts, we run the risk of inadvertently (or purposely) silencing others through the production of knowledge.

Though Lowenthal hinted as early as 1961 at the idea that all geography is imagined, imagined geography has continued to be used in a rather limited way to apply only to those parts of geography obviously biased and imagined by the beholder. Lowenthal (1961) suggested that our view of the world would always be both centered around ourselves, and thus partial in its ability to depict the world. Thus, geographies, would, to some extent, always be imagined. As such, it is essential that we analyze how such geographies are produced. While considerable attention has been focused on the role that the geographic imagination plays in the world of map production, consideration of this role has largely been absent from the study of health knowledge and its production.

II. Producing Health Knowledge: Turning an Eye Toward the Production of Biomedical Truths

Recently in his call for more rigorous attention to be paid to political ecology within health geography, King identified the interrogation of “health discourses produced by actors and institutions” as a priority for the sub-discipline (2010: 46). Similarly,

Davies et al. suggest the need for a “plurality of both knowledges and geographies” in the work that is beginning to unfold on how “the interplay of biological process, social practice, and positionality” produces health knowledge (2004: 293). Davies et al. point to a “tension between situated processes that produce knowledge enclosed around particular notions of medical expertise or professional conduct, against those moments in which identities, bodies, and knowledges appear more fluid, contested and open” (2004: 294). While Davies et al.’s piece serves as an introduction to the unfolding tensions within the geography of health knowledges presented in the 2004 special issues of *Health & Place*, the research circumvents the issue of how biomedical knowledge is actively produced.

As researchers begin to explore these tensions, focus has largely been on alternatives to traditional sources of knowledge and on the inability of lay individuals to question expert produced health knowledge. In the special issue of *Health & Place* discussed above, Bondi (2004) and Clarke et al. (2004) focus on the professionalization of fields outside of traditional chemotherapy-based medicine, namely counseling, Chinese medicine, and chiropractics. Similarly, Williamson (2004) focuses on the emergence of a new interdisciplinary focus within MPH (Masters in Public Health) programs, broadening the focus beyond strict biomedical definitions of health. Both Hall (2004) and Davies and Burgess (2004) critique the idea that patients, and other lay individuals, can participate in their own health decisions and the formulation of health knowledge. They suggest that because of the power relations at play, individuals outside of biomedicine cannot contribute to the knowledge produced and used by doctors, particularly specialists. Dyer (2004) paints a similar picture illustrating the inability of

lay members to contradict expert knowledge within Local Research Ethics Committees. While each of these interpretations and critical essays sheds light on the geography of health knowledge, none directly questions how medical knowledge is produced; instead they skirt around the issue, illustrating both how alternatives to biomedical knowledge are produced, and how biomedical knowledge is NOT produced.

Since Lupton's 1992 call for the use of discourse analysis in health research, many have used it as a methodology for unpacking the ways in which both health systems and diseases are discussed. Health geographers have used discourse analysis to unburden various health narratives, particularly those visible in popular media and public policy. Of these health narratives, three stand out in the literature: the outbreak narrative, militaristic metaphors, and market-based narratives. Wald (2008) clearly details the outbreak narrative that is rampant in discussions of infectious disease today. She draws attention to the way in which news sources use of terms like 'hyperinfective,' 'new,' 'primitive,' 'primordial,' and 'plague' to not only paint a picture of coming doom, but also to place blame for the disease on individual bodies and places (Wald, 2008).

Chiang and Duann (2007) draw attention to how the SARS outbreak is discussed differently by Chinese and Taiwanese newspapers with alternate political leanings. They argue that the way in which each newspaper refers to the SARS syndrome, as well as the metaphors associated with its viewpoint, illustrate the political bias of each newspaper. While the paper favoring Taiwanese independence from China paints the disease as an attack on Taiwan from Mainland China, the Chinese national paper, after first failing to report the outbreak for 45 days, discusses the same outbreak as 'atypical pneumonia,'

using a generic medical condition to downplay the severity of the disease (Chiang & Duann, 2007).

Larson et al. (2005) deconstruct the militaristic metaphors associated with disease within health policy, shedding light on the way in which they are constructed through communication between scientists and policy makers. Others have followed suit, illustrating just how pervasive militaristic metaphors are in disease discourses (see, for example, Patton, 1990; Ostherr, 2005).

Similarly, market and business-based metaphors dominate discussions of health provision (Segal, 1997; Malone, 1999). Malone points to discussions of health care based on “the notion of policy ‘entrepreneurs’ who ‘market’ policy innovations and create ‘demand’ for these ‘products’” (1999: 16). In an article published recently on Forbes.com entitled “The Healthcare Market is Broken and Needs to be Fixed,” and in many similar contemporary stories, the focus rests on the ‘costs’ of health care, ‘consumer-driven’ health care models, and a ‘rationing of services’ (Kain, 2011).

In addition to the identification of the particular discourses that arise within more general discussions of disease and our treatment of them, several researchers (see, for example, Altman, 1986; Patton, 1990), most notably Cindy Patton, have explored how the discourses surrounding HIV/AIDS are constructed. Her book, *Inventing AIDS*, details the history of the construction of HIV/AIDS, focusing on the differing discourses around ‘African AIDS’ and AIDS in the West (Patton, 1990). Patton (1990) is unique in focusing on the contradictions between how AIDS is understood in two differing geographical contexts. Her work is also unique in that it questions the ‘scientific’ knowledge surrounding the disease, refusing to accept the product of medical research as

the only truth about the disease (Patton, 1990). Though Patton's work approaches the topics and themes that this thesis addresses, some of her later work, as well as much of the research that has used *Inventing AIDS* as a starting point, has explored questions of gender and stigma, particularly in their relation to popular knowledge and public policy.

Similarly, Jarosz's (1992) discussion of the metaphor of Africa as 'the dark continent' within HIV/AIDS research emphasizes the way that geographic imaginaries become visible within academic research. Unfortunately, while analyses of the discourses and stigma around disease within the popular literature and press are rampant, few researchers have sought to analyze the discourses that arise within academic biomedical literature, choosing instead to focus on constructions of health by lay individuals. As the work of Hall (2004) and Davies and Burgess (2004) suggests, despite attempts at inclusivity, biomedical truths are still somewhat inaccessible to lay individuals. Given the lack of research looking into the construction of these truths within geography, it could be argued that this inaccessibility extends to academic researchers as well. Some physicians, however, have themselves attempted to move beyond this boundary, producing ethnographic research based on their experiences within the biomedical world. Most notably, Becker et al.'s *The Boys in White* represents a unique ethnography of a community of medical students. While social science research of medicine has been explored by a number of physician researchers, few have considered how medical 'realities' are actively constructed.

III. Positing the Parasite: Expanding Foucauldian Theorizations of the Body

Although parasites often invoke a strong emotional response from individuals, they have not specifically been examined as part of explorations of medical

understandings either within the popular or biomedical literatures. Perhaps because they invite such strong responses they have not been independently theorized as unique from other diseases. Drawing on the work of Foucauldian scholars, particularly those focused around issues such as child birth and menstruation, other conditions that trouble our neat and tidy constructions of our own bodies, I will outline my own theorization of the parasite and how this theorization places the parasite in the perfect position to trouble the scientific medical literature.

Within the literature on the body, a number of authors make clear the inherent permeable quality of the body and thus how flawed a self/other dichotomy is, most often employing the example of the pregnant woman being simultaneously both self and other (Shildrick, 1997; Longhurst, 2001, among others). This literature has largely arisen out of feminist geographies and thus pays particular attention to women's bodies and the ways in which they are constructed and subjugated.

A number of main themes have become the basis for much of the work centered around and within the body. First, the biomedical division between the mind and the body has become the central focus of much Foucauldian scholarship. Rising out of Foucault's *History of Sexuality* (1978), and particularly his discussion of the links between the body and individual identity, many have explored the complete separation of mind and body that has become so characteristic of biomedicine today (Armstrong, 1997; Turner, 1997). Shildrick (1997) traces the history of this distinction back to the Enlightenment, suggesting a simultaneous division between the mind and the body and between female bodies and male bodies. She points to the work of Descartes in which he separates the *res cogitans*, or the mind, with its powers of intelligence, animation,

spirituality, and selfhood, from *res extensa*, or the body, a machine susceptible to the laws of the natural world (Shildrick, 1997). Shildrick explains that as personhood became centered around the mind, and not the body, women's bodies were reduced to their reproductive and maternal functions. Just as women were slaves to their bodies, unable to exert control over their own beings, men were able to rise above, employing their bodies in direct service to the superior mind (Shildrick, 1997). One example that Shildrick uses by way of illustration is that of the female menses. Women's menses were used to represent a lack of control that women exhibited over their own bodies and by extension over themselves. Finally, Shildrick points to the quote "I think, therefore I am," arising during the European Enlightenment, as a direct signal of the privileging of mind over body that has become so characteristic of western enlightened society (Shildrick, 1997: 25-26).

Second, the medical construction of the normalized "healthy" body in direct opposition to the pathological "morbid" body became a main focus of research, particularly within the field of sociology of health (Turner, 1997). This work draws largely from Foucault's *The Birth of the Clinic* (1975), which sought to connect the rise of biomedical science with the social conditions that supported its development, and his *Madness and Civilization* (1965), which deconstructed the link between 'madness' and criminality and problematized the social construction of psychiatric illness (Armstrong, 1997). As Armstrong explains it, the 19th century marked a clear shift in our perceptions of disease. Death in the 18th century was considered a natural inevitability, while in the 19th century it became a pathological condition that could and should be postponed (Armstrong, 1997). Shildrick (1997) agrees with Armstrong's argument explaining that

the normal/pathological dichotomy becomes salient at the point at which the epistemological division between life and death is problematized. Shildrick further explains that “modern medicine is firmly rooted in the idea that health is some kind of given: a normative state which can be restored by defeating the abnormality of disease” (1997: 17). Patients are often dehumanized by this reductionist focus that medicine places on the pathology of the body, recognizing the individual only in so far as she or he is a malfunctioning part of a larger healthy system (Shildrick, 1997). Patients become nothing more than containers for the diseases they carry (Armstrong, 1997). And while it is recognized that some diseases are more socially constructed than others (Turner points to the differences between social constructions of hysteria and gout), ultimately, the way in which illness is constructed has important consequences for the self-perception of individuals both healthy and ill (Turner, 1992; Shildrick, 1997).

Third, the idea that the body is a stable, unchanging, self-evident entity with clearly defined boundaries that can be uncovered as truths is problematized by geographers using Foucauldian analyses (Shildrick, 1997; Longhurst, 2001). Traditional biomedical models differentiate the body only by symptoms of disease or signs of health, thus forgetting its fluid nature (Shildrick, 1997). Anatomists are seen as uncovering truths about the body, not as constructing them (Shildrick, 1997). Armstrong (1997) troubles these assumptions pointing to the way in which bodies are both historically and culturally located. He illustrates how the body does not contain intrinsic features that can be uncovered unmediated by particular forms of knowledge (Armstrong, 1997).

The cleanly defined boundaries that biomedicine ascribes to the body serve to focus the gaze of the clinic. Not only are bodies socially constructed, but also they

become fabricated as containers holding diseases and abnormalities (Shildrick 1997; Armstrong, 1997). Just as women's bodies become conceptualized as containers for their future children, bodies in general become conceptualized as containers for pathogens (Shildrick, 1997).

Many of the themes I have outlined above represent dualisms, namely mind/body, normal/pathological, healthy/morbid, inside the body/outside the body, and self/other. Because these dichotomies are so entrenched in the human psyche, it is difficult for us to perceive the in-between, or something lying wholly outside the categories that we have already established in our minds. Shildrick identifies this problem, calling for a "move towards embodied selves...[which] celebrates embodiment as process, and speaks both to the refusal to split body and mind, and to the refusal to allow ourselves to be either normalized or pathologised" (1997: 61).

Parasites present the perfect opportunity to illustrate, analyze, and critique these dichotomies, ultimately allowing for the revision of existing theory and the development of new theory based on their conceptualization. My discussion of parasites applies the themes of feminist geographies of the body to a subject matter not inherently feminist and not traditionally looked at by feminist geographers. Though feminist geographies and geographies of the body share ample links with health geography, within the subfield of health and medical geography there remains a disconnect between the more theoretical study of the body and the more empirical study of disease.

Kearns and Moon's 2002 piece, "From Medical to Health Geography: Novelty, Place and Theory after a Decade of Change," suggests that portions of health geography have distanced themselves from disease, focusing instead on human wellbeing and its

social determinants. Despite the fact that Kearns and Moon (2002) identify current health geography as more critical, less quantitative, more linked with other trends and developments within geography, and more heavily theorized than earlier incarnations of the sub-discipline, they point to a disconnect between theory and empirics within the field. While it is important to appropriately choose which theory to use in particular empirical analyses, it is also important for the further development and refinement of theory to continually extend the use of theory to new subject matters. Though Foucault pointed to how physical illnesses, and not just psychiatric illnesses, were socially constructed, and while health geographers have started to apply Foucauldian theorizations to the human experience of disease, and particularly in the case of chronic diseases such as HIV/AIDS, much of the Foucauldian analyses within health geography have largely failed to engage with acute infectious disease, particularly parasites.

Parasites shed tremendous light on the self/other dichotomy often discussed within the literature on the body, and even more frequently discussed within the literature on geographic imaginaries. Because parasites are at once part of you and simultaneously another organism, they by definition blur the boundary between self and other. Because they are often not as temporary as the inherently transitory experience of pregnancy, I suggest that they offer an even better example of the constructed, rather than inherent, nature of our body's boundaries. Unlike pregnancy, where the fetus is the partial product of the woman carrying it, parasites are entirely foreign. More specifically, parasites are of particular interest because they trouble the boundaries between the human self and the natural other. Parasites, often referred to as bugs or creatures or even creepy crawlies,

easily fall into the realm of nature despite the fact that they are inherently a human condition.

Though they may be thought of as ‘natural,’ they are almost never conceptualized as ‘normal’ within the biomedical literature. This contradicts the common association between that which is ‘natural’ and that which is ‘normal.’ When I describe my interest in parasites to people, I often see looks of disgust and hear comments of “gross” or “yuck.” At least within western society, parasites carry a largely, if not entirely, negative connotation. In English the term “parasitic” is used to describe someone who leaches off another, offering no redeeming benefits. Within the medical discourse, parasites are almost exclusively talked about as conditions in need of treatment. Yet interestingly enough, parasites have been found to be extremely beneficial in treating certain conditions, including irritable bowel syndrome, and it is thought that having parasites stimulates immune function. According to the ‘hygiene hypothesis,’ diminished exposure to particular microbes as a result of modern hygiene has led to an increase in prevalence of chronic inflammatory disorders in many developed countries (Rook, 2008).

Desowitz (1981), in his book *New Guinea Tapeworms and Jewish Grandmothers: Tales of Parasites and People*, does a wonderful job of outlining some of the health benefits attributable to parasites. Desowitz points to the “dynamic balance in which the diseases of one society can actually suppress those of another” (1981: 129). For example, studies in New Guinea have pointed to the role that malaria endemicity plays in lowering blood pressure and decreasing cholesterol (Desowitz, 1981). Similarly, Greenwood and Voller (1970) point to evidence that malaria decreases acuity and the probability of allergic reactions and autoimmune diseases. Desowitz (1981) also points

to the way in which chronic worm-induced anemia can cause resistance to bacterial infections. Finally a number of researchers have pointed to the way in which many parasitized animals grow larger than their non-parasitized relatives (see, for example, Lincicome et al., 1963; Mueller & Reed, 1968; Cheng, 1971).

Ultimately, because I am not an infectious disease epidemiologist, and, because the purpose of this thesis is not to comment on how parasites should be treated, I do not intend this thesis to be used as an argument for or against the treatment of disease. What I seek to do is to draw attention to the ways in which what is ‘known’ about parasites is based on personal and cultural perceptions of diseases and their geographies. To illustrate this construction of knowledge, this thesis focuses specifically on two parasites, namely hookworm (*Necator americanus* or *Ancylostoma duodenale*) and toxoplasmosis (*Toxoplasma gondii*). In the section that follows, I will introduce each of the parasites to set a foundation for the discussion of my findings.

IV. Introducing the Medicalized Parasite: An Overview of Hookworm and Toxoplasmosis

Hookworm, along with whipworm and roundworms, is one of three extremely common soil-transmitted helminthes, or STHs (Hotez, 2008). STHs make up the majority of the cases lumped into the category of neglected tropical diseases (Hotez, 2008). As can be imagined by the name, neglected tropical diseases (NTDs) are just that, neglected. Like most NTDs, hookworm has largely been ignored until recent efforts lead largely by Peter Hotez have encouraged new research to be directed toward this understudied area. While hookworm is far from a popular topic of research in geography (A search of Health & Place returned 5 articles discussing hookworm: Kalla 1995; Lewis

and Rapaport, 1995; Halvorson, 2004; Kazembe et al., 2009; and Halvorson et al., 2011), it is certainly a growing focus of research within the broader social sciences (the same search in Social Science & Medicine returned 118 articles: see, for example, Waterkeyn and Cairncross, 2005; Singer et al., 2006; McEniry, 2011; Tanner et al., 2011; and De Pinho Campos et al., 2011) and within epidemiology.

Worldwide, there are approximately 576 million cases of hookworm, largely among school-aged children, though this is undoubtedly underestimated (Hotez, 2008). Hookworm spreads through contact with infective larvae, generally found in soil that has been contaminated with human feces (Hotez, 2008). Because hookworms use the ‘hook’ at the end of their tail to latch onto the lining of the small intestine, they often cause gastrointestinal bleeding (Hotez, 2008). While a low worm burden rarely leads to noticeable symptoms, as the worm burden increases, so too does the severity of symptoms (Hotez, 2008). High worm burdens are most common in children and typically cause anemia which over an extended period of time can cause developmental delays. According to Hotez, “hookworm costs more healthy life years lost through disability (DALYs) annually than any other parasitic worm infection” but rarely results in death (2008: 24).

Hookworm is common throughout most of the developing world. “The greatest concentration of cases occurs in rural areas of sub-Saharan Africa (198 million cases), East Asia and the Pacific region (149 million cases), the Indian subcontinent (130 million cases), and tropical regions of the Americas (50 million cases), especially Brazil and Central America” (Hotez, 2008). Though hookworm is now uncommon in most of the

developed world, hookworm used to be endemic in the southern United States (along with other parasites) and can still be found there (Hotez, 2008).

Though not classified as a neglected tropical disease, toxoplasmosis has, even more than most NTDs, been largely absent from social studies of medicine and geography research. In a search of the archives of *Health & Place*, the keyword “toxoplasmosis” produced no articles. In a similar search of *Social Science & Medicine*, there were eight results (Bennett, 1987; Tormans, 1993; Goldin, 1994; Marshall and O’Keefe, 1995; Burnley, 1999; Mariko, 2003; Wolff et al., 2005; and Gagnon et al., 2009). None were specifically focused on toxoplasmosis with each discussing it only in passing. Despite the lack of research on toxoplasmosis, the CDC has targeted toxoplasmosis as one of the United States’ Neglected Parasitic Infections, and a priority for public health action (CDC, 2012a).

Toxoplasmosis is most commonly spread through consumption of undercooked contaminated meat and directly from contact with animals or their feces (CDC, 2012b). While toxoplasmosis rarely causes complications for healthy adults, it can be debilitating or deadly for immuno-compromised individuals and fetuses whose mothers become infected during pregnancy. For this reason, the CDC recommends that pregnant women take special precautions while handling animals (particularly cats), that they do not change litter boxes, and that they do not adopt new cats while pregnant (CDC, 2012b). Toxoplasmosis can also be a serious risk for individuals with compromised immune systems, and thus there has been a marked increase in severe toxoplasmosis cases since the arrival of HIV in the United States (CDC, 2012b).

The CDC (2012b) estimates that approximately 22.5% of the adult population in the United States has been infected with *Toxoplasma gondii*, the parasite causing toxoplasmosis. Despite these fairly precise estimates of toxoplasmosis prevalence in the United States, the geography of the disease remains somewhat mysterious. The CDC (2012b) simply explains that toxoplasmosis is found worldwide ranging in prevalence from <10% to >90%, a very broad generalization.

V. Developing a Conceptual Framework: A Case Study of Two Parasites

Ultimately, geographic imaginaries need to be applied to research of health knowledge. In analyzing the ways in which geographic imaginaries influence the production of biomedical knowledge, this research can shed light on the epistemology of health knowledge. This research will also allow us to acknowledge the ways in which human perceptions influence the production of fact, so that we might better understand how it is that we know what we know.

In this chapter I have attempted to outline the literatures both from which this research developed and to which it will contribute. This thesis uses the concept of geographical imaginaries, drawing heavily on the work of both Gregory (1994) and Said (1978), to trouble the ways knowledge becomes truth. Particularly within the realm of medical science, it is often difficult to see how personal perceptions bias what is taken as fact. Using the concept of geographic imaginaries, however, this thesis will uncover those moments where a parasites' geography dictates what is 'known' about it.

This thesis also draws heavily from researchers who have studied knowledge production and reproduction, particularly within the realm of health. While this quickly growing field has historically focused on the development of lay knowledge, few

researchers have grappled with the construction of scientific knowledge. Drawing from the work of Cindy Patton (1990) and Lucy Jarosz (1992), this thesis will challenge scientific knowledge through an examination and analysis of parasitology textbooks as discourse.

Though this work differs significantly from previous studies of parasites, I have used Foucauldian theorizations of the parasite, drawn most notably from Shildrick (1997), to illustrate the unique ways in which parasites can shed light on larger phenomena within medical knowledge constructions. Because parasites transcend many of the binaries that we have constructed (self-other, human-nature, inside-outside), they offer a unique understanding of how such imaginary binaries, particularly when applied to geography, become taken as truths. Finally, I have given the reader a basic understanding of the two parasites at the focus of this research and will detail the methodology used to conduct this analysis in the next chapter.

CHAPTER III: Analyzing the Parasite and its Image: An Examination of Methodology

This chapter outlines the methodology I used in order to answer the research questions presented in Chapter I:

1. Are differences in the way parasites are conceptualized visible within the biomedical literature?
2. To what extent can these differences be explained by the conceptions people hold about the places where they perceive parasites to be located?
3. How do these geographic imaginaries become visible within the scientific discourse?

Given that this research explores the production of biomedical understandings of disease, I decided to look directly at biomedical textbooks as products of and means of communicating scientific discourse. I used content and discourse analysis to examine the ways in which both hookworm and toxoplasmosis in particular, but also parasites more generally, are depicted within these texts. These techniques allowed me to examine and to come to understand the differing discourses surrounding each parasite and how those discourses came to be accepted as scientific truths.

Having observed the strong reactions of people to the idea of parasites, I was curious to see whether such deep-held disgust was echoed within the biomedical discourse. This inductive research arose out of my own observations and questions, ultimately seeking to shed light on the more general question of how we know what we know. It is exploratory research because a comparative content and discourse analysis of parasites and their related diseases has not been previously undertaken and explanatory research because the end goal of this thesis is to explain how personal and cultural

disease perceptions impact what is published about the given diseases. While this research focuses on two particular parasites, this thesis speaks to concerns about parasites and disease more generally, and well beyond the specific conditions addressed. As nomothetic research, it seeks to explain the more general causal factors, rather than focus specifically on the intricacies of a single disease.

I. Defining the Unit of Analysis: Medical Textbooks

Given my desire to understand the construction of biomedical ‘truths,’ this research uses biomedical textbooks as a physical representation of the biomedical discourse. Because textbooks are the means by which such specialized knowledge is communicated to younger generations of medical practitioners and researchers, they offer a unique insight into the biomedical discourse. Yuen’s (2011) work similarly relies on textbooks as static moments worthy of study within a larger discourse. Reviewed and juried primary sources (e.g. peer-reviewed journal articles) document the production of scientific knowledge while textbooks, used by medical students and later researchers, represent secondary source venues for knowledge reproduction and dissemination. Textbooks are, quite literally, the means by which knowledge is reproduced and disseminated.

Textbooks, along with other products of biomedical discourse, including guides to best practices, medical journals, and patient records, have not been critically examined, with notable exceptions in the field of psychology. Crowe, for example, offers an insightful analysis of the DSM-IV, the “most authoritative text on mental disorder in contemporary western society” (2000: 69). Mental disorder, and the medical treatment of it, has had a long history of being analyzed and questioned because it is seen as being a

‘softer’ discipline within the medical sciences and more subject to the biases of society and culture. This perception of the discipline is beginning to change now that psychiatry is taught as a form of neurology. One classic example is the removal of homosexuality from the DSM-II after decades of recognition as a mental disorder. Crowe argues that the DSM-IV, like the three previous Diagnostic and Statistical Manuals of Mental Disorders before it, uses its description of psychiatric disease to construct normality as the binary opposite of the conditions described. In its description of diagnostic symptoms, Crowe (2000) illustrates how the DSM-IV constructs productivity, rationality, moderation, and individualism as normal within our society.

For this analysis I chose to focus in particular on parasitology textbooks. Given the deeply-held beliefs that people share about parasites, they offer a great example of the discourses that circulate around disease. Because parasites transcend the self-other binary (they are simultaneously foreign objects, and yet a part of us), we tend to have strong preconceptions about them, preconceptions that I will argue become entrenched even within scientific biomedical discourses. In other words, most people are disgusted, if not repulsed by parasites, a phenomenon that affects how they are studied. I analyzed the discourses around two distinct parasites in order to compare and contrast the ways in which each is represented.

I chose to focus on two particular parasites: hookworm (*Necator americanus* or *Ancylostoma duodenale*) and toxoplasmosis (*Toxoplasma gondii*), both for their similarities and differences. Both hookworm and toxoplasmosis are treatable conditions. Neither is especially serious, except in very particular instances. Toxoplasmosis can be dangerous for pregnant women and immuno-compromised individuals, but for the

majority of the population, it is harmless. Similarly hookworm can be dangerous in individuals who are not getting adequate nutrition, most notably children, because of the resulting anemia, but for most individuals, hookworm is more of an inconvenience than a problem.

While the two parasites are similar in their severity and both are treatable, their geographies and their visibility are markedly different. Hookworm is extremely common in the developing world and is much less common, though not non-existent, in the developed world, including the United States (Hotez, 2008). Toxoplasmosis on the other hand is most commonly found in the developed world, but has been reported (and likely underreported) all over the developing world as well. Given that cats are the definitive host of the parasite, its geography reflects the geography of cat ownership, a phenomenon far more common in the developed world than in the developing world (Wallace et al., 1993). Within the developing world, cat ownership, is highly associated with the most developed areas and the social elite. Because I am interested in the geographic imaginaries associated with different parasites, I found this difference in geography, or perceived geography, to be important to this research.

Additionally, the two parasites differ tremendously in size and thus visibility. While hookworm is visible to the naked eye in its adult form and looks, as one might imagine, like a worm, toxoplasmosis is blood-borne and thus, to the lay individual, more closely resembles a microscopic virus or bacterium. Though I was not initially searching for two parasites that differed so immensely in size, I think the difference plays a marked role in how each becomes represented within the literature. The size of a parasite has a serious impact on our preconceptions; hookworm, by virtue of being visible to the naked

eye and quite literally a worm, inherently becomes perceived of as much more grotesque than the otherwise similar toxoplasma. I will explore this relationship further below.

Because I am problematizing the medical discourse surrounding parasites, I specifically chose texts that represented this discourse. I used purposive sampling in selecting the textbooks analyzed. I ordered 14 parasitology textbooks, the total available through the Summit Library System. I eliminated two from consideration; the first because it was a self-instructional text aimed at lay individuals interested in parasites, rather than a text aimed at medical students, clinicians, researchers, epidemiologists, parasitologists, and other members of the biomedical community, and the second because it was written in the style of a memoir by a parasitologist reflecting on his own experiences in the field. Neither of these titles fit within the literature I was attempting to examine as they were not specifically aimed at passing on medical knowledge about parasites and their treatment. This research analyzes the 12 remaining texts listed below.

- Bogitish, B. J., Carter, C. E., & Oeltmann, T. N. (2005). *Human parasitology* (3rd ed.). Boston, MA: Elsevier Academic Press.
- Garcia, L. S. (2001). *Diagnostic medical parasitology* (4th ed.). Washington D.C.: ASM Press.
- Gosling, P. J. (2005). *Dictionary of parasitology*. Boca Raton, LA: Taylor & Francis.
- Heelan, J. (2004). *Cases in human parasitology*. Washington D.C.: ASM Press.
- Heelan, J. S. & Ingersoll, F. W. (2002). *Essentials of human parasitology*. Albany, NY: Delmar Thomson Learning.
- John, D. T. & Petri, W. A. (2006). *Markell and Voge's medical parasitology* (9th ed.). St. Louis, MO: Saunders Elsevier.
- Marquardt, W. C., Demaree, R. S., & Grieve, R. B. (2000). *Parasitology and vector biology* (2nd ed.). San Diego, CA: Harcourt Academic Press.
- Mehlhorn, H. (Eds.). (2001). *Encyclopedic reference of parasitology* (2nd ed.). New York, NY: Springer.
- Peters, W. & Pasvol, G. (2007). *Atlas of tropical medicine and parasitology* (6th ed.). Philadelphia, PA: Elsevier Limited.

- Roberts, L. S. & Janovy, J. (2000). *Gerald D. Schmidt & Larry S. Roberts' foundations of parasitology* (6th ed.). Boston, MA: McGraw Hill.
- Spicer, W. J. (2000). *Clinical Bacteriology, mycology and parasitology: An illustrated colour text*. New York, NY: Churchill Livingstone.
- Sullivan, J. T. (2004). *A color atlas of parasitology*. San Francisco, CA: University of San Francisco.

Given that each text is an expression of knowledge production and reproduction, it is essential to consider the social context of that production (Waitt, 2010; Rose, 2012). It is necessary to consider who wrote the text, the position that enabled them to write the text, and what their motivation may have been for writing it, basically, the “*institutional location* of a discourse” (quoted from Rose, 2012; Waitt, 2010). Just as my research seeks to produce knowledge about how a parasitic disease is constructed within the biomedical literature, the textbooks themselves reproduce knowledge about parasites and document diagnostic criteria, treatments, best practices, etc., ‘truths’ within the biomedical community. As Rose indicates, even “Foucault, for all his reluctance to ascribe unidirectional causality, insisted on the need to locate the social site from which particular statements are made, and to position the speaker of a statement in terms of their social authority” (Rose, 2012: 220). In order to be able to comment on the context of this data, I considered the credentials of each author, where and when each of the texts was published, and the texts’ collective role as instructional material for medical students and future researchers.

All of the texts in this analysis were written by authors with institutional affiliations in the United States, the United Kingdom, Australia, and Germany, and were published between 2000 and 2010, thus representing a single decade of recent

parasitology knowledge. In conducting the analysis, I noticed no marked patterns based on either the year of publication or the institutional affiliation of the authors.

Because of the principle of intertextuality, or as Hay explains it, “the necessary interdependence of a text with those that have preceded it” (2005: 285), it was not necessary for me to look at every book on parasitology in order to conduct this analysis. The majority of the information in each text I examined was shared across texts, though variations existed in how it was presented. While some texts focused more heavily on diagnosis or treatment, others focused on transmission and prevention. Similarly, while some used ample images and maps, others were almost entirely comprised of written text. Ultimately, however, the way in which each of the diseases was talked about was similar, as was the general information provided for each parasite. Given the relationships that exist between the textbooks, their authors, and their publishers, an examination of twelve texts that were easily accessible served the purpose for this analysis. Given the marked intertextuality within the textbook genre, I believe these twelve books to be representative of parasitology textbooks as a whole.

II. Conducting the Analysis: Combining Content and Discourse Analyses

Both content and discourse analysis rely on the coding of the documents being analyzed. Once the documents have been coded, they can be analyzed for themes within the discourse. Content analysis generally counts codes and themes that have been assigned, while discourse analysis qualifies those codes and themes, ultimately giving a more in-depth picture of the discourse. Both analyses are somewhat fluid and I frequently returned to the texts throughout the coding, analysis, and writing portions of this research.

Following the leads of Tonkiss (1998), Rose (2012), and Waitt (2010), I began by “forgetting” any and all preconceived notions I had concerning parasitology and its representation in order to approach my research subject with a clear mind and “fresh eyes” (Waitt, 2010: 223). I was aided in this task by the notable lack of research analyzing the discourses present in textbooks, particularly those within the medical sciences. I had, however, based on a wealth of research looking at popular medical discourses, developed my own set of expectations of what I might find within the texts.

From the numerous works I have mentioned previously, most notably those of Wald (2008) and Crowe (2000), from numerous works on geographic imaginaries, namely those of Gregory (1994) and Said (1978), and from the work of Foucault (1965; 1975), I expected to find 1) geographic descriptions of hookworm, though none of toxoplasmosis, 2) associations between hookworm and the environment (particularly rural, outdoor settings), though no similar associations from toxoplasmosis, 3) a more scientific discussion of toxoplasmosis than hookworm, 4) images of hookworm, though not of toxoplasmosis, and 5) numerous examples of hookworm, though few of toxoplasmosis. Though I had some expectation of themes I would find, the themes I anticipated were vague and in need of refinement.

To begin coding, I started by reading through the relevant sections of several texts. Though I did not read each text before beginning the coding process, I felt confident, given the similarity of the texts, that my reading of four texts (a third of the content) was sufficient to develop a set of codes that I could then use to code all of the texts. By reading through several texts first, I was able to develop *in vivo* codes and further develop my expectations for hybrid emic-etic codes. “As Foucault says, pre-

existing categories ‘must be held in suspense. They must not be rejected definitively, of course, but the tranquility with which they are accepted must be disturbed; we must show that they do not come about by themselves, but are always the result of a construction the rules of which must be known and the justification of which must be scrutinized.’” (as quoted in Rose, 2012: 210). Following this advice, I critically examined my own preconceptions and their relationship to the data being analyzed before modifying and adopting them into my coding scheme. Additionally, I allowed myself to add codes during the first round of coding. Once I had developed my list of codes and coded each of the texts, I organized the codes into main themes in preparation for the analysis. To be sure that I had coded each document consistently, I read back through the entirety of the texts to verify my own coding and to add any codes that had been developed during the coding of the later documents to the earlier documents.

Below are several excerpts from one of the textbooks analyzed illustrating the codes assigned. In examples where more than one code was assigned, both are listed.

Table 1: An Example of Coding

“When the surface of the ground is wet, after rain or morning dew, they move to the surface and extend themselves like snakes, waving back and forth in a manner that provides maximal opportunity for contact with a host.”	1. Imagery→like snakes
“It says something about human nature that many people at first refused to use latrines and ultimately were persuaded only with great difficulty.”	1. Prevention→sanitation →latrines 2. Sanitation unnatural
“Economic dependence on nightsoil in family gardens remains one of the most persistent of all problems in parasitology.”	1. Prevention→sanitation →stop using nightsoil 2. Economics v. health
“Thus, toxoplasmosis is a major cause of human birth defects, probably causing more congenital abnormalities in	1. Cause of birth defects

the United States than rubella, herpes, and syphilis combined.”	2. Playing on emotion → fear
“Intestinal lesions can kill kittens in two to three weeks.”	1. Playing on emotion → dead kittens

Notice how similar codes are grouped together under the themes of ‘playing on emotion,’ ‘prevention,’ and ‘imagery.’

In my analysis of the texts selected, I chose to combine both content and discourse analysis. Content analysis, or the “careful, detailed, systematic examination and interpretation of a particular body of material in an effort to identify patterns, themes, biases, and meanings” (Berg and Lune, 2012: 349), is much less straight forward than it sounds. Mixed conceptions of content analysis abound ranging from quantitative to qualitative methods. Waitt (2010), for example, defines content analysis as the quantification of occurrences of particular themes and/or words. On the other hand, Berg and Lune (2012) take a more in depth look differentiating between conventional, directed, and summative content analysis, and latent and manifest content analysis blurring the boundaries between content and discourse analysis.

Given the overlap between qualitative content analysis and discourse analysis, for the purposes of this research, I initially chose not to differentiate between the two, and will discuss my use of discourse analysis later in this chapter. To begin my analysis, I chose to employ a quantitative definition of content analysis, summative content analysis, not to be able to make any definitive conclusions based on how much was written about any topic, but rather to give me a starting point. “*Summative content analysis* begins from existing words or phrases in the text itself (the raw data), and counts these; then the

researcher extends his or her exploration to include *latent meanings* and themes that are apparent in the data” (Berg and Lune, 2012: 352) ultimately accumulating an inventory of codes and their repetition. I began with a manifest analysis, taking specific words and phrases from the text and using them to develop the codes. From there I moved into a latent analysis in which I interpreted the underlying symbolism and meaning evident in the texts in order to develop a second complementary set of codes. I totaled all usages of each code and grouped them into a number of categories as a means of organizing my own thoughts and interpretations of the texts.

Instead of comparing the frequency of themes to each other, I used the summative content analysis to compare how frequently particular themes appeared in discussions of hookworm as compared with discussions of toxoplasmosis. I was less interested in the relative emphasis on particular themes as it was clear that some texts emphasized diagnostics, others treatment, and still others disease etiology. Instead, I was interested in looking at how such emphases shifted within texts depending on the parasite in question.

Looking at the comparative weighting of themes, it became evident which themes would most reveal the differences within the discourses on the two parasites, and thus served to further focus my attention. Finally, I reexamined instances of those specific themes, using discourse analysis to better understand both what was written about each parasite and how it was written, so that I might better understand how each was constructed within the medical discourse.

While I used quantitative content analysis as a starting point for analyzing the texts, discourse analysis afforded a deeper examination, not only of the texts themselves, but also of the relationships between themes within and between texts (Rose, 2012). Like

content analysis, discourse analysis can be interpreted in a number of ways. Lupton explains the two most popular forms of discourse analysis as, first, a linguistic analysis of conversations or texts at a micro level, and second, following the “historicophilosophical approach taken by Foucault in his analyses of power relations inherent in such institutions as mental hospitals and medical clinics” (Lupton, 1992: 145). For this research I relied on this second form of discourse analysis, ignoring the more formal linguistic analysis.

Discourse analysis allowed me to address the issue of how the medical discourse persuades its audience, producing “effects of truth” (Rose, 2012: 215). The field of medicine holds immense power because it is able to paint itself as a purely scientific enterprise. Given the reputation of medical texts as fact, I was particularly interested in examining how that reputation was actively constructed within the discourse through the use of terminology and images.

I was particularly interested in using visual discourse analysis to analyze the images presented within the textbooks, because as Aitken and Craine (2005) suggest, visual images offer us a symbolic representation of a dominant order and organization. As Rose explains, discourse analyses of visual images have been particularly interested in how social difference is constructed (Rose, 2012). In this case, I was interested in how the differences between parasites were constructed and how those constructions were reflected in the choice of images.

Given that there were significantly fewer images than text in most of the parasitology textbooks, and to combat the argument that, in reality, toxoplasmosis and hookworm look quite different, I broadened my study to include images of other parasites

within the texts. For each image I examined, I noted with which parasites the image was associated and grouped the parasites and their related images according to their similarities and differences as I discussed earlier in my explanation of the similarities and differences between toxoplasmosis and hookworm.

Rose (2012), Waitt (2010), and Tonkiss (1998), all point to the “*complexity and contradictions* internal to discourses” as a fruitful direction for study in discourse analyses (Rose, 2012: 217). As Rose explains, “part of the power of a specific discursive formation may rest precisely on the multiplicity of different arguments that can be produced in its terms” (2012: 218). In my examination of both the text and the images, and their associated codes, I remained attentive to contradictions, particularly to those that arose out of the relationship between the descriptions of hookworm and toxoplasmosis.

Finally, Rose (2012), Tonkiss (1998), and others, argue that much of discourse analysis is about what is not said. “Absences can be as productive as explicit naming; *invisibility* can have just as powerful effects as visibility (Rose, 2012: 219). My reasoning for deciding to do a comparative analysis, as opposed to an analysis of just one parasite or a single family of parasites, was specifically to allow those silences to become visible. I have struggled with how one knows when a silence is meaningful, when it is an honest omission based on a lack of data. Conducting a comparative analysis relieved my anxiety with respect to this issue and ultimately increased the validity and credibility of my analysis.

III. Justifying a Methodology: Assessing the Strengths and Weaknesses

Content and discourse analyses' greatest strength is their flexibility (Berg and Lune, 2012; Babbie, 2011). As both Berg and Lune (2012) and Babbie (2011) point out, the biggest strength of content analysis is that it is unobtrusive. It does not require direct interaction with those creating the discourse. The importance of this flexibility, as Babbie (2011) explains it, is that it becomes quite easy for students to retrace their steps or redo portions of the analysis as they learn by doing. So, while I will not attempt to claim that my analysis was perfect from the start, I feel confident that the finished product offers a high degree of both validity and reliability.

As Babbie reminds us, validity, or credibility, “involves the question of whether you are measuring what you say you are measuring” (2011: 442). This research seeks to address the issue of how geographic imaginations become part of the discourse around disease. Given that this research seeks to comment on the biomedical discourse, I have examined a key product of that discourse, textbooks. Because textbooks are the means by which the discourse is communicated to new generations of medical practitioners and researchers, they offer an important window into the discourse. By using discourse analysis, I am able to review this discourse without the added complication of direct interaction with its creators, in this case, doctors or senior researchers. Thus, this research delves directly into the discourse that it seeks to discuss rather than engaging ways in which the discourse is translated for the lay individual or social science researcher.

Similarly, Babbie explains reliability or dependability as “a question of whether a measurement of observational technique would yield the same data if it were possible to

measure or observe the same thing several times independently” (2011: 443). Since in a discourse or content analysis it *is* possible to take a second look at the data, I have listed the full citations of each of the texts I used to allow future critics to examine the raw data and come to their own conclusions. To aid in this endeavor, I have attempted to include quotes and images wherever possible in an attempt to allow the reader to follow the connections I have made between data and theory and to assess their reliability themselves.

Berg and Lune remind us of the importance of matching research questions with the methodology used, claiming that content analysis is “ineffective for testing causal relationships between variables” (2012: 376). While this may be the case, discourse and content analysis offer an important mechanism for analyzing how particular knowledges are produced and circulated through texts. Because I am exploring the production and reproduction of knowledge by and within a particular community, my analysis of the documents produced by members of that community for the education of future members offers clear insight.

While the data is both reliable and valid, and the methods used match the questions being asked, the limitations of this research lie in its scope. This research, given the limited time available to conduct a master’s thesis, has focused exclusively on one product of the biomedical discourse, and has not analyzed other biomedical literature, such as journal articles, patient files, or grand rounds lectures. Textbooks that attempt to cover general biomedical knowledge about different diseases and conditions for the medical student or prospective researcher are essential for all medical training and basic research. Thus an analysis grounded solely in their content can prove highly valuable in

understanding fundamental constructions of biomedical knowledge. Additionally, this thesis relies entirely on Western parasitology textbooks published between 2000 and 2010. This conscious decision to focus on a particular discourse, namely that of recent Western parasitology knowledge, omitted an examination of non-Western texts or of older texts which would likely have produced different findings and thus is an area that could be pursued in further research.

Similarly, this thesis focuses primarily on two particular parasites and does not uniquely analyze all parasites; thus this analysis will not allow us to comment specifically on another parasite or disease not directly examined. The aforementioned limitations, however, fail to diminish in any way the importance of this research and serve only to highlight possibilities for further research, something that will be discussed further in Chapter V. Although this research addresses only two parasites and their related conditions, the fact that these particular parasites were specifically chosen for their differences, does allow more general commentary on the patterns of biomedical knowledge that shape new generations of doctors and researchers, the stated goal of this work.

CHAPTER IV: Extracting the Imaginaries from Passages on Parasites: A Discussion of the Findings

This chapter seeks to answer the question of how geographic imaginaries become entrenched in scientific literature such as parasitology texts. Through the use of maps and descriptions of geography, the use of images and written literary imagery, and through the attribution of causation of disease, I will explore the ways in which our geographic imaginaries shape what is known and understood about both hookworm and toxoplasmosis. Ultimately, I will outline the differences in the way that these two parasites have been constructed within a piece of the biomedical literature, focusing on the perceived geography of the parasites to explain these differences.

I. Mapping the Geography of Parasites: Whose Geography Matters?

As a geographer, the first thing I looked for in my analysis of the textbooks was how they discussed the geography of each of the parasites. Based on my own perceptions as well as significant background reading on the two parasites, I had expected to see discussions of the geography of hookworm, but for similar discussions of toxoplasmosis to be entirely absent. While the contrast between the two was not as pronounced as I had anticipated, hookworm was portrayed as having a relevant geography, while the geography of toxoplasmosis, though not absent, was portrayed as largely irrelevant to the study of the disease.

In analyzing the representations of these parasites' geographies, I focused on two distinct sources of information that will structure my discussion. First, I observed the maps included in the texts. The presence of maps is often a sign of emphasis placed on the geography of that parasite, while the absence of a map generally indicates a perceived

irrelevance of or lack of knowledge about the disease's geographic components.

Following my analysis of the maps, I assessed the textual discussions of geography of both hookworm and toxoplasmosis, finding similar emphases within the textual and visual (mapped) representation of each parasite's geography.

A. Maps

Within the texts, maps are generally associated with diseases most common in the developing world. Diseases common in the developed world are not usually mapped. In an examination of the maps present in the text, the only maps illustrating geographic distribution of diseases as common or more common in the Global North than in the Global South were *Fasciola hepatica*, *Echinococcus*, West Nile Virus, *Trichinella*, and Rocky Mountain Spotted Tick Fever. Of the more than forty diseases mapped, only these five showed any significant geographic distribution in the developed world. One text (John & Petri, 2006) specifically claims to omit maps of both diseases with highly restricted distribution as well as those that “occur essentially worldwide.” and it is likely that other authors made similar judgment calls without making their rationales as clear. The variation in which diseases were mapped within texts, however, coupled with the clear bias toward mapping developing world diseases in every single text analyzed, speaks to an unmistakable pattern. While three of the eight texts that included maps (37.5%), mapped hookworm distribution, not a single text mapped the distribution, incidence, prevalence, or risk of toxoplasmosis infection.

Once the decision has been made to map a disease, cartographers face a myriad of choices. A cartographer's decision as to what to include in or exclude from a given map directly impacts the information conveyed. Similarly, a cartographer's decision to map

risk, prevalence, incidence, or geographic distribution affects the message the map delivers.

While there is nothing inherently wrong with the majority of choices that cartographers make about what to map and how to map it, the problem lies in how many of their choices are justified and/or explained to the map reader. While two of the texts analyzed are self-proclaimed atlases, neither justifies its cartography choices. Only John and Petri (2006) offer any justification for why they mapped what they did and no text offered any explanations for the choices and value judgments that went into individual maps.

Each of the three maps of hookworm in the textbooks illustrates the known geographic distribution of the parasite. All three maps depict the distribution as a simple binary: either the parasite was present or absent. Two of the maps differentiate between *Ancylostoma duodenale* and *Necator americanus*. Not a single map of prevalence, incidence, or relative risk of hookworm infection was published in any of the texts. None of the maps justified their choice of mapping technique or design style. As distribution maps, the mapmakers would have had to decide what qualified as an endemic area and what didn't. In other words, the cartographers would have to decide if three cases a year would be enough to be considered endemic and thus mapped, or whether 100 cases would be required? Despite this huge subjectivity, none of the texts commented on how the maps were constructed. None of the maps quantify the number of cases required to determine distribution of the parasite nor do they illustrate variation in caseload between locations where the parasite is endemic. Ultimately this lack of detail suggests that the maps in these texts may not be intended as analytic tools, but instead were more likely

included as a means of illustrating a disease's geography, something only deemed necessary for Global South diseases. Similarly, the remarkable consistency between the maps illustrates a consensus of understanding worthy of critical attention.

B. Textual Descriptions of Geography

Within the text itself, the emphasis on geography painted a picture similar to that described by the selection of maps. Of the twelve texts analyzed, only five (42%) even acknowledged that toxoplasmosis had a geography; two of these simply stated that the parasite could be found worldwide. Only three actually discussed how toxoplasmosis prevalence varied geographically, singling out places such as England, New Zealand, and France in their examples. While these three texts did offer two to five examples each, the specific examples used effectively placed toxoplasmosis within the realm of developed world diseases. Despite acknowledgement by some texts that the disease was worldwide in its distribution, the small quantity of examples served to de-emphasize the importance of geography on the disease's distribution, as the quantity of geographic references for toxoplasmosis is hugely overshadowed by the numerous references to hookworm in particular countries, regions, and continents.

Throughout discussions of hookworm, geographic descriptors appear as a means of situating an example, describing an image, or illustrating the geographic variation in prevalence. Within the texts there were ample references to particular developing world settings, effectively painting a geography of the parasite in the readers' mind. While the majority (63%) of the locations mentioned in this context are developing world countries (India and China are the two most commonly used examples), mention of larger regions was also common (31%); most notably, Africa, southeast Asia, and

Mediterranean/southern Europe were mentioned frequently. Compared to the five total locations mentioned throughout the books' collective discussions of toxoplasmosis, discussions of hookworm yielded 28 unique references to countries or regions, many of them repeated multiple times between the texts.

Also of note is the fact that many of the books reference hookworm occurrences in the American South. The emphasis on the U.S. South is likely the result of a heightened attention on the local, rather than on the traditional broad overall focus of geographic reference. Each of the texts that discussed hookworm distribution in the U.S. was published in the United States by authors with American research affiliations. Further evidence of the emphasis on the local is that references to the U.S. South were the only references to a sub-national region found within the discussions of either parasite. This shows that, while some of the authors thought it necessary to include the possibility of domestic infection within their text (and not all authors did), they clarified their discussion limiting local transmission to a single region so as to uphold the us/them dichotomy among the majority of readers.

Beyond these national and regional references, the local geographies and ecologies discussed within the books varied significantly depending upon which parasite was being analyzed. While only a single text acknowledged that toxoplasmosis had a local ecology, providing no more detail than "development of infective sporozoites depends on environmental conditions" (Heelan, 2004), seven of the texts outlined the environmental geography of hookworm. Everything from hookworm's high prevalence in mines, to its dependence on moisture, temperature, soil type and pH, and even its dependence on shade were considered. While the authors depicted hookworm as having

a clear environmental geography, toxoplasmosis was represented as having no ecology or local geography at all. While explaining the local ecology of disease may not be the purpose of these books, the fact that such discussion is present in reference to one parasite and not the other is telling.

Ultimately these descriptions of geography, or the lack thereof, illustrate the clear geographic associations that the authors held about the particular parasites. While hookworm was painted as a developing world disease with a clear ecology and highly influenced by the environment, toxoplasmosis was depicted as a developed world disease without an environmental component. While both maps and discussions of geography begin to paint a picture in the mind of the reader because of preconceived geographic imaginaries that he or she may hold, that picture is further refined by visual images and textual imagery within the books.

II. Picturing Parasites: Images and Imagery of Disease

As I explored the codes generated from my analysis of the texts, one of the things that became apparent was the use of imagery in both the written and graphic descriptions of the parasites. Given the limited number of images of these two parasites, I broadened my analysis of images to include all images associated with disease in the textbooks. However, given the wealth of text on both hookworm and toxoplasmosis, I focused specifically on these two parasites in my analysis of textual imagery. Because the analysis of images includes a broader set of diseases than my analysis of the written text, I will begin with a discussion of the visual imagery and move on to a discussion of the textual imagery, paying particular attention to the similarities and differences between the two analyses.

A. Images

In my analysis of the images present in the textbooks, I identified three main themes that differentiate the images and further reinforce the us/them dichotomy. First, the level of what I term ‘grotesqueness’ of the images varies according to the parasite the image is representing. Second, the people shown in the images differ significantly in appearance, race, and level of anonymity according to the parasite. Finally, images illustrating what I call the ‘context’ of the disease depend heavily on what parasite the image represents and whether that parasite is associated with a developing world context or a developed world context.

i. Grotesqueness

Grotesqueness, or how graphically repulsive the images are, varied significantly depending on the disease. While the intended audience of the book, aspiring parasitologists, may not find such grotesque images difficult to see, the pattern of images illustrates a remarkable difference between the representations of parasites common in the Global North as compared with the Global South. While there are most certainly differences in the appearances of different parasites and conditions, using images of a variety of diseases aided in my ability to compare the grotesqueness with which they were visually illustrated. Additionally, to aid in the comparison, I have, at times speculated about a realistic potential for grotesqueness of specific parasites and symptoms. In the analysis that follows, I will be pointing to specific images as examples of larger trends. While I am commenting on the grotesqueness of particular images, it is the overall pattern of the quantity and repetition of images that generally differentiates the representations of the various diseases.

Images of conditions such as toxoplasmosis are often highly stylized, effectively reducing the grotesqueness of their appearance. In image A, one can see the overly stylized image of a human eye that was used to illustrate a possible complication of toxoplasmosis. As we all know from Halloween and horror films, human eyeballs can most certainly be displayed in grotesque ways; however here, the way the image is stylized and colored removes the potential grotesqueness of the eye. Similarly, we have all seen grotesque images of deformed skulls, yet though such deformations can be a side effect of toxoplasmosis, all images of such side effects in the textbooks are depicted as x-ray images, minimizing their grotesqueness. Here, the way in which the image is made to look scientific and technologically-based reduces its potential to appear grotesque. While an x-ray may be what a parasitologist sees diagnostically, similar diagnostic images using technology are rare in images of developing world diseases.

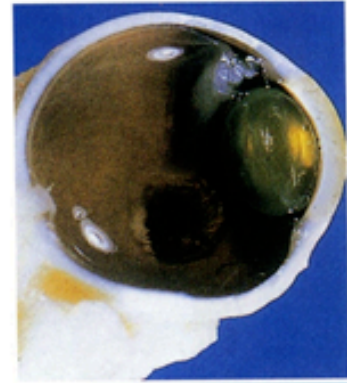


Image A: Eye in Congenital Toxoplasmosis
Reproduced courtesy of Peters, W. & Pasvol, G. (2007). *Atlas of Tropical Medicine and Parasitology* (6th ed.). Philadelphia, PA: Elsevier Limited. Original source of image: R. Cooke.

Conversely, images of hookworm are often chosen in such a way as to overemphasize the grotesqueness of the parasite. Within the texts there are a collective 23 images of the worms baring their ‘teeth,’ blown up in such a way as to appear akin to monsters or vampires (see image B). Similarly, while images of toxoplasmosis are stylized, avoiding

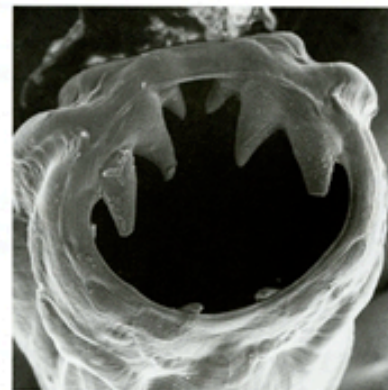


Image B: Hookworm Teeth
Reproduced courtesy of Peters, W. & Pasvol, G. (2007). *Atlas of Tropical Medicine and Parasitology* (6th ed.). Philadelphia, PA: Elsevier Limited. Original source of image: B. E. Matthews.



Image C: Cutaneous Larva Migrans
Reproduced courtesy of Peters, W. & Pasvol, G. (2007). *Atlas of Tropical Medicine and Parasitology* (6th ed.). Philadelphia, PA: Elsevier Limited. Original source of image: G. Pasvol.



Image D: Young Boy with Ascaris Worms Protruding from the Anus
Reproduced courtesy of Peters, W. & Pasvol, G. (2007). *Atlas of Tropical Medicine and Parasitology* (6th ed.). Philadelphia, PA: Elsevier Limited. Original source of image: B. Ochoa.

grotesqueness, images of hookworm emphasize the grotesqueness of the clinical symptoms, despite the fact that the rare complications associated with hookworm are generally no more disturbing than similarly rare complications associated with toxoplasmosis. Image C illustrates a skin rash that can be associated with hookworm. Image D depicts a child whose extreme worm burden has been expelled through the anus. Notice the lack of stylization in these images, preserving and emphasizing the grotesqueness of the condition. Image D is photographed while still attached to the body of the child to make graphic the grotesqueness of the condition.

Hookworm is not alone in its emphasis on the grotesque. For example, Guinea worm is often displayed extremely grotesquely. Not only is it grotesque when it is depicted, but guinea worm is also disproportionately represented in the images of the texts. Like hookworm, guinea worm is, in its

adult stage, visible to the naked eye and found in the developing world, in this case mostly in Sudan; however unlike hookworm, the guinea worm parasite must be extracted from the human leg either surgically or 'traditionally,' an inch or so at a time, an

inherently grotesque process. Given this grotesqueness, images of the guinea worm parasite appear far more often than other diseases of similar global prevalence or burden.

Similarly, because of the extreme deformity, images of severe elephantiasis are also overrepresented within the texts. Elephantiasis is an extreme manifestation of filariasis, another disease of the developing world. Because of the way it attacks the lymphatic system, individuals with filariasis sometimes develop deformed legs or scrotum. Because of its grotesque appearance, images of such deformity are overrepresented in the text.

Similarly to the representation of toxoplasmosis, other diseases of the developed world were illustrated with stylized or cropped images so as to minimize the grotesqueness of their appearance. In Peters' & Pasvol's (2007) discussion of Lyme disease, for example, all of the images of symptoms are closely cropped around the relevant area, removing much of the context and with it, much of the potential for grotesqueness. Similarly, while ticks, the vector of Lyme disease, can most certainly be depicted in a grotesque way, for example, actively sucking a human's blood, or closely zoomed in on so as to make it appear larger than it is (similar to images B1-B3 of hookworm), or even somewhat engorged following a blood meal, the tick that is depicted appears to be clinging on to a piece of hay against a black background and appears similar to any common insect. The aspect of the tick that would emphasize its grotesqueness, the fact that it sucks blood, is completely absent from its representation.

Ultimately, it is clear that the level of grotesqueness varies considerably with the type of parasite or disease. While the level of grotesqueness depicted is ultimately representative of the choices made by the books' authors and editors, because the texts

serve to educate students within the discipline, they actively reproduce the geographic imaginaries presented within them in a new generation of parasitologists. Thus, the grotesqueness of certain images and not others serves to reproduce the imaginaries that we already hold about the geographies of each parasite.

ii. People

Like the level of grotesqueness, the images of individuals differed dramatically depending on the disease with which they were associated. Within the field of medicine, anonymity and confidentiality are highly stressed. The degree to which individuals appearing in these photos were offered confidentiality or anonymity can be seen in the way their faces are portrayed, or not portrayed. In many of the images of individuals illustrating diseases common in the developed world, the faces of the individuals have been covered or excluded. As you can see in Image E, an image of a child suffering from neonatal tetanus, even the infant's face has been covered to protect his anonymity. Image F depicts a woman with a severe form of chicken pox, and again her eyes have been covered. Many other images of developed world diseases, for example Rocky Mountain spotted fever, typhus, Cat-scratch disease, and Lyme disease, depict only the relevant



Image E: Neonatal Tetanus
Reproduced courtesy of Peters, W. & Pasvol, G. (2007). *Atlas of Tropical Medicine and Parasitology* (6th ed.). Philadelphia, PA: Elsevier Limited. Original source of image: W. F. Jackson.



Image F: Fulminating Varicella
Reproduced courtesy of Peters, W. & Pasvol, G. (2007). *Atlas of Tropical Medicine and Parasitology* (6th ed.). Philadelphia, PA: Elsevier Limited. Original source of image: G. Pasvol.

portion of the body, cropping the face out of the image altogether.

By contrast, images of individuals with disease more common in the developing world are rarely afforded this luxury.

Take, for example, image G.



Image G: Scrotal Elephantiasis as a Result of Onchocerciasis. Reproduced courtesy of Peters, W. & Pasvol, G. (2007). *Atlas of Tropical Medicine and Parasitology* (6th ed.). Philadelphia, PA: Elsevier Limited. Original source of image: O. P. Arya.

Though the faces of the individuals are not shown, the image clearly depicts three individuals infected with onchocerciasis standing in one room with their clothing removed. Here, there has been little, if any, effort taken to protect the anonymity of the patients as they have been put on display for the purposes of a medical photograph.

While it is entirely possible that these individuals knowingly consented to the taking of this photograph, this image is part of a larger pattern: black and brown bodies, particularly genitalia and deformity, put on display for western doctors, students, and researchers.

Another example is visible in image H of a man suffering from a rare complication of leishmaniasis called post-kala-azar dermal leishmaniasis. Here the eyes of the individual have not been covered the way similar facial images of white individuals have been in the same text. Similarly, numerous images depict children with distended abdomens and though the focus of the image is the core of the body, the face is rarely cropped out of the image.



Image H: Post-kala-azar Dermal Leishmaniasis (PKDL). Reproduced courtesy of Peters, W. & Pasvol, G. (2007). *Atlas of Tropical Medicine and Parasitology* (6th ed.). Philadelphia, PA: Elsevier Limited. Original source of image: R. E. Kuntz.

Not only are these images characterized by the lack of anonymity that they offer, but also, the way the patients have been described in the photo captions demonstrates the lack of individuality granted these people. The man shown in image H is described in its textual caption only as a “Chinese patient.” Image G is described as depicting “three African patients.” Finally, images I and J are said to be depicting a “Fijian” and an “African” respectively. Conversely, in images of diseases common in the developed world, it is rare to find any geographic descriptors. Individuals depicted are generally not described at all, and on the rare occasion that they are, are described as “a man in Germany,” rather than as a “German man.”

The characterization of these individuals serves to distance the reader from the diseases of others, further emphasizing the us/them dichotomy. While we grant anonymity and personhood to individuals with ‘our’ diseases, those suffering from ‘their’ diseases lose their individuality and become characterized only by their suffering, their deformity, and their geography.

iii. Context

The context of the photos used to illustrate these diseases offers clear insight into

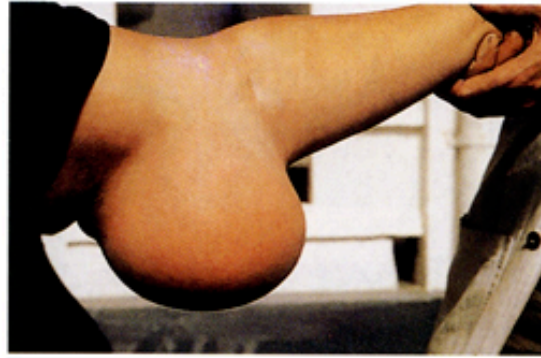


Image I: Elephantiasis in “a Fijian”
Reproduced courtesy of Peters, W. & Pasvol, G. (2007). *Atlas of Tropical Medicine and Parasitology* (6th ed). Philadelphia, PA: Elsevier Limited. Original source of image: J. F. Kassel.



Image J: Nodules on “an African”
Reproduced courtesy of Peters, W. & Pasvol, G. (2007). *Atlas of Tropical Medicine and Parasitology* (6th ed). Philadelphia, PA: Elsevier Limited. Original source of image: J. Anderson & H. Fuglesang.

the geographic imaginaries assigned them. By context I am referring to the images used to illustrate the settings in which diseases are common. While images of developing world diseases often include depictions of the environment and of traditional technologies, similar images associated with diseases of the developed world are absent. While the broader context of disease in the Global South is important in understanding the disease itself, context is largely ignored in the Global North as irrelevant to diagnosis, treatment, and prevention.



Image K. Traditional fishing as means of schistosomiasis infection
Reproduced courtesy of Peters, W. & Pasvol, G. (2007). *Atlas of Tropical Medicine and Parasitology* (6th ed.). Philadelphia, PA: Elsevier Limited. Original source of image: A. Gabrielli.

Environment becomes a common theme in many of the images associated with developing world diseases. In a discussion of helminths, images of rice paddies and local water pumps are a common theme, as these are seen as likely sources of the disease.

Similarly, traditional technologies are also clearly visible. Image K illustrates a number of young men using traditional nets to catch fish. Here the image is associated with schistosomiasis, a parasite transmitted to humans through contact with water. Similarly image L, associated with hookworm, illustrates a traditional plow pulled by a water



Image L. Traditional Agriculture as Means of Hookworm Infection
Reproduced courtesy of Peters, W. & Pasvol, G. (2007). *Atlas of Tropical Medicine and Parasitology* (6th ed.). Philadelphia, PA: Elsevier Limited. Original source of image: W. Peters.

buffalo. In both images, it is likely that individuals have been infected through the means illustrated, but what is not shown, are the numerous ways in which modern technology has influenced the spread of disease.



Image M: Washing clothes as means of schistosomiasis infection
Reproduced courtesy of Peters, W. & Pasvol, G. (2007). *Atlas of Tropical Medicine and Parasitology* (6th ed.). Philadelphia, PA: Elsevier Limited. Original source of image: R. Sturrock.

In addition to what the images represent, the coloring of the images affects how we interpret them as readers. Images M and N both show women using local water sources; in one, women are washing clothing, while in the other they are collecting water. The images are associated with schistosomiasis and trypanosomiasis respectively, though they could easily have been used to illustrate any number of neglected tropical diseases. Notice in these photos how the coloring of the photograph gives an impression of age. The photos appear to be older, and regardless of whether they are or not, we associate them with the past and with outdated technologies. The brownish tint that these images take on, not only make them look old, but also dirty. Because of the coloring of the image, the subject of each image appears dirty. The water in both images is a rich brown, similar in color to the dirt. Regardless of whether or not the water appeared that color in reality, and



Image N: Collecting Water as Means of Onchocerciasis Infection
Reproduced courtesy of Peters, W. & Pasvol, G. (2007). *Atlas of Tropical Medicine and Parasitology* (6th ed.). Philadelphia, PA: Elsevier Limited. Original source of image: D. A. T. Baldry.

irrespective of why it might appear so, the connotation is one of uncleanness and poor sanitation.

While hookworm and other neglected tropical diseases offer numerous images of these environmental conditions, toxoplasmosis has no such images associated with it. Though one could easily include photographs of litter boxes, cats interacting with humans, pregnant women, etc., no such contextual images are present. Toxoplasmosis, like other developed world diseases, is not depicted as the product of its environment. Through the use of images, these texts render the Global North as having no environment and no environmental considerations.

B. Imagery

The text used to describe the parasites paints a picture in the mind of the reader. While toxoplasmosis was described largely scientifically and offered few examples of textual imagery, hookworm offered numerous graphic textual examples loosely following the themes outlined in the previous discussion of visual images: grotesqueness, people, and context. The textual imagery is differentiated most notably by the level of focus on grotesque aspects of the disease and by a focus on the “backwardness” of areas in which the parasite is endemic.

As an example of the emphasis on the grotesque aspects in the hookworm disease description, the following quote paints a picture in the readers’ mind of hookworm as thousands of little snakes covering the ground we walk on, slithering over each other in an attempt to bite us.

When the surface of the ground is wet, after rain or morning dew, they move to the surface and extend themselves like snakes, waving back

and forth in a manner that provides maximal opportunity for contact with a host. Thousands of juveniles often group together, crawling over each other and waving rhythmically in unison. (Roberts & Janovy, 2000: 406)

Although we are all familiar with more evocative textual imagery, this imagery stands out in a text that largely relies on more evenhanded, scientific language in its descriptions. During this same phase of reproduction, hookworm larvae are often described as attacking humans as they find a host and penetrate the skin. In the two quotes that follow, notice the military metaphors used to describe hookworm infection. “Invasion commences when infective larvae penetrate human skin” (Bogitsh, Carter, & Oeltmann, 2005: 344). “Similar to the manner in which animal schistosome larvae attack humans, infective filariform hookworm larvae of animals, for which humans are incompatible hosts, often penetrate human skin” (Bogitsh, Carter, & Oeltmann, 2005: 346). Here the use of the words ‘invasion’ and ‘attack’ paint a picture of military action in which these miniscule larvae become a threat equivalent to an invading army. While militaristic metaphors have been well documented within health literature, their use serves to reinforce the way new generations of individuals imagine the world.

Later stages of the hookworm lifecycle are similarly illustrated in such a way as to emphasize their grotesqueness. Adult worms are often described as “bloodsuckers” (Marquardt, Demaree, & Grieve, 2000: 369), connoting such images as vampires or bats. Just as in visual images, there is heavy emphasis within the text on the teeth of these parasites, as well as on their ‘feeding’ process. “Upon reaching the small intestine,

young worms use their buccal capsule and “teeth” to burrow through the mucosa, where they vigorously begin feeding upon blood” (Bogitsh, Carter, & Oeltmann, 2005: 344-5). “On reaching the small intestine, young worms attach to the mucosa with their strong buccal capsule and teeth, and they begin to feed on blood” (Roberts & Janovy, 2000: 410). In the above remarkably similar examples, the young worms become something to be feared, and thus treated, despite the fact that most individuals hosting them do not know they are infected and experience no symptoms.

In much the same way that the grotesque nature of hookworm is emphasized, the ‘backward’ nature of the societies in which they are endemic is also emphasized through the text. Given that hookworm is largely transmitted through fecal contamination of the soil, many of the texts used this transmission route to illustrate the unsanitary nature of individuals of the developing world. In the textual examples that follow, the authors are clearly stepping outside of their scientific writing to comment on the lifestyles of infected populations. “It says something about human nature that many people at first refused to use latrines and ultimately were persuaded only with great difficulty” (Roberts & Janovy, 2000: 411). Further, many of these comments focus on the lack of personal hygiene of individuals. This is problematic for two reasons. First, it places the onus of infection on individual bodies, ascribing blame through the personalization of cultural hygiene practices, a colonial phenomenon. And second, it takes the socially constructed idea of personal hygiene and applies it to a society that does not share that construction. In the examples below, notice how misunderstandings of cultural practices shape the characterization of these populations.

[H]elminthiases provide an index of the level of personal hygiene and sanitation in a community, since they depend for their dispersal, among other factors, on the indiscriminate deposition of faecal material on the ground. (Peters & Pasvol, 2007: 135)

In tropical and subtropical areas, wet soil (such as that found at the edges of rice fields, rubber plantations and the surroundings of villages in areas of high rainfall) supports the maturation of hookworm larvae from eggs deposited by indiscriminate defaecation. (Peters & Pasvol, 2007: 143)

Note in the above examples that defecation is described as indiscriminate. Most often, however, that is not the case. Fecal matter is used very specifically as fertilizers and thus is only beneficial in very particular locations, namely gardens and fields. Given their usefulness, feces are rarely wasted through ‘indiscriminate defecation.’

In the example that follows, one set of authors has taken the characterization of these populations even further. “Promiscuous defecation, associated with poverty and ignorance, keeps soil contamination high” (Roberts & Janovy, 2000: 410). Here the use of the negatively connoted ‘promiscuous’ coupled with its stated association with ignorance paints a clear image of a backward society, too stupid to clean up after itself. Yet these authors clearly understand the economic importance of these societies’ actions as they later state that “[e]conomic dependence on nightsoil in family gardens remains one of the most persistent of all problems in parasitology” (Roberts & Janovy, 2000: 411). This clear contradiction, illustrates the way in which the authors own geographic imaginaries about these places have come to influence their writing.

Unlike hookworm, toxoplasmosis has comparatively few examples of literary imagery within its discussion. Those examples that do arise are used to play on the emotions of readers, conjuring images of dying kittens and dead or deformed babies. Here, the imagery is used to paint a picture of this disease as relevant to us and worthy of our attention.

Toxoplasmosis is generally only serious in immuno-compromised individuals. The two largest categories of these individuals are infants whose mothers were infected during pregnancy and individuals suffering from AIDS, for which toxoplasmosis is an opportunistic infection. Because of its severity in infants, every single text analyzed emphasized the potential for babies to die as a result of infection.

Clinically, maternal infection is usually primary and asymptomatic (like listeriosis), but the fetus may die or become severely affected (often months after birth), with convulsions, chorioretinitis, cerebral atrophy and hepatosplenomegaly, with consequent microcephaly, massive ventricles and mental retardation. (Spicer, 2000: 186-7)

While the author admits that this outcome is unlikely, the author goes on to list all of the worst-case scenarios. Likewise discussions of birth defects are pervasive within the toxoplasmosis literature. “[T]oxoplasmosis is a major cause of human birth defects, probably causing more congenital abnormalities in the United States than rubella, herpes, and syphilis combined” (Roberts & Janovy, 2000: 131). While this focus may be warranted, even some of the authors have called attention to the way in which babies have become the overwhelming emphasis of study concerning toxoplasmosis. “Emphasis on pediatric patients, particularly neonates, is seen in the extensive literature on serologic

testing” (Garcia, 2001: 139). Likely because of the intrinsic connection that we feel toward infants, they are disproportionately emphasized to illustrate the importance of combating toxoplasmosis. Here, the us/them dichotomy is further entrenched as toxoplasmosis clearly becomes focused in the ‘us’ realm through the emotional connections that we create while reading about the suffering of babies.

Similarly, despite the fact that each of these textbooks is focused on human disease, often their descriptions are used to create an emotional connection through the illustration of the effect that toxoplasmosis can have on cats. Cats are the definitive host of toxoplasmosis, and given our close connection to cats as a society (likely one of the reasons that toxoplasmosis prevalence in the United States is as high as it is), they are easily employed to produce an emotional reaction in the reader. In the United States, 35% of households have cats; there are a total of 86.4 million owned cats nationally (The Humane Society, 2011). “[I]ntestinal lesions can kill kittens in two to three weeks” (Roberts & Janovy, 2000: 131). While discussions of the transmission of toxoplasmosis from cats to humans are important, and are thus emphasized in the texts, there are rightfully very few discussions of the progression of disease in cats. This quote, however, through its depiction of the kitten, paints cats as innocent victims of the disease rather than focusing on them as sources of infection.

III. Analyzing Causes of Disease: The Proximal Us and Distal Other

While the geographies ascribed to parasite and the imagery used to describe them form the bulk of our geographic imaginaries, the causes of different diseases can further shed light on our understanding of them. Because ‘cause’ is a rather loosely defined principle, all diseases have multiple causes. Causes range from the very immediate or

proximal to the very distal. For example, hookworm is caused by the burrowing of a parasite into the skin, but it is also, on the other extreme, caused by poverty and structural violence. It is this varying scale of causation that sheds light on our understanding of disease.

Within the texts analyzed, the scale of causation emphasized varied significantly between hookworm and toxoplasmosis. Most of the emphasis in hookworm was on both the contamination of soil, which I would characterize as mid-scale, and on the broader issues of poverty, education, and sanitation, which I would consider large-scale or distal causes. Conversely, the emphasis within discussions of toxoplasmosis was on the ingestion of oocysts, which I would characterize as proximal cause, and on handling of cats, what I would consider a mid-scale cause. “It is believed that humans are usually infected by eating food contaminated with oocysts” (Spicer, 2000: 73). There was no discussion of the broader social context that might enable these more immediate causes to arise, for example, meat consumption and pet ownership.

Similarly in discussions of how to control each infection, many authors suggested broad social change as a means of controlling hookworm incidence. “Education, better sanitation, personal hygiene and the wearing of shoes should improve control” (Spicer, 2000: 79). In the above quote, it is clear that the author sees the most potential for control in targeting the more broad scale, distal causes of disease, rather than focusing on the more immediate factors. Other authors, like the one quoted below, tended a bit more toward mid-scale interventions. “Sanitary disposal of feces is the primary means of infection control. This is sometimes difficult in poor rural communities where sanitary facilities are minimal or absent” (Garcia, 2001: 285). While Garcia’s interventions

target more proximal causes than many, her suggestion is still one of structural change, rather than individual risk mitigation.

On the other hand, control of toxoplasmosis is most often discussed as an individual's own responsibility and targets the immediate and mid-scale interventions. "Control and prevention are by avoiding cats and undercooked meat (with tissue cysts) during pregnancy" (Spicer, 2000: 187). Here the suggestion is that high-risk individuals avoid immediate sources of infection, emphasizing the proximal understanding of causation surrounding the disease. I find the qualification of meat to be avoided (specifically meat with tissue cysts) to even further bring the proximal cause of infection with oocysts or tissue cysts to prominence.

Ultimately the way in which diseases are discussed, mapped, and illustrated, have a profound impact on the way in which we interpret the world. Diseases associated with the developing world take on qualities that we associate with the developing world, further reinforcing those associations. Similarly, diseases that we encounter in our everyday lives, take on a very different set of qualities, reinforcing the distinctions that we have drawn in our minds between us and them. And these geographic imaginaries are not confined to our opinions; instead, they become entrenched in what we consider fact. As I have demonstrated in this chapter, the scientific rhetoric of parasitology texts is laced in the products of our own geographic imaginations.

CHAPTER V: Repossessing the Parasite: A Conclusion

This thesis questions the ways in which geographic imaginaries become visible within the biomedical discourse. Using discourse and content analysis I have analyzed the ways in which two parasitic diseases, hookworm and toxoplasmosis, have been constructed within parasitology texts. From the findings detailed in the previous chapter, several conclusions concerning the major themes emerge. These conclusions provide cohesive answers to each of the questions posed in Chapter I.

The unequal emphasis on the geography and ecology of developing world diseases emerges as an important theme. While hookworm's geography is discussed at length, citing numerous examples and maps, the geography of toxoplasmosis is all but absent. This clear disparity illustrates the underlying conceptions we hold about the perceived geography of each condition. While the developing world has many environmental factors that must be considered with respect to anything that happens there, as well as 'exotic' locations that should be discussed, understandings of the developed world are not mediated by its environment, and thus there is little perceived need for any smaller geographic area to be discussed.

A second major theme concerns the physical representation of the parasite and its disease symptoms. While diseases of the developing world are often presented as grotesque and backward, distancing the reader, similar diseases of the developed world are illustrated in such a way as to attract the reader. While both images and discussions of hookworm paint the parasite as a disgusting snake-like vampire found in backward societies, toxoplasmosis is described and illustrated with much more scientific language and images, with the exception of its emphasis on kittens and babies, two things that

easily elicit an emotional response among readers. These relatively opposed representations of the two parasites illustrate the degree to which the underlying perceptions about the places in which the diseases are found color how they are represented. Hookworm, a developing world disease, takes on the qualities that the authors associate with that part of the world: namely a high level of grotesqueness and a backward, uneducated citizenry.

A third theme reflects the representations of individuals and the societies in which they live and work. The individuals depicted in images of developing world diseases differ significantly from those depicted in images associated with developed world diseases. While developing world individuals are identified only by their geography and deformity, their anonymity is not protected by the covering of their faces. Conversely, developed world individuals are generally depicted with their face cropped out of the image or with their face covered by a black band to protect their anonymity. Their geography is generally absent from the description of the image. This may, at first glance, seem contrary to the overarching theme of constructing greater distance between the reader and the developing world by showing the faces of those suffering from developing world diseases and providing more descriptors about those people; in reality, the covering of the faces of those infected with developed world diseases coupled with the lack of information about those individuals allows us to assign our own descriptors to them. Because we know next to nothing about those individuals, any one of them could be just like us. Here, the decision to exclude information about those individuals in the developed world, allows us to better relate to them, while the inclusion of information

about those in the developing world, allows us to distance ourselves emotionally from them.

Finally, the way in which disease causation is described in the texts illustrates another salient thematic difference between the portrayal of Global North and Global South conditions. The parasitology texts attribute hookworm to more distal causes such as poverty, lack of education, and improper sanitation. On the other hand, the texts attributed toxoplasmosis to more proximal causes, namely the ingestion of oocysts. As a result, the control measures proposed for each disease varied according to their assigned causes. It is important to note that causes of developing world diseases are perceived as structural, while causes of diseases in the developed world are considered more immediate and thus their control (by avoidance) becomes the personal responsibility of individuals.

The conclusions I have drawn above serve to address the research questions first proposed in Chapter I. For added convenience, the questions are duplicated below:

1. Are differences in the way parasites are conceptualized visible within the biomedical literature?
2. To what extent can these differences be explained by the conceptions people hold about the places where they perceive parasites to be located?
3. How do these geographic imaginaries become visible within the scientific discourse?

In the paragraphs that follow, I will respond to each question independently in order to draw clear and comprehensive conclusions.

In response to the first question, it is obvious that differences in the way parasites are conceptualized are clearly visible within this piece of the biomedical literature. These differences become evident 1) in the choice of images associated with each parasite, 2) in the imagery present within descriptions of parasites, 3) in the way the parasites geography is discussed, and 4) in the causes assigned to each disease. Not only are these differences visible, but they extend deep beneath the surface to affect what is known about each disease.

In response to the second question, how different parasites are constructed depends heavily on their (perceived) geography. While developing world diseases are presented so as to emotionally distance the reader from them and those infected with them, developed world diseases are depicted in such a way as to play on the emotions of the reader, encouraging an emotional connection with the disease and those suffering from it. The geographic influences on disease construction are clearly visible in 1) the discussions of environmental influences, 2) the causes of the disease, 3) the level of grotesqueness with which the parasite is discussed and illustrated, and 4) the way in which individuals with the disease are depicted as is detailed above.

In addressing the third question, these geographic imaginaries become visible within the scientific discourse in the way that the diseases are discussed and in the images that are associated with them. Throughout this analysis, the geographic imaginaries of the authors have been rendered visible in that developing world diseases are represented differently than similar developed world diseases. While the developing world diseases have been represented so as to distance the reader from them, developed world conditions have been discussed in such a way as to draw the reader in, evidence of a clear us/them

dichotomy. While developed world diseases are constructed as ‘our’ diseases, the conditions of the developing world are considered ‘their’ diseases.

I. Contributing to the Literature

Ultimately this research makes considerable contributions to the same literatures on which it is based. Given the ways in which this research speaks to the us/them dichotomy suggested by Said’s orientalism, it lies solidly within the body of literature on geographic imaginaries. This research is unique however, in that it provides an empirical example of this phenomenon external to the fields of cartography or historical geography. While some have theorized the universal extent of geographic imaginaries, there have been only limited examinations of how the geographic imagination becomes entrenched in discourse. Much has been written on the ways in which our geographic imaginaries infiltrate maps and historical documents linked to colonialism, imperialism, and the slave trade. This same phenomenon, however, has not been analyzed previously in reference to modern biomedical discourse.

In addition to what is contributed to the literature on geographic imaginaries, this research offers tremendous insight in the exploration of health knowledge. While similar studies have been conducted within this literature looking at more popular discourses, few studies have been willing to engage with more scientific discourses like biomedical textbooks. This research illuminates the epistemological question of how our own perceptions influence how knowledge is produced and reproduced. It is my hope that this research will serve to encourage others to question literatures that claim to be based on fact and science, constructions that we now recognize as saturated with our own geographical imaginations.

This research also serves to illustrate how parasites can be used to further develop and conceptualize Foucauldian theorizations of the body. Although many researchers rely on Foucault's work as a basis for their own theorizations, to my knowledge none have used the idea of the parasite to aid in our own understandings of the body from a Foucauldian perspective. Given the dualisms that parasitism transcends, its discussion produces strong responses from the average individual, creating ideal conditions in which to extend Foucault's own work on the body.

Finally, though the focus of this work is quite different from other geographical studies of parasites within medical geography, this thesis encourages us to reconsider how we have ourselves conceptualized parasites and disease more generally. While most work within this literature relies on a biomedical understanding of disease, as I have shown, this understanding is often laced with the geographic imaginations of those individuals constructing the knowledge, namely western clinicians, researchers, and academics. In any geographical work that rests on assumptions and facts that are produced through others' geographic imaginaries, it is important to acknowledge the way in which those facts are produced. Given the way western civilization elevates science, it is rare for researchers to acknowledge that is the production of scientific knowledge could be the product of anything other than objective fact. As a result, the geographic imaginaries that are replicated within scientific discourses become internalized as inherent truths. Ultimately, it is through processes similar to the ones I have demonstrated in this thesis that orientalism, racism, and stereotypes are reproduced within a community.

II. Advocating Directions for Future Research

Given that this research relies entirely on an analysis of parasitology textbooks, future research might take a similar approach in examining other forms of biomedical discourse including patient charts, medical journals, and grand rounds lectures. Because textbooks often build on earlier editions and edit where necessary to produce newer editions, remnants of an older discourse can be carried over without the realization of the authors or editors. While the fact that these geographic imaginaries did not draw attention during the editing process suggests that they are alive and well, an examination of pieces of the discourse that do not rely as heavily on earlier works may show change in the discourse over time. It would also be fascinating to see if similar constructions hold true within biomedical discourses produced in the developing world. While there are few biomedical textbooks in use in the United States that were published in the Global South, there are constantly growing medical communities in many countries of the developing world that may have a very different understanding of parasites and disease.

While this work sheds light on biomedical constructions of the parasite, it does not examine the understandings of those individuals actually infected with them. Further research should be undertaken with infected populations in an effort to understand their own conceptions of endemic disease. Given that parasites can be found globally, there are likely a wide variety of cultural understandings of parasitic disease in different populations, an area of research that would benefit from further analysis. Finally, as I discussed in Chapter II, there is a growing literature on the health benefits of parasites warranting research to explore how the publication of these benefits might change social perceptions of parasites.

As I discussed above, further research should be conducted conceptualizing parasites from the perspective of Foucauldian theorizations of the body. While Foucault himself does not use parasites as examples in his work, they provide a unique lens for troubling the dualisms that he delineates. Both this thesis and future theorizations of parasites have the potential to allow academics a broader understanding of disease processes as reflected in the strongly-held beliefs that people have about them. Researchers should not ignore this important window into our understanding of parasite infestation and disease in general. The strong responses people have to parasites may serve as canaries in a coal mine, offering clear insights into phenomena that are often invisible.

This thesis, while about parasites, is more broadly about disease and about the epistemology of science. It is about disease, in that the phenomena described throughout the thesis are not limited to parasitic conditions. The geographic imaginaries that become entrenched in constructions of parasites are similarly entrenched, though perhaps not as visibly, in discussions of other diseases, a topic of research much in need of further analysis.

Finally, as I mentioned above, this thesis is about the epistemology of science. This thesis explains how it is that we know what we know about parasites. This research asks questions and provides answers on how scientific knowledge is produced and reproduced. While common belief would suggest that science is produced through the scientific method alone, this thesis demonstrates how the cultural subconscious infiltrates that construction. While this is just one example of how this is done, further research should evaluate other ways in which the subconscious is rendered visible, affecting both

fact and opinion. Ultimately, this thesis stretches far beyond the lowly parasite, illuminating profound implications for the so-called scientific basis of our society.

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